

META 2025 Torremolinos - Spain

The 15th International Conference on Metamaterials, Photonic Crystals and Plasmonics



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Torremolinos - Spain



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META 2025 Torremolinos - Spain

The 15th International Conference on Metamaterials, Photonic Crystals and Plasmonics

Edited by

Khaled Mnaymneh | National Research Council, Canada
Said Zouhdi | Paris-Saclay University, France

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Please, visit <https://www.metacmed.eu> for further details about the research program, DCs projects, and application procedures to follow.

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PLENARY SPEAKERS



Robert W. Boyd

University of Ottawa (Canada) & University of Rochester (USA)

Applications of highly nonlinear epsilon-near-zero materials in photonics

Robert W. Boyd received the B.S. degree in physics from the Massachusetts Institute of Technology and the Ph.D. degree in physics in 1977 from the University of California at Berkeley. His Ph.D. thesis was supervised by Charles Townes and involved the use of nonlinear optical techniques in infrared detection for astronomy. Professor Boyd joined the faculty of the Institute of Optics of the University of Rochester in 1977 and in July 2001 he became the M. Parker Givens Professor of Optics. In 2010, he became Professor of Physics and Canada Excellence Research Chair in Quantum Nonlinear Optics at the University of Ottawa. His research interests include studies of nonlinear optical interactions, studies of the nonlinear optical properties of materials, the development of photonic devices including photonic biosensors, and studies of the quantum statistical properties of nonlinear optical interactions. Professor Boyd has written two books, co-edited two anthologies, published over 200 research papers, and has been awarded five patents. He is a fellow of the Optical Society of America and of the American Physical Society and is the past chair of the Division of Laser Science of the American Physical Society.

Applications of highly nonlinear epsilon-near-zero materials in photonics

Optical materials display extremely large nonlinear response in a spectral band around their plasma frequency. This presentation reviews the origin of this behavior and provides examples of such materials and of applications enabled by this response.



Nader Engheta

University of Pennsylvania (USA)

Metastructures That Compute and Optimize

Nader Engheta is the H. Nedwill Ramsey Professor at the University of Pennsylvania in Philadelphia with affiliations in the Departments of Electrical and Systems Engineering, Physics and Astronomy, Bioengineering, and Materials Science and Engineering. He received his BS degree from the University of Tehran, and his MS and Ph.D. degrees from Caltech. His current research activities span a broad range of areas including optics, metamaterials, electrodynamics, microwaves, photonics, nano-optics, graphene photonics, imaging and sensing inspired by eyes of animal species, microwave and optical antennas, and physics and engineering of fields and waves. He has received several awards for his research including the 2023 Benjamin Franklin Medal in Electrical Engineering, Election to the American Academy of Arts and Sciences (2023), Caltech Distinguished Alumni Award (2023), the 2020 Isaac Newton Medal and Prize from the Institute of Physics (UK), the 2020 Max Born Award from the OPTICA (formerly Optical Society), the 2019 Ellis Island Medal of Honor, the 2018 IEEE Pioneer Award in Nanotechnology, the 2022 Hermann Anton Haus Lecture at MIT, the 2015 SPIE Gold Medal, the 2014 Balthasar van der Pol Gold Medal from the International Union of Radio Science (URSI), the 2017 William Streifer Scientific Achievement Award, the Canadian Academy of Engineering as an International Fellow the Fellow of US National Academy of Inventors (NAI), the IEEE Electromagnetics Award, the Vannevar Bush Faculty Fellowship Award from DoD, the Wheatstone Lecture in King's College London, 2006 Scientific American Magazine 50 Leaders in Science and Technology, and the Guggenheim Fellowship. He is a Fellow of nine international scientific and technical organizations, i.e., IEEE, OPTICA, APS, MRS, SPIE, URSI, AAAS, IOP and NAI. He has received the honorary doctoral degrees from the Aalto University in Finland in 2016, the University of Stuttgart, Germany in 2016, and Ukraine's National Technical University Kharkov Polytechnic Institute in 2017.

Metastructures That Compute and Optimize

I will present some of the most recent results of our ongoing research projects on nonlocal metasurfaces and metastructures that perform ultrafast analog computation, such as vector-matrix multiplication, matrix inversion, constrained optimization, equation solving, etc. I will also discuss how incoherent light can be used for certain analog computations.



Ortwin Hess

Trinity College Dublin (Ireland)

Nanoplasmonic Quantum Photonics

Ortwin Hess currently holds the Chair Professorship of Quantum Nanophotonics and an SFI Research Professorship in the School of Physics and the CRANN Institute of Trinity College Dublin, The University of Dublin, Ireland. He is Editor-in-Chief of the gold open-access journal APL Quantum. Ortwin is a Fellow of the Institute of Physics (FInstP), a Fellow of Optica (formerly OSA) and a Professorial Fellow of Trinity College Dublin. Previously, Ortwin held the Leverhulme Chair in Metamaterials in the Blackett Laboratory at Imperial College London, UK. From 2003 to 2010 he was a full professor at the University of Surrey (Guildford, UK) and visiting professor at Stanford University, USA, and at the Ludwig-Maximilians University of Munich, Germany. Ortwin obtained the Dr.-rer-nat. (PhD) degree from the Technical University of Berlin, Germany in 1993 and the Habilitation (Dr.-habil.) at the University of Stuttgart, Germany in 1997. Ortwin's research interests bridge quantum nanophotonics with semiconductor and metamaterials physics, laser science and bio-medical photonics. He discovered the 'trapped-rainbow' principle, had the idea of stopped-light lasing and made defining contributions to the fields of spatio-temporal dynamics of semiconductor lasers, ultraslow light in metamaterials, complex quantum dot photonics and photonic crystals and strong coupling in nanoplasmonics. Ortwin pioneered active nanoplasmonics and optical metamaterials with quantum gain for which he has been awarded the Royal Society Rumford Medal.

Nanoplasmonic Quantum Photonics

Nanoplasmonic quantum photonics revolutionizes quantum information technologies by enabling room-temperature quantum operations through extreme nanoscale field confinement and strong photon-emitter coupling. This facilitates ultrafast single-photon emission, multipartite entanglement, near-field coupling, and quantum sensing, enhanced by quantum nanoplasmonic coherent perfect absorption, paving the way for practical quantum devices operable at ambient conditions.



Stefanie Kroker

Technische Universität Braunschweig (Germany)

Routes for integrated photonics and meta-optics in quantum technologies and precision experiments

Stefanie Kroker studied Physics at Friedrich Schiller University in Jena/Germany and Universidad de Granada/Spain. She did her PhD with the Institute of applied Physics at Friedrich Schiller University in 2014 and became assistant professor at TU Braunschweig and the German national metrology institute, PTB in 2016. In 2020 Stefanie Kroker received the Science Award Lower Saxony and in 2021 she was appointed to a full professorship at TU Braunschweig. She is a member of the German clusters of excellence QuantumFrontiers and PhoenixD. Since 2023 she is associate editor of the journal APL Quantum. Stefanie's research covers nanophotonic and integrated optical systems for applications in sensing, high-precision metrology and quantum technologies. In 2024 she received a Consolidator Grant from the European Research Council.

Routes for integrated photonics and meta-optics in quantum technologies and precision experiments

Integrated photonics and meta-optics enable compact, precise light control, advancing optical metrology in applications like atomic clocks and gravitational wave detectors. This work explores nanophotonic devices for precision experiments and atom chips, focusing on light-matter interactions and the impact of material properties on performance and precision.



Gloria Platero Coello

ICMM-CSIC (Spain)

Robust Edge States in Topological Lattices for Quantum information Transfer

Gloria Platero Coello Gloria Platero is Research Professor at the Materials Science Institute of Madrid, at the CSIC (Spanish Research Council), which is located at the excellence Campus CSIC-UAM (Autonomous University of Madrid). She leads the group at ICMM: "New Platforms and Nanodevices for Quantum Simulation and Quantum Computation" <https://wp.icmm.csic.es/npqsic/> and belongs to the University Institute Gregorio Millán on Nanoscience and Industrial Mathematics (Carlos III University of Madrid). She has given over hundred invited, keynote or plenary talks in international conferences and she has been invited to give seminars and to make stays in many research centers all over the world. She has been Mercator Fellow at the University of Regensburg. Supervisor of many PhD students, most of them are working successfully in Academia. She is Fellow of the APS (Quantum Information), and Secretary of the C8 IUPAP Commission on Semiconductor Physics. She will be Chair on January 2025. Her research belongs to the field of Quantum Nanotechnologies. She investigates the theory of spin qubits in quantum dot arrays, their manipulation and the transfer of quantum information in these systems, for quantum computation purposes. She also investigates hybrid systems: superconducting cavities coupled to qubits, where photons are the flying qubits. Time periodic driven systems is one of her main topics of research. She investigates as well, in different platforms as photonic crystals, the role of topological edge states for the transfer of quantum information.

Robust Edge States in Topological Lattices for Quantum information Transfer

This talk will deal with the transfer of quantum information using protected topological edge states. I will discuss the long-range transfer in a dimer chain, a 1D topological insulator, and in the Creutz-Ladder lattice and the role of topological domain walls to speed up the particle transfer.



Eli Yablonovitch

IUC Berkeley (USA)

What I Wish I Had Known, as I Searched for the First 3d Photonic Bandgap

Eli Yablonovitch is a Professor of Electrical Engineering and Computer Sciences at UC Berkeley, where he holds the James & Katherine Lau Chair in Engineering. He is the Director of the NSF Center for Energy Efficient Electronics Science (E3S), a multi-University Center headquartered at Berkeley.

Prof. Yablonovitch introduced the idea that strained semiconductor lasers could have superior performance due to reduced valence band (hole) effective mass. With almost every human interaction with the internet, optical telecommunication occurs by strained semiconductor lasers. He is regarded as a Father of the Photonic BandGap concept, and he coined the term "Photonic Crystal". The geometrical structure of the first experimentally realized Photonic bandgap, is sometimes called "Yablonovite". In his photovoltaic research, Yablonovitch introduced the $4(n^2)^2$ ("Yablonovitch Limit") light-trapping factor that is in worldwide use, for almost all commercial solar panels. His mantra that "a great solar cell also needs to be a great LED", is the basis of the world record solar cells: single-junction 29.1% efficiency; dual-junction 31.5%; quadruple-junction 38.8% efficiency; all at 1 sun. His startup company Ethertronics Inc., has shipped over 2 billion cellphone antennas.

Prof. Yablonovitch is elected as a Member of the National Academy of Engineering, the National Academy of Sciences, the American Academy of Arts & Sciences, and is a Foreign Member of the Royal Society of London. He has been awarded the Buckley Prize of the American Physical Society, the Isaac Newton Medal of the UK Institute of Physics, the Rank Prize (UK), the Harvey Prize (Israel), the IEEE Photonics Award, the IET Mountbatten Medal (UK), the Julius Springer Prize (Germany), the R.W. Wood Prize, the W. Streifer Scientific Achievement Award, and the Adolf Lomb Medal. He also has an honorary Ph.D. from the Royal Institute of Technology, Stockholm, & the Hong Kong Univ. of Science & Technology, and is honorary Professor at Nanjing University.

What I Wish I Had Known, as I Searched for the First 3d Photonic Bandgap

The first 3-dimensional Photonic Bandgap was found by Edison-ian search, trial-and-error, guided by physical intuition. The 4-year search was beset by pseudo-gaps, and required deep physical insights to find the right geometry (diamond unit cell in a face-centered-cubic lattice). Nonetheless, there do exist mathematical techniques for 3d geometry optimization that could have led to the right structure more quickly.

KEYNOTE SPEAKERS



Andrea Alù

City University of New York (USA)

Space-time metamaterials

Andrea Alù is a Distinguished Professor at the City University of New York (CUNY), the Founding Director of the Photonics Initiative at the CUNY Advanced Science Research Center, and the Einstein Professor of Physics at the CUNY Graduate Center. He received his Laurea (2001) and PhD (2007) from the University of Roma Tre, Italy, and, after a postdoc at the University of Pennsylvania, he joined the faculty of the University of Texas at Austin in 2009, where he was the Temple Foundation Endowed Professor until Jan. 2018. Dr. Alù is a Fellow of the National Academy of Inventors (NAI), the American Association for the Advancement of Science (AAAS), the Institute of Electrical and Electronic Engineers (IEEE), the Materials Research Society (MRS), Optica, the International Society for Optics and Photonics (SPIE) and the American Physical Society (APS). He is the President of Metamorphose, a Highly Cited Researcher since 2017, a Simons Investigator in Physics, the director of the Simons Collaboration on Extreme Wave Phenomena Based on Symmetries, and the Editor in Chief of Optical Materials Express. He has received several scientific awards, including the NSF Alan T. Waterman award, the Blavatnik National Award for Physical Sciences and Engineering, the IEEE Kiyo Tomiyasu Award, the ICO Prize in Optics, the OSA Adolph Lomb Medal, and the URSI Issac Koga Gold Medal.

Space-time metamaterials

In this talk, I will discuss my group's recent work in the area of space-time metamaterials, with an emphasis on the use of abrupt time switching and spatio-temporal modulation patterns for efficient frequency translation and energy manipulation.



Harry Atwater

California Institute of Technology (USA)

Active Metastructures – Tailoring Space-Time and Breaking Reciprocity

Harry Atwater is the Otis Booth Leadership Chair of the Division of Engineering and Applied Science, and the Howard Hughes Professor of Applied Physics and Materials Science at the California Institute of Technology. Atwater's scientific effort focuses on nanophotonic light-matter interactions. His work spans fundamental nanophotonic phenomena and applications, including active wavefront shaping of light using metasurfaces, optical propulsion of lightsails, quantum and 2D nanophotonics as well as solar energy conversion, on earth and in space.

Atwater was an early pioneer in nanophotonics and plasmonics and gave a name to the field of plasmonics in 2001. He is Chair of the LightSail Committee for the Breakthrough Starshot program. Currently Atwater is also the Director for the Liquid Sunlight Alliance (LiSA), a Department of Energy Hub program for solar fuels, and was also the founding Editor in Chief of the journal ACS Photonics. Atwater is a Member of the US National Academy of Engineering, a Fellow of APS, MRS, SPIE and Optica, a Web of Science Highly Cited Researcher from 2014-2023, and is recipient of numerous awards, including the 2021 von Hippel Award of the Materials Research Society.

Active Metastructures – Tailoring Space-Time and Breaking Reciprocity

In this talk, I will discuss approaches to spatiotemporal wavefront control in active metastructures that can modify energy and momentum states of light, break reciprocity via space-time modulation, and break Kirchhoff's radiation law via action of external or internal magnetic fields.



Renaud Bachelot

Université de Technologie of Troyes (France) & Nanyang Technological University (Singapore)

Hybrid plasmonic nanosystems based on weak and strong coupling

Renaud Bachelot is a full professor of physics at the University of Technology of Troyes (UTT) that he joined in 1996 after graduate studies and PhD at the University of Paris-Cité and ESPCI graduate school (Paris, University PSL). His area of expertise includes nano-optics, nanophotonics, near-field optics, local light/polymer interaction, scanning probe microscopy, nano-optoelectronics and hybrid nanoplasmonics. He recently joined the CINTRA Lab (CNRS/NTU/CINTRA) as an Adjunct Senior Research Scientist. At UTT, R. Bachelot is the director of the Graduate School “Nanooptics & Nanophotonics” (nano-phot.utt.fr) including both master and PhD programs. From 2011 to 2019, RB has been the director of the Light, nanomaterials nanotechnologies CNRS Laboratory involving more than 100 people (l2n.utt.fr). His national and international influence includes current and past activities and positions such as (e.g.) adjunct professor at the LuMin Laboratory (University of Paris-Saclay), Board Member of the Faculty of Physics of Sorbonne University, elected board member of the French Society of Physics, condensed matter section division, adjunct-professor of the Shanghai University (since 2019, “1000-talents” award since 2020), invited scholar in Argonne National Laboratory, USA, and chair of the NFO-15 international conference that took place in August 2018 in Troyes, France. RB has (co)supervised 24 PhD students and is the co-author of more than 130 peer-reviewed articles (H=46, cf. google scholar), 10 book chapters and 5 patents.

Hybrid plasmonic nanosystems based on weak and strong coupling

Hybrid plasmonic nanosystems based on weak or strong coupling are discussed in terms of controlling the spatial distribution, and associated symmetry, of the active medium in the vicinity of the metallic nanocavities.



Guillaume Baffou

Institut Fresnel - CNRS (France)

Wavefront microscopy for nanophotonics

Guillaume Baffou is a CNRS researcher at the Institut Fresnel in Marseille, France. He graduated from the Ecole Normale Supérieure de Cachan (now ENS Paris-Saclay) and earned his Ph.D. in Nanoscience from Paris XI University in 2007. Following his doctorate, he undertook a postdoctoral fellowship at ICFO, Barcelona, where he worked on plasmonics and related photothermal effects under the supervision of Prof. Romain Quidant. In 2010, he joined the CNRS and the Institut Fresnel. His contributions to research at the intersection of optics, thermodynamics, and small-scale biology have earned him several honors, including the CNRS Bronze Medal in 2015. In 2018, he was awarded an ERC Consolidator Grant. Most recently, during the 2023–2024 academic year, he spent a year at Columbia University in New York on a Fulbright grant, collaborating with Prof. Rafael Yuste's team.

Wavefront microscopy for nanophotonics

Cross-grating wavefront microscopy (CGM) consists of the association of a 4-wave diffraction grating and a camera separated by millimeter distance. We show how CGM can be used to measure the optical properties of nanoparticles, 2D material a metasurfaces, such as the complex optical polarizability, conductivity, refractive indices, and cross-sections.



Konstantin Bliokh

Donostia International Physics Center (Spain)

Chiral Vortices, Skyrmions, Möbius Strips: From Nanooptics to Ocean Waves

Konstantin Bliokh received the MSc and PhD degrees in physics from the Kharkov National University (Ukraine) in 1998 and 2001, respectively. After that, he worked as a research scientist at the Institute of Radio Astronomy (Ukraine, 2001–2009). He was a post-doctoral fellow at Bar-Ilan University (Israel, 2003–2005), a visiting research scientist at Technion–Israel Institute of Technology (Israel, 2007), a Linkage International research fellow at the Australian National University (Australia, 2008–2009), a Marie Curie research fellow at the National University of Ireland (Ireland, 2009–2011), an associate professor at the Australian National University (Australia, 2015–2019), and a senior research scientist at RIKEN (Japan, 2011–2024). Starting from 2024, he is an Ikerbasque Professor at the Donostia International Physics Center (Spain). His ongoing research areas include: complex wave systems, geometric phases, spin-orbit interactions, wave momentum and angular momentum, wave vortices, wave-matter interactions, etc. He has co-authored more than 130 scientific papers, reviews, and book chapters.

Vortices, Skyrmions, Möbius Strips: From Nanooptics to Ocean Waves

I will present recent theoretical and experimental results on: (i) subwavelength high-intensity vortices around ‘holes’ in 2D wave systems: from polaritons to ocean waves, (ii) Bessel-type vortices, displacement-field skyrmions, and polarization Möbius strips in sound and water waves, and (iii) manipulation of floating particles using topologically structured water waves.



Alexandra Boltasseva

Purdue University (USA)

Quasi-2D Materials: From Tailorable Photonics to New Physics

Alexandra Boltasseva is a Ron and Dotty Garvin Tonjes Distinguished Professor of Electrical and Computer Engineering with courtesy appointment in Materials Engineering at Purdue University. She received her PhD in electrical engineering at Technical University of Denmark, DTU in 2004. Boltasseva specializes in nanophotonics, quantum photonics, and optical materials. She is the 2023 recipient of the R.W. Wood Prize (Optica, formerly Optical Society of America), 2022 Guggenheim Fellow, 2018 Blavatnik National Award for Young Scientists Finalist and received the 2013 Institute for Electrical and Electronics Engineers (IEEE) Photonics Society Young Investigator Award, 2013 Materials Research Society (MRS) Outstanding Young Investigator Award, the 2011 MIT Technology Review Top Young Innovator (TR35), the 2009 Young Researcher Award in Advanced Optical Technologies from the University of Erlangen-Nuremberg, Germany, and the Young Elite-Researcher Award from the Danish Council for Independent Research (2008). She is a Fellow of the National Academy of Inventors (NAI), MRS, IEEE, Optica, and SPIE. She served on MRS Board of Directors and is former Editor-in-Chief for Optical Materials Express journal.

Quasi-2D Materials: From Tailorable Photonics to New Physics

We discuss the designer-like characteristics of MXenes, achievable with the choice of transition metal and control of stoichiometry, remarkable tailorability of properties of TD materials with the thickness, and ultra-fast TCOs response. We also explore new device concepts for flat optics/metasurfaces.



Kai Chang

Zhejiang University (China)

Exotic Exciton Phases in Two-Dimensional Quantum Materials

Kai Chang is a chair professor at the School of Physics, Zhejiang University. His research focuses on semiconductor physics and device physics, topological quantum matter and spintronics for decades. He has published more than 200 SCI papers including Nature sub-journals, PRL and other SCI papers. He won the second-class prize of the National Natural Science Award in 2004, and was awarded the 2013 Chinese Physical Society Huang Kun Solid State Physics and Semiconductor Physical Science Award. In 2019, he was elected as an academician of the Chinese Academy of Sciences. He is currently a member of the C8 Committee on Semiconductor Physics of the International Union of Pure and Applied Physics (IUPAP).

Exotic Exciton Phases in Two-Dimensional Quantum Materials

Exciton insulator phases has attracted intensive interests in 2D systems. We demonstrate the existence of topological exciton in InAs/GaSb quantum wells resilient to intense in-plane magnetic fields, identify conventional and novel topological exciton density waves in van der Waals systems, and propose light-engineered exciton supersolidity in heterostructures.



Zhigang Chen

Nankai University (China)

Empowering Topological Photonics for OAM Manipulation

Zhigang Chen is currently a Chair Professor at Nankai University, a recipient of China's National Overseas High-Level Talent Program, and a Chief Scientist of a National Key R&D Program. His research interests include nonlinear optics, topological photonics, and optical trapping and manipulation. Dr. Chen is a Fellow of both Optica and the American Physical Society (APS). He has served as an editor or editorial board member for several journals, including Light: Science & Applications, Laser & Photonics Reviews, Optics Letters, Science Bulletin, and Advances in Physics: X. He has also chaired numerous international conferences, including CLEO-Fundamental Science and the Nonlinear Optics Topical Meeting.

Empowering Topological Photonics for OAM Manipulation

In this talk, we present a few demonstrated examples of topology-driven photonic applications based on the simplest topological model. Building on these foundations, we introduce our design and implementation of more advanced photonic structures that enable robust optical vortex transport and effective manipulation of orbital angular momentum (OAM).



Karin Everschor-Sitte

University of Duisburg-Essen (Germany)

Rethinking Linking - Topology in Magnetism, and Plasmonics

Karin Everschor-Sitte is a professor of Theoretical Physics at the University of Duisburg-Essen in Germany. Her main scientific research fields are the complex fundamental physics of topological magnetic textures and spintronics-based unconventional computing. After completing her PhD at the University of Cologne in 2012, Karin Everschor-Sitte worked as a postdoc at the Technical University Munich and then received a DAAD postdoctoral fellowship to conduct research at the University of Texas at Austin. Followed by a period as a postdoc, she led an Emmy Noether group at the Johannes Gutenberg University Mainz, from 2016 to 2021. In 2018, she received the Hertha-Sponer-Prize, and in 2024, she was honored as the Wohlfarth Lecturer.

Rethinking Linking - Topology in Magnetism, and Plasmonics

Topology in physics explores robust, fault-tolerant states of matter aiming at practical applications. Similar topological structures arise in magnetism, optics, and plasmonics despite differing physics. A challenge is understanding them when traditional mathematical topological frameworks are not necessarily applicable. Linking and geometry offer intuitive ways to describe these complex textures.



Vivian Ferry

University of Minnesota (USA)

Computational Models of Light Management in Photovoltaics and LEDs

Vivian Ferry is an Associate Professor in the Department of Chemical Engineering and Materials Science at the University of Minnesota. Prior to joining Minnesota, she was a Postdoctoral Fellow at Lawrence Berkeley National Laboratory working with Prof. A. Paul Alivisatos, and she received her PhD in Chemistry from the California Institute of Technology working with Prof. Harry A. Atwater. Her work in nano-optics and optical materials has resulted in more than 50 journal publications. Her research includes fundamentals of optical materials and applications, including chiral materials, phase-change materials, luminescent materials and composites, large-area fabrication of nanostructures, and applications to energy, sensing, and optoelectronic devices. She is the recipient of an NSF CAREER award, an Air Force Office of Scientific Research Young Investigator Award, the Marion Milligan Mason Award for Women in the Chemical Sciences, the SPIE Early Career Achievement Award, and was named as one of Technology Review's 35 Innovators under 35.

Computational Models of Light Management in Photovoltaics and LEDs

This talk will discuss the computational models for light management strategies in photovoltaics, including systems that integrate luminescent solar concentrators in greenhouses and reduce the temperature of outdoor panels.



Mark C. Hersam

Northwestern University (USA)

Chemically Functionalized 2D Materials for Quantum Photonic Science and Technology

Mark C. Hersam is the Walter P. Murphy Professor of Materials Science and Engineering, Director of the Materials Research Center, and Chair of the Materials Science and Engineering Department at Northwestern University. He also holds faculty appointments in the Departments of Chemistry, Applied Physics, Medicine, and Electrical Engineering. He earned a B.S. in Electrical Engineering from the University of Illinois at Urbana-Champaign (UIUC) in 1996, M.Phil. in Physics from the University of Cambridge (UK) in 1997, and Ph.D. in Electrical Engineering from UIUC in 2000. His research interests include nanoelectronic materials, additive manufacturing, scanning probe microscopy, renewable energy, sensors, neuromorphic computing, and quantum information science. Dr. Hersam has received several honors including the Presidential Early Career Award for Scientists and Engineers, TMS Robert Lansing Hardy Award, MRS Mid-Career Researcher Award, AVS Medard Welch Award, U.S. Science Envoy, MacArthur Fellowship, and eight Teacher of the Year Awards. Dr. Hersam has been repeatedly named a Clarivate Analytics Highly Cited Researcher with over 700 peer-reviewed publications that have been cited more than 78,000 times. An elected member of the American Academy of Arts and Sciences, National Academy of Engineering, and National Academy of Inventors with over 170 issued and pending patents, Dr. Hersam has founded two companies, NanoIntegris and Volexion, which are suppliers of nanoelectronic and battery materials, respectively. Dr. Hersam is a Fellow of MRS, ACS, ECS, AVS, APS, AAAS, SPIE, and IEEE, and also serves as an Executive Editor of ACS Nano.

Chemically Functionalized 2D Materials for Quantum Photonic Science and Technology

Chemical functionalization allows tailoring of the properties of 2D materials and the degree of coupling across heterointerfaces. In this talk, the prospects of 2D materials for quantum photonic science and technology will be discussed with a focus on how chemical functionalization can enhance quantum emission in 2D transition metal dichalcogenides.



Maria Kafesaki

University of Crete & FORTH (Greece)

Empowering chiral metamaterials with gain materials

Maria Kafesaki is Professor in the Dept. of Materials Science and Engineering of the University of Crete and Adjunct Researcher at the Institute of Electronic Structure and Laser (IESL) of Foundation for Research and Technology Hellas (FORTH). She obtained her Ph.D. from the Physics Department of the University of Crete, Greece. She has worked as post-doctoral researcher in CSIC in Madrid, Spain, and in IESL of FORTH. Her current research is on the area of electromagnetic wave propagation in periodic and random media, with emphasis on metamaterials, where she has large theoretical and computational experience. She has more than 140 publications in refereed journals and more than 80 invited talks at international conferences/schools and Institutions. She has participated in many European projects as well as in the organization of many international conferences and schools. She is Fellow of Optica.

Empowering chiral metamaterials with gain materials

We will review our recent works on chiral metamaterials involving gain materials and on chiral metamaterials combining gain and loss. Special attention will be given to parity-time symmetric chiral metamaterials and to chiral metamaterials for circularly polarized laser emission.



Alexander V. Kildishev

Purdue University (USA)

Beyond the Voigt lineshapes: Efficient statistics-convolved approximants in the time domain

Alexander V. Kildishev works on theory and numerical modeling for nanophotonics. He has had several breakthrough results on negative refractive index metamaterials, optical artificial magnetic structures, loss compensation in metamaterials, plasmonic nanolasers, optical metasurfaces, optical cloaks, and hyperlenses. His current interests also cover the AI-driven inverse design of metadevices in optics and acoustics. He has been included on the Highly Cited Researchers List for the years of 2018, 2022, and 2023 in Web of Science (WOS), which recognizes world-class researchers selected for their exceptional research performance with multiple highly cited papers that rank in the top 1% by citations in the cross-field category. Prof. Kildishev is a Fellow of Optica (OSA).

Beyond the Voigt lineshapes: Efficient statistics-convolved approximants in the time domain

We present a minimax-based approach for efficient time-domain modeling of optical responses from materials with disorder. The utility of our approach, generally applicable to symmetric and non-symmetric disorder statistics, is demonstrated by the non-classical oscillator, relaxation, and conductivity models, achieving the shortest possible numerical stencil for a given controlled accuracy.



Philippe Lalanne

Institut d'Optique - CNRS (France)

Tailoring the visual appearance with correlated-disorder metasurfaces

Philippe Lalanne currently works as a CNRS Research Scientist in Bordeaux. He is an expert in nanoscale electrodynamics. Over the course of his career, he has introduced novel modal theories, established general principles for designing high-Q microcavities, clarified the role of plasmons in the extraordinary optical transmissions, and demonstrated the first high-NA optical metalenses using high-index nanostructures during the late 1990s. Presently, his research interest focuses on the non-Hermitian interaction of light with nanoresonators and disordered optical metasurfaces. From 2018 to 2022, he held the role of Director for the GDR Ondes that gathers the French community working on electromagnetic waves. He received several distinctions, including the prestigious 2023 ERC Advanced grant. He is a fellow of IOP, SPIE and OPTICA.

Tailoring the visual appearance with correlated-disorder metasurfaces

We will review our current effort to model the resonance of individual resonators and collections of them with various theories, including quasinormal modes expansion and multiple scattering.



Howard Lee

UC Irvine (USA)

Functional "Meta"-Optical Fibers for Advanced Imaging and Endoscopy

Howard Lee is currently an Associate Professor in the Department of Physics and Astronomy at UC Irvine. Before joining UCI in 2020, he was an Associated Professor in the Department of Physics at Baylor University and IQSE Fellow and visiting professor in the Institute for Quantum Science and Engineering (IQSE) at TexasA&M. He was a Postdoctoral Fellow at the Caltech, working with Prof. Harry Atwater in active plasmonics/metasurfaces. He received his PhD in Physics from the Max Planck Institute for the Science of Light in Germany in 2012 under the supervision of Prof. Philip Russell. His work on nano-optics, plasmonics/metasurfaces, and fiber optics has led to 50 journal publications in various journals, such as Science, Nano Letters, Advanced Materials, as well as 100 invited talks and 180 conference papers. Dr. Lee is a recipient of a 2025 IEEE Photonics Society Distinguished Lecturer, a 2024 SPIE Fellow, a 2023 Finalist of Moore Inventor Fellow, a 2023 UCI Beall Innovation Award in Physical Sciences, a 2022 Finalist of Moore Inventor Fellow, a 2021 iCANX Young Scientist Award, a 2021 Finalist of Rising Stars of Light, 2020 SPIE Rising Researcher, a 2019 DARPA Director's Fellowship, a 2019 IEEE OGC Young Scientist Award, a 2018 NSF CAREER Award, a 2017 DARPA Young Faculty Award, a 2018 OSA Ambassador, and a 2017 APS Robert S. Hyer Award. He has strong passion in promoting optical sciences and physics to students and the general public, and in serving for the professional communities. He organized more than 25 technical sessions in nanophotonics/metasurfaces in international conferences (Optica, META, PQE, MRS, IEEE) and serves as Lead Symposium Organizer for plasmonic/metasurface symposiums at 2019-2025 MRS Fall Meeting and 2020-2025 MRS Spring Meeting (organized > 2000 presentations).

Functional "Meta"-Optical Fibers for Advanced Imaging and Endoscopy

In this talk, I will review the various material platforms (metallic, dielectric, and compound structures) and geometric platforms which have been utilized in "meta"-fiber devices to date. I will present our recent development of "Meta"-optical fiber, an advanced optical fiber integrated with emerging metasurface concepts. I will present the development of ultrathin optical metalens which is cascaded on the facet of optical fiber that enables advanced optical functions via wavefront shaping such as light focusing.



Konstantinos Makris

University of Crete - FORTH (Greece)

Non-normality, Pseudospectra and Exponential sensitivity

Konstantinos Makris is Associate Professor in the Department of Physics, of the University of Crete and Affiliated Researcher at the Institute of Electronic Structure and Laser (IESL) of Foundation for Research and Technology Hellas (FORTH). He obtained his PhD in Theoretical Photonics from the School of Optics and Photonics (CREOL-FCPE) at the University of Central Florida, Orlando (USA) in 2008. From 2008 until 2010 he was a postdoctoral researcher at Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland. During 2011 he was Lecturer at Institute for Theoretical Physics of Vienna University of Technology (TU-Wien), Austria. From 2012 until 2015 he was a Marie Curie fellow between Princeton University, USA and TU-Wien, Austria. His current research interests lie on non-Hermitian physics, nonlinear optics, photonics lattices and wave propagation in complex media. He has more than 100 publications in refereed journals and more than 60 invited talks-colloquia at international conferences/schools and Institutions. In 2022 he was awarded an ERC consolidator grant related to open disorder systems. He was also elected as a 2023 Fellow of OPTICA (former OSA).

Non-normality, Pseudospectra and Exponential sensitivity

In the context of non-Hermitian photonics, we present recent results regarding non-normal optical waveguides. We investigate photonic lattices with gain/loss, as well as, asymmetric couplings and study their spectral and dynamical response based on pseudospectra theory. The recent notions of exponential sensitivity, and power eigenchannels will be also discussed.



Marco Miniaci

IEMN-CNRS (France)

Bioinspired metamaterials

Marco Miniaci is a permanent researcher at the French National Scientific Research Centre (CNRS) appointed at the Institute of Electronics, Microelectronics and Nanotechnology (IEMN) of Villeneuve D'Ascq, in France. His research interests cover theoretical, numerical, and experimental aspects of wave propagation and structural mechanics of phononic crystals and elastic metamaterials. Marco Miniaci currently is the principal investigator of the ERC StG « POSEIDON » (dealing with bioinspired metamaterials, topological protection and underwater acoustics), coordinator of the MAGNIFIC HORIZON-CL4-2022-RESILIENCE-01-10 (dealing with materials for a next generation of (nano-)opto-electro-mechanical systems), and participate into the MetAcMed HORIZON-MSCA-2022-DN-01 (dealing with acoustic and mechanical metamaterials for biomedical and energy harvesting applications).

Bioinspired metamaterials



Sir John Pendry

Imperial College London (UK)

Talk 1. Quantum Aspects of Light Propagation in Time-Varying Media

Talk 2. Modulating Optical Properties in Time Using Plasmonic Resonances

John Pendry has worked at the Blackett Laboratory, Imperial College London, since 1981. His research at Imperial College reflects his broad interests in physics but has recently concentrated on optics and electromagnetism in general. In collaboration with scientists at The Marconi Company he designed a series of 'metamaterials' whose properties owed more to their micro-structure than to the constituent materials. The metamaterial concept caught on and now is a major topic not only of research activity, but also of application to 5G and 6G network technology, MRI, satellite communications and much else, though popular interest has concentrated on his design for a cloak of invisibility.

Talk 1. Quantum Aspects of Light Propagation in Time-Varying Media

Recent experiments demonstrate ultra-fast modulation of refractive indices opening up the field of space-time modulation. Breaking time invariance presents new challenges to theory with the removal of conservation of energy/frequency. New conservation laws are emerging which deepen our understanding of these systems.

Talk 2. Modulating Optical Properties in Time Using Plasmonic Resonances

Plasmonic effects in Indium Tin Oxide enable rapid switching of transparency which can be exploited to modulate THz radiation on a fs time scale.



Kaushik Senguptav

Princeton University (USA)

AI to Discover and Synthesize Sub-terahertz Chips beyond Human Intuition

Kaushik Sengupta received his Ph.D. in Electrical Engineering from Caltech in 2012. Dr. Sengupta joined the Department of Electrical and Computer Engineering at Princeton University, Princeton, NJ, as a Faculty Member in 2013, where he is currently a Professor. His research interests include novel chip-scale architectures for intelligent sensing and communication for a wide range of emerging applications.

Dr. Sengupta is an IEEE Fellow. He received the DARPA Young Faculty Award in 2018, the Bell Labs Prize in 2017, the Young Investigator Program Award from the ONR in 2017, the 2015 Microwave Prize, and multiple best paper awards in IEEE IMS and RFIC. He served as a Distinguished Lecturer for the IEEE Solid-State Circuits Society from 2019 to 2020 and for the IEEE Microwave Theory and Technology Society from 2021 to 2023. He is a recipient of the 2021 IEEE Microwave Theory and Technology Outstanding Young Engineer Award and the 2022 IEEE Solid-state Circuits New Frontier Award. He currently serves as the co-chair of the IEEE Solid-state Directions Sub-committee and as a technical advisor for the wireless start-up company, GuRu, based in Pasadena, CA. His group received IEEE Journal of Solid-State Circuits Best Paper of the Year in 2023.

AI to Discover and Synthesize Sub-terahertz Chips beyond Human Intuition

Traditionally, chip-scale high-frequency system design has been in the domain of the experts. We demonstrate here for the first time how AI can not only allow design times that are orders of magnitude faster, but also unearth new sub-THz chip architectures that are beyond human intuition.



Vladimir M. Shalaev

Purdue University (UK)

Silicon Quantum Photonics

Vladimir M. Shalaev, Scientific Director for Nanophotonics at Birck Nanotechnology Center and Distinguished Professor of Electrical and Computer Engineering at Purdue University, specializes in nanophotonics, plasmonics, optical metamaterials and quantum photonics. Prof. Shalaev has received several awards for his research, including the APS Frank Isakson Prize for Optical Effects in Solids, the Optica (formerly, Optical Society of America) Max Born Award for his pioneering contributions to the field of optical metamaterials, the Willis E. Lamb Award for Laser Science and Quantum Optics, IEEE Photonics Society William Streifer Scientific Achievement Award, Rolf Landauer medal of the ETOPIM (Electrical, Transport and Optical Properties of Inhomogeneous Media) International Association, the UNESCO Medal for the development of nanosciences and nanotechnologies, and the OSA and SPIE Goodman Book Writing Award. Prof. Shalaev is recognized as a Highly Cited Researcher in physics by the Web of Science Group for 7 consecutive years, in 2017-2023. He is a Fellow of the IEEE, APS, SPIE, MRS and Optica.

Silicon Quantum Photonics

We discuss scalable quantum photonics circuitry based on room-temperature single-photon emitters in silicon nitride that we recently discovered in this technologically important material platform. We also consider integration of SiN single-photon emitters with waveguides as well as the quantum emission enhancement through integration with resonant cavities and plasmonic nanostructures.



Marin Soljačić

MIT (USA)

Certain intersections of AI and Photonics

Marin Soljačić is a Professor of Physics at MIT. He is a founder of a few companies, including WiTricity Corporation (2007) and Lightelligence (2017). His main research interests are in artificial intelligence as well as electromagnetic phenomena, focusing on nanophotonics, non-linear optics, and wireless power transfer. He is a co-author of more than 300 scientific articles, more than 100 issued US patents, and he has been invited to give more than 100 invited talks at conferences and universities around the world. He is a recipient of the Adolph Lomb medal from the Optical Society of America (2005), and the TR35 award of the Technology Review magazine (2006). In 2008, he was awarded a MacArthur fellowship "genius" grant. He is an international member of the Croatian Academy of Engineering since 2009. In 2011 he became a Young Global Leader (YGL) of the World Economic Forum. In 2014, he was awarded Blavatnik National Award, as well as Invented Here! (Boston Patent Law Association). In 2017, he was awarded "The Order of the Croatian Daystar, with the image of Ruder Bošković", the Croatian President's top medal for Science. In 2017, the Croatian President also awarded him with "The Order of the Croatian Interlace" medal. He was a Highly Cited Researcher according to WoS for 2019, 2020, 2021, 2022 & 2023. In 2023, he was awarded Max Born award of Optica.

Certain intersections of AI and Photonics

This talk will explore how photonics can enhance AI hardware and how AI can accelerate photonics research. Topics will include large language models for scientific discovery and robotics for photonics experiments, highlighting key opportunities and challenges at this intersection.



Clivia M. Sotomayor Torres

Iberian Nanotechnology Laboratory - INL (Portugal)

Spectral Frequency Response of Hypersonic Phonons in a Non-Trivial Topological Waveguide

Clivia M. Sotomayor Torres obtained her PhD in Physics in 1984 from the University of Manchester, UK. She held tenured academic appointments at Saint Andrews and Glasgow universities in the UK, at Wuppertal University in Germany and was a research professor at the National university of Ireland University College Cork (Tyndall National Institute). From 2007 to 2023 she was an ICREA research professor and group leader of the Phononic and Photonic Nanostructures group at the ICN2 in Spain. Clivia received awards from the Royal Society of Edinburgh, the Nuffield Foundation and an Amelia Earhart Fellowship from ZONTA International (USA). She carries out research in the science and engineering of phononic nanostructures, nanophotonics and thermal transport. In 2020 she was elected to the Academia Europaea. She is holder of an European Research Council advanced grant investigating phonon transport in topological waveguides. Since September 2023 she is the Director General of the International Iberian Nanotechnology Laboratory (INL) in Braga, Portugal, where she has set up a new research group.

Spectral Frequency Response of Hypersonic Phonons in a Non-Trivial Topological Waveguide

The spectral frequency response of a hypersonic phononic wave propagating along a non-trivial topological waveguide is obtained by laser Doppler vibrometry. The guided mode at 2.115 GHz is shown to propagate with minimal loss..



Vincent Tournat

Laboratory of Acoustics - CNRS, Le Mans University (France)

Transition waves in multistable mechanical metamaterials

Vincent Tournat currently holds a Research Professor position at CNRS and conducts research in the field of nonlinear waves and acoustics at the Laboratory of Acoustics at Le Mans University in France. VT graduated with a major in solid state physics, acoustics & wave physics and defended his PhD thesis on nonlinear acoustics in granular materials in 2003. He then spent the year 2004 as a postdoc at Hokkaido University, Japan, working on laser picosecond ultrasonics, prior to starting at CNRS. During his first years at CNRS, he established two research groups on acoustics of granular media and laser ultrasonics, then participated in developing two other areas of research in his department, ultrasonic non-destructive testing, and acoustic metamaterials. For the last decade, his research focuses on nonlinear waves in flexible mechanical metamaterials. From 2007 to 2022, VT led the "Acoustics and Mechanics of Materials" research team of more than 50 people. His research achievements have been awarded prizes on several occasions, including the CNRS Bronze Medal in 2010 and the Silver Whistle early career award by the International Commission on Ultrasonics (ICU) in 2013. Until 2024, he has been the director of the Institut d'Acoustique - Graduate School (<http://iags.univ-lemans.fr>) created in 2017 and awarded the national label "Graduate School" (a selection of few Institutes comprising high impact research laboratories, departments, as well as recognized master, engineering and doctoral curriculae). VT has been regularly invited for research visits in Japan, Chile, Spain, USA and he is a visiting research Professor at Harvard University since September 2022. <https://perso.univ-lemans.fr/vtournat/>

Transition waves in multistable mechanical metamaterials

I will highlight the fundamentals and a selection of recent results on transition waves triggering, propagation, and discuss some of their potential applications. In general, these reconfiguration fronts obey nonlinear reaction-diffusion equations and show specific properties not necessarily found in other waves supported by periodic and/or nonlinear media.



Seokho Yun

Samsung Advanced Institute of Technology - SAIT (Korea)

AI-Driven Photonics: From Metaphotonics to Silicon Photonics Integration

Seokho Yun is the Vice President of Technology at the Samsung Advanced Institute of Technology (SAIT), where he leads the Photonics Research Team, advancing research and development in meta-photonics and silicon photonics. His expertise lies in meta-photonics and silicon photonics, with a strong focus on enhancing device performance, enabling miniaturization, and pioneering innovative functionalities. He earned his Ph.D. in Electrical Engineering from Pennsylvania State University and conducted postdoctoral research at the Materials Research Science & Engineering Center, specializing in metamaterials and plasmonics applications.

Since joining Samsung Electronics in 2012, he has played a key role in leading meta-photonics sensor projects. Under his leadership, in February 2025, his team successfully commercialized the world's first image sensor integrating meta-photonics color-routing nanostructures. As the demand for high-speed data processing continues to accelerate in the AI era, he is spearheading the development of next-generation ultra-high-speed optical interconnect technologies based on silicon photonics. Additionally, he is driving research on the convergence of silicon photonics and meta-photonics, shaping the future of photonics innovation.

AI-Driven Photonics: From Metaphotonics to Silicon Photonics Integration

As we enter the AI era, photonics is evolving beyond boundaries. This keynote explores advances in metaphotonics and silicon photonics—enabling next-generation image sensors, LiDAR, micro-LED displays, and optical interconnects. Their convergence opens new pathways to compact, power-efficient, and high-performance devices that elevate the capabilities of future optical systems.



Nikolay Zheludev

University of Southampton (UK)

Photonic Metamaterial Time Crystals and Timetronics

Nikolay Zheludev's research interests are in nanophotonics and metamaterials. He is the Deputy Director of the Optoelectronics Research Centre in Southampton University, UK. Prof. Zheludev is elected as a Fellow of the Royal Society (UK) and Member of the USA National Academy of Engineering. He is a Fellow of the European Physical Society (EPS), the Optical Society (OSA) and the Institute of Physics (London). He has been awarded the Michael Faraday Gold Medal, Thomas Young Medal and President of Singapore Science and Technology Award.

Photonic Metamaterial Time Crystals and Timetronics

We discuss recent developments in understanding functionalities and developing applications of time crystals - a new state of matter, a many-body interacting system that exhibits a spontaneous mobilization transition to the robust state of oscillation, breaking time translation symmetry under an infinitely small change of the external driving force.

TUTORIAL



Prof. Andrea Alù

City University of New York (USA)

Wednesday 23th July

14:00 - 15:00 — Torremolinos

Nonlocal metasurfaces

Andrea Alù is a Distinguished Professor at the City University of New York (CUNY), the Founding Director of the Photonics Initiative at the CUNY Advanced Science Research Center, and the Einstein Professor of Physics at the CUNY Graduate Center. He received his Laurea (2001) and PhD (2007) from the University of Roma Tre, Italy, and, after a postdoc at the University of Pennsylvania, he joined the faculty of the University of Texas at Austin in 2009, where he was the Temple Foundation Endowed Professor until Jan. 2018. Dr. Alù is a Fellow of the National Academy of Inventors (NAI), the American Association for the Advancement of Science (AAAS), the Institute of Electrical and Electronic Engineers (IEEE), the Materials Research Society (MRS), Optica, the International Society for Optics and Photonics (SPIE) and the American Physical Society (APS). He is the President of Metamorphose, a Highly Cited Researcher since 2017, a Simons Investigator in Physics, the director of the Simons Collaboration on Extreme Wave Phenomena Based on Symmetries, and the Editor in Chief of Optical Materials Express. He has received several scientific awards, including the NSF Alan T. Waterman award, the Blavatnik National Award for Physical Sciences and Engineering, the IEEE Kiyo Tomiyasu Award, the ICO Prize in Optics, the OSA Adolph Lomb Medal, and the URSI Issac Koga Gold Medal.

Nonlocal metasurfaces

The use of engineered nonlocal responses in metasurfaces has been recently unveiled as a paradigm for extreme wave control, enabling rational control over space, time, frequency and momentum of the incoming signals, as well as analog-based image processing and computing. Several recent demonstrations of metasurfaces performing edge-detection and image-processing using engineered spatial nonlocality have shown a path towards ultrafast, efficient, massively parallel analog image processing based on passive devices, which holds the promise for being extended towards general analog computing platforms. Space-time nonlocal metasurfaces performing the space- and time-derivatives of the incoming signal were also envisioned by tailoring their frequency and momentum dispersion. In this tutorial, I will discuss the basics of nonlocality engineering in metasurfaces and their various implementations and opportunities for this field of research, showcasing compact meta-structures with reconfigurable properties that can perform mathematical operations, solve compact mathematical problems and address the issues of reprogrammability and cascaded responses. I will discuss how these findings may open exciting opportunities for applications in imaging, automotive vehicles, sensing and computing, and serve as a pre-processing tool for simplifying complex computing architectures.

The tutorial is free and open to all META conference attendees.

GUIDELINES FOR PRESENTERS

Oral Presentations

Each session room is equipped with a stationary computer connected to a LCD projector. Presenters must load their presentation files in advance onto the session computer. Technician personnel will be available to assist you.

Scheduled time slots for oral presentations are 15 mn for regular, 20 mn for invited presentations, 30 mn for keynote talks and 35 mn for plenary talks, including questions and discussions. Presenters are required to report to their session room and to their session Chair at least 15 minutes prior to the start of their session.

The session chair must be present in the session room at least 15 minutes before the start of the session and must strictly observe the starting time and time limit of each paper.

Poster Presentations

Presenters are requested to stand by their posters during their session. One poster board, A0 size (118.9 x 84.1 cm), in portrait orientation, will be available for each poster. Pins or thumbtacks are provided to mount your posters on the board. All presenters are required to mount their papers 30mn before the session and remove them at the end of their sessions. Posters must be prepared using the standard AES poster template (available on the conference [website](#)).

USEFUL INFORMATION

Venue

META 2025 will be held at
Palacio de Congresos y Exposiciones de la Costa del Sol
3 Calle Mexico, 29620 Torremolinos (Spain)

<https://palacio-congresos.es>

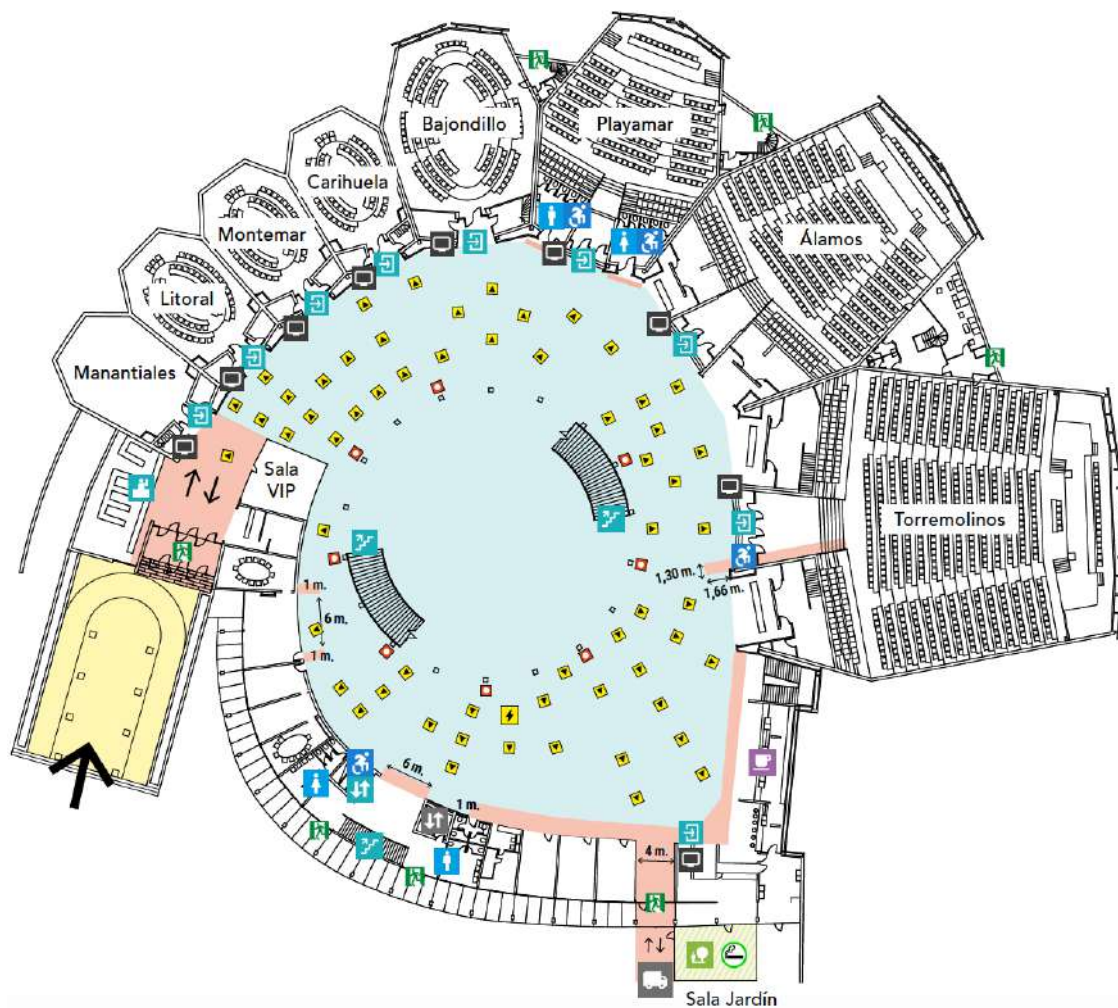


Opened in October 1970, the Palacio de Congresos y Exposiciones de Torremolinos (Congress and Exhibition Centre) was the result of a project designed in 1967 by the architects Rafael de la Hoz and Gerardo Olivares James. The building, which became the state heritage property in 1971.

The complex is built on an estate of 70,000 square meters, of which 18,000 square meters are gardens. Situated in a privileged location in the municipality of Torremolinos and located in the upper area of the town on a hill overlooking the sea, the Congress Center is an icon of Malaga's coastal landscape.



The building is arranged in a circular format around which the various auditoriums, meeting rooms, administrative offices and annexed buildings are distributed. The central hall is presided over by its most iconic visual symbol, an emblem of convention and business tourism in Spain: a large translucent dome with an unprecedented crystal lamp hanging from the center of the exposed radial roof, falling like drops in a waterfall spilling over the center of the composition.



Getting to Venue

Getting to Torremolinos from Malaga Airport

Torremolinos is around 8km away from Malaga international airport. You can go from the airport to the city center by taxi, by train or by bus.

Taxi

The airport has a well-signposted taxi rank outside the arrivals area of Terminal T3. Make sure that the taxi driver has started the taximeter at the beginning of the journey (minimum fare). We recommend requesting a receipt for any complaint or claim.

Train

The new suburban train station in the new Terminal T3 building links the airport with Torremolinos city centre and other cities like Benalmadena and Fuengirola in one direction, and it links Malaga city center in the other direction.

The train station is situated underground and accessed via escalators. It is well signposted and can be reached via the square outside arrivals or outside departures. Before the station entry barriers you will see several self-service tickets machines on your right where you can buy your tickets.

The first train to Torremolinos leaves the airport at 05:32, leaving every 20-30 minutes until the last train at 23:42. Line: C1. Estimated travel time: 10 minutes.

Bus

You will find the bus stop straight in front of you outside the arrivals area of Terminal T3 on the side of the road where there are a couple of shelters with seats. You will also see a ticket office in the left hand corner of the arrivals forecourt where you should purchase your tickets for the journey. Line: Torremolinos-Benalmadena-Airport. Estimated travel time: 30 minutes.

Getting to Torremolinos from Malaga train station

There are two train stations in the centre of Malaga : Maria Zambrano and Centro Alameda. Maria Zambrano station provides high-speed (AVE) and long-distance links to many Spanish cities like Barcelona, Cordoba, Madrid, Santiago de Compostela, Seville, etc, as well as local and regional routes.

You can take Line C1 from any of the two stations to reach Torremolinos. The estimated travel time is 20 minutes. You can check the timetables on the website of the national rail company [RENFE](https://www.renfe.es).

Getting to Torremolinos from Malaga bus station

Malaga bus station is located at the street "Paseo de los Tilos" very near Maria Zambrano train station. So it will be very easy to take a bus or a train from this station. You can take bus line Malaga-Torremolinos. Estimated travel time: 20 minutes.

TECHNICAL PROGRAM

Monday 21st July, 2025

Registration
Reception Desk
15:00 - 18:00

Tuesday 22nd July, 2025

Registration

Reception Desk

08:00 - 17:30

Opening Address

Torremolinos

08:45 - 09:00

09:00 - 10:10 — Torremolinos

Session 1A1

Plenary Session I

Chaired by: Andrea Alu

09:00 : **Plenary talk**

Robust Edge States in Topological Lattices for Quantum information Transfer

J. Zurita¹, C. E. Creffield², Gloria Platero Coello¹

¹*Materials Science Institute of Madrid (Spain)*, ²*Complutense University of Madrid (Spain)*

This talk will deal with the transfer of quantum information using protected topological edge states. I will discuss the long-range transfer in a dimer chain, a 1D topological insulator, and in the Creutz-Ladder lattice and the role of topological domain walls to speed up the particle transfer.

09:35 : **Plenary talk**

Metastructures That Compute and Optimize

Nader Engheta

University of Pennsylvania (USA)

I will present some of the most recent results of our ongoing research projects on nonlocal metasurfaces and metastructures that perform ultrafast analog computation, such as vector-matrix multiplication, matrix inversion, constrained optimization, equation solving, etc. I will also discuss how incoherent light can be used for certain analog computations.

Coffee Break

Session 1P1

Poster session I

10:10 - 10:50

P1: A Broadband Artificial Magnetic Conductor Utilising Magnetodielectric Substrate And Multilayered Metasurface

Cameron Gallagher¹, Simon Berry², Chris Lawrence², Alastair Hibbins¹

¹*The University of Exeter (United Kingdom)*, ²*QinetiQ Ltd. (United Kingdom)*

We present an artificial magnetic conductor comprising a multilayered metasurface and a magnetodielectric composite. The metasurface confines the electric field, prioritizing the bandwidth enhancement of the relative

permeability over the reduction from the relative permittivity. This design achieves a 110 % bandwidth (300-1100 MHz) with a significantly sub-wavelength height <15mm.

P2: Study Of Active And Bleached Tdbc Dye Devices For Photonics Applications

Bienlo-Flora Zerbo¹, Komlan S. Gadedjisso-Tossou², Jean-Michel Benoit¹, Clementine Symonds¹, Joel Bellessa¹, Alban Gassenq¹

¹ILM - University Lyon 1 (France), ²Université de Lomé (Togo)

We have investigated local photobleaching in TDBC layers for grating and strong coupling applications. This method allows to be modulate the refractive index both locally and spectrally, enabling the patterning of micro-devices with spectral modulation. We will present fundamental properties and fabricated devices, highlighting the high potential of such material.

P3: Quadratic Weyl Semimetal And Topological Double Negative Refraction In Phononic Crystals

Yating Yang

Beijing University of Chemical Technology (China)

We report the realization of an acoustic quadratic Weyl semimetal, which hosts a pair of quadratic Weyl points with opposite charges. Nonzero charges of the quadrature Weyl points give rise to the Fermi-arc boundary states. We further achieve the double negative refraction of the boundary acoustic waves without reflection.

P4: Aluminum Nonlinear Metasurface With Giant Saturable absorption For A Polarization-maintaining Mode-locking Fiber Laser

Hailun Xie, Lili Gui, Kun Xu

Beijing University of Posts and Telecommunications (China)

We experimentally demonstrate a stable polarization-maintaining mode-locking fiber laser operating around 1 micron, assisted by a surface-lattice-resonance aluminum metasurface saturable absorber with giant modulation depth (9.6 %).

P5: High-efficiency Metasurface Color Routers Inverse-designed Via Accelerated Genetic Algorithms

Hyoseok Park¹, Samuel Kim², Yeonsang Park¹, Myungjae Lee²

¹Chungnam National University (Korea), ²Seoul National University (Korea)

Metasurface color routers surpass color-filter arrays in image sensors by directing specific wavelengths of light to corresponding pixels. We inverse-designed a metasurface color router with high efficiency using a genetic algorithm accelerated by a U-net. The fabricated router shows efficiencies with 73 %, 69 %, and 45 % for RGB.

P6: Magnetic Field Induced Shift In Lspr Of Photochemical Synthesized ZnO/ag Nanocomposites

Roman Redko, Vitaliy Shvalagin, Grigori Milenin, Svitlana Redko

V. Lashkaryov Institute of Semiconductor Physics (Ukraine)

The influence of the ZnO nanoparticles magnetic field pre-treatment on the position of the plasmon resonance peak in ZnO/Ag nanocomposites was detected. "Memory effect"during 30 days after magnetic field pre-treatment was observed. Possible physical mechanism related to ferromagnetic-like behaviour of ZnO nanoparticles is discussed,

P7: Suppressing Photobleaching Of J-aggregates Via Strong Light-matter Coupling

Yadav Rohit Umashankar, Parinda Vasa

Indian Institute of Technology Bombay (India)

we experimentally investigate the suppression of photobleaching of cyanine dye j-aggregates when it is strongly coupled to propagating surface plasmons on planar silver film. The experimental technique involves the novelty of probing only the strongly coupled molecules for bleaching suppression in the Kretschmann configuration with no background from uncoupled molecules.

P8: Multimode Phonon Lasing In A Self-modulated Silicon Optomechanical Crystal Cavity

David Alonso Tomás¹, Carlos Mas Arabi², Carles Milián², Néstor E. Capuj³, Alejandro Martínez², Daniel Navarro Urríos¹

¹Universitat de Barcelona (Spain), ²Universitat Politècnica de València (Spain), ³Universidad de La Laguna (Spain)

We theoretically and experimentally investigate an optically self-modulated multimode optomechanical plat-

form. The self-induced modulation adapts to optomechanical feedback from multiple modes, enabling synchronous pumping and driving them into high-amplitude, coherent mechanical motion despite strong mode competition. These findings advance the generation of multi-phonon coherent sources in chip-integrated silicon platforms.

P9: On-chip Lasers On Waveguides: A Meta-morphosis In Waveguide Imaging!

Oliver Olsson, Khosro Zangeneh Kamali, Erik Strandberg Strandberg, Hana Šípová-Jungová, Mikael Käll

Chalmers University of Technology (Sweden)

Scattering-based microscopy with an evanescent field enhances signal-to-noise by suppressing background. Waveguides generate evanescent waves, but edge-coupling of light is difficult to use. Bonding a VCSEL to a waveguide platform enables an easy coupling via a grating coupler. Integrating a metasurface into the VCSEL tilts emission, improving waveguide excitation.

P10: Experimental Realization Of Convolution Processing In Photonic Synthetic Dimensions

Xinyuan Hu, Bing Wang, Chenzhi Qin, Peixiang Lu

Huazhong University of Science and Technology (China)

We use synthetic photonic lattice constructed from two coupled fiber loops to design an optical convolution processing unit, achieving the arbitrary convolution operations. The convolution process is completed with two phase modulators and two intensity modulators, which the convolution kernels can be dynamically reconfigured through phase and intensity modulation.

P11: Accelerating Proximity-field Nanopatterning: Gpu-optimized Electromagnetic Solvers For Complex 3d Nanostructure Design

Dohyeon Lee¹, Moosung Lee², Bakytgul Yerenzhep³, Myungjoon Kim¹, Hugonnet Herve¹, Seokwoo Jeon³, Jonghwa Shin¹, Yongkeun Park⁴

¹KAIST (Korea), ²KAIST (Germany), ³Korea University (Korea), ⁴KAIST (Korea)

We enhance the phase mask design process of proximity-field nanopatterning by integrating a GPU-accelerated convergent Born series solver with gradient-based optimization. This method outperforms FDTD in 2D and 3D simulations, enabling efficient, high-contrast nanostructure design. Our approach advances PnP, expanding its potential for complex 3D nanofabrication.

P12: Chaos-based Communication In Synthetic Temporal Lattices

Chenyu Liu, Bing Wang, Peixiang Lu

Huazhong University of Science and Technology (China)

We presents a tunable nonlinearity method in synthetic temporal lattices via opto-electric feedback, experimentally demonstrating bistability-to-chaos transitions and constructing a high-entropy chaos-based encryption system. The findings enable advanced secure communication schemes within synthetic dimension platforms.

P13: Novel Sensing Technique For Non-destructive Composites Monitoring

Valentina Zhukova¹, P. Corte-León¹, A. Allue², K. Gondra², J. M. Blanco³, Arcady Zhukov¹

¹University of Basque Country (Spain), ²Gaiker Technological Centre (Spain), ³UPV/EHU (Spain)

Using free space setup we observed a remarkable change of the reflection and transmission at frequencies of 4-7 GHz upon the matrix polymerization with embedded magnetic microwire inclusions. Observed dependencies are attributed to the influence of heating and stresses variation on magnetic properties of magnetic microwires during the matrix polymerization.

P14: Incoherent Dielectric Tensor Tomography For Robust 3d Birefringence Imaging Using Non-interferometric System

Juheon Lee, Herve Hugonnet, Chulmin Oh, YongKeun Park

KAIST (Korea)

We present an incoherent dielectric tensor tomography (DTT) for robust three-dimensional birefringence imaging of anisotropic structures. By employing phase deconvolution microscopy and a digital micromirror device, our approach overcomes noise limitations in conventional DTT. Experimental validation with liquid crystal droplets demonstrates accurate internal alignment reconstruction, enabling robust birefringence analysis.

P15: 3d Strain Tensor Analysis In Micro-indented Glass Via Dielectric Tensor Tomogram**Juheon Lee, YongKeun Park***KAIST (Korea)*

Dielectric tensor tomography (DTT) enables 3D visualization of strain in materials through optical birefringence. Applying the stress-optic law, we determine principal strains and orientations in micro-indented glass, revealing density variations and crack propagation. Our findings highlight DTT's potential for non-destructive strain analysis and characterization of complex strain distributions.

P16: Cofactor Regeneration In Enzyme Membrane Reactors By Photoenzymatic Methods: A Biomimetic Light-harvesting Platform With Ionic Porphyrins For Co2 Reduction**Zhibo Zhang, Manuel Pinelo***Technical University of Denmark (Denmark)*

Photoenzymatic platforms enable efficient cofactor regeneration for enzymatic reactions requiring redox cycling. We present an ionic porphyrin-based light-harvesting system that enhances NADH regeneration and enzymatic CO₂ reduction. By optimizing photonic absorption and charge transfer, this biomimetic approach improves energy conversion, demonstrating potential for sustainable photocatalysis and solar-driven biomanufacturing.

P17: Manipulation Of Silver Thicknesses Of Patterned Metal By Nanosphere Lithography And Electroplating For A Smart Window**Cheng-Yuan Xiao, Tsung-Yu Huang***Ming Chi University of Technology (Taiwan)*

By regulating solar heat, smart windows mitigate the overall vicious cycle fueled by global warming. Our electrochromic approach integrates electroplated silver and nanospheres, enabling transmittance from 0 % to clarity. Surpassing traditional systems, this flexible technology delivers dynamic sun modulation, enhanced performance, and improved energy efficiency, significantly boosting global architectural sustainability.

P18: Upo Diffracted Field By A Pec-backed Chiral Half-sheet**Giovanni Riccio¹, Flaminio Ferrara¹, Gianluca Gennarelli², Rocco Guerriero¹, Francesco Chiadini¹**¹University of Salerno (Italy), ²I.R.E.A. - C.N.R. (Italy)

A Uniform Asymptotic Physical Optics solution is provided to evaluate the plane wave diffraction by a uniaxial anisotropic chiral half-sheet with a perfect electrical conductor backing. The incidence direction is assumed to be perpendicular to the linear edge of the chiral sheet.

P19: Excitation Of Multiple Fano Resonances Through Broadband Oblique-wire-bundle Metamaterial Absorbers And Targeted Molecules**Kai Lin Hsiao, Tsung-Yu Huang***Ming Chi University of Technology (Taiwan)*

To improve the absorption sensitivity of sensors, we have studied the absorption interaction with multiple functional groups in the sample through oblique wire bundle (OWB) metamaterial absorber with molecular functional groups' absorption. We developed four Fano resonances with three PMMA functional groups and one carbon functional group for better sensitivity.

P20: Dual-directional Acoustic Metamaterial Absorber For Noise Reduction**Tzu-Hsuan Chan, Tsung-Yu Huang***Ming Chi University of Technology (Taiwan)*

This study explores an acoustic metamaterial with dual-directional absorption, allowing sound waves to enter from two perpendicular directions for multi-directional noise absorption. This study utilizes a 3D printer to create Lego bricks, which can be assembled. Users can customize the structure as needed. This design enhancing flexibility for various environments.

P21: Electrically-biased Surface Plasmon Nanolaser With A Hyperbolic Metasurface**Jun-Yu Wu, Tsung-Yu Huang***Ming Chi University of Technology (Taiwan)*

In this study, we employed a hyperbolic metasurface of alternating air and metallic stripes for demonstration of the nanolaser. The hyperbolic metasurface provides three-dimensional confinement of surface plasmons, enabling smaller physical and modal volumes compared to others. Furthermore, the minimal volume facilitates

miniaturization and integration of photonic integrated circuits efficiently.

P22: Slanted Anisotropic Metasurfaces for Enhanced Reflectance Minimization in CMOS Image Sensors

Mingwan Cho, Jonghwa Shin

KAIST (Korea)

We propose a slanted anisotropic metasurface (SAMS) to minimize reflectance in silicon photodetectors by adapting to incidence angle and polarization variations. Using slanted TiO₂ elliptical nanodisks, our SAMS achieves broadband antireflection in the visible spectrum over $\pm 40^\circ$ angles through enhanced impedance matching, promising improved optical performance.

P23: Sequential Deposition of Silver Nanoparticles on Silicon Ripples for LSPR Anisotropy minimization and SERS Applications

Tarundeep Kaur Lamba, Sebin Augustine, K. P. Sooraj, Mukesh Ranjan

Institute for Plasma Research (India)

This work introduces the sequential deposition method for Ag-NPs on a silicon ripple substrate. This method enables the formation of nearly spherical NPs and prevents LSPR anisotropy. The concept is validated through detailed FDTD simulations, experiments, and SERS analysis, demonstrating its effectiveness in enhancing signal uniformity and intensity.

P24: Generation of high-efficiency bi-functional holography with metasurfaces

Changhong Dai¹, Tong Liu², Dongyi Wang³, Lei Zhou¹

¹Fudan University (China), ²The Hong Kong University of Science and Technology (Hong Kong), ³The University of Hong Kong (China)

Here we propose a generic approach to design ultra-thin and high-efficiency metasurfaces for multiple holographic images' generation. Utilizing high-efficiency reflective meta-atoms exhibiting incident-spin-delinked reflection phases governed by geometric and resonant mechanisms, distinct holographic images can be generated by the metasurface with the thickness $\sim 1/4 \lambda$ and efficiencies $\sim 48.08\%$.

P25: Discretization effects in topological plasmonics

Alexander Neuhaus, Pascal Dreher, Frank Meyer zu Heringdorf

University of Duisburg-Essen (Germany)

Determining the full electric field of surface plasmon polaritons (SPPs) is experimentally challenging. Therefore, experimental data often needs to be compared to numerical simulations. We use a Hankel-wavelet based simulation to address why Chern numbers, invariant in topologic plasmonic systems, are systematically smaller than the theoretical expectation.

P26: Metamaterial-based Dielectric Elastomers for Enhanced Energy Harvesting

A. Dutta, Y. Pennec, G. Leveque, B. Djafari-Rouhani, M. Miniaci

Université de Lille (France)

This work investigates the integration of mechanical metamaterials into dielectric elastomer generators (DEGs) to enhance energy harvesting performance. By introducing auxetic and multi-stable geometries in both two-dimensional (2D) and three-dimensional (3D) DEGs, we demonstrate enhanced capacitance variation and broadband response, leveraging metamaterial-induced nonlinearities and deformations to improve energy conversion efficiency.

P27: Emitting properties of a-Si:C:H-coated 2D-opaline photonic crystals

S. I. Pavlov¹, M. E. Bochkarev², S. A. Dyakov³, V. G. Golubev¹, S. A. Grudinkin¹, M. F. Limonov², A. B. Pevtsov¹

¹Ioffe Institute (Russia), ²ITMO University (Russia), ³Skolkovo Institute of Science and Technology (Russia)

Two-dimensional photonic crystals are fabricated from opal slabs coated with an a-Si:C:H emitting layer. The optical response of the emitting 2D PhC's near Γ -point of the Brillouin zone have been studied. A significant increase in the luminescence intensity in the visible spectral range has been demonstrated in the synthesized structures.

P28: Theoretical study and experimental validation of nonlocal metasurfaces for Augmented Reality

Pietro Baldin¹, Alberto Sivera¹, Rafael Bellei de Carvalho¹, Filippo Coviello¹, Vittorio Bonino², Jacopo

Stefano Pelli Cresi², Anna Cesaratto², Tommaso Ongarello², Paolo Biagioni¹, Roman Sordan¹, Giovanni Isella¹, Gianluca Valentini¹, Giulio Cerullo¹, Giuseppe Della Valle¹

¹Politecnico di Milano (Italy), ²Smart Eyewear Lab (Italy)

This poster summarizes all the activities we have performed to achieve advanced nonlocal metasurfaces for this application, focusing on the theoretical studies and simulations, but also with experimental validations on structures fabricated at our facilities.

10:50 - 12:40 — Torremolinos

Session 1A2

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Vladimir Shalaev

10:50 : **Keynote talk**

Quasi-2d Materials: From Tailorable Photonics To New Physics

Alexandra Boltasseva

Purdue University (USA)

We discuss the designer-like characteristics of MXenes, achievable with the choice of transition metal and control of stoichiometry, remarkable tailorability of properties of TD materials with the thickness, and ultra-fast TCOs response. We also explore new device concepts for flat optics/metasurfaces.

11:20 : **Invited talk**

Degenerate Metasurface Eigenstates: Coupling And Interfering For Maximum-chiral Optics

Maxim Gorkunov¹, Alexander Antonov², Yuri Kivshar³

¹NRC "Kurchatov Institute"(Russia), ²Ludwig-Maximilians-Universität München (Germany), ³Australian National University (Australia)

Maximum-chiral metasurfaces, selectively interacting with circularly polarized light, are designed by optimizing their photonic eigenstates. The design constraints are relaxed by employing uncoupled interfering and coupled hybridized eigenstates. Then freestanding planar structures become helicity-preserving chiral mirrors, while those stacked upon substrates perform as chiral filters, absorbers and reflectors.

11:40 : **Invited talk**

Non-Hermitian Dynamics In Bosonic Systems: Classical And Quantum Realizations

Yogesh Joglekar

Indiana University Indianapolis (USA)

Open non-Hermitian systems, also called PT symmetric systems, have been extensively investigated, mostly with waves, but recently also in the quantum domain. With a photonic Floquet topological insulator and number-resolved phonon dynamics as examples, I will present salient properties of such systems in the classical and quantum domains respectively.

12:00 : **Invited talk**

Configurable Quantum Simulator For Few Atoms In A Super-Resolved Optical Tweezers

Vincent Mancois¹, Kelvin Lim¹, Haijun Wu², Yijie Shen¹, David Wilkowski¹

¹Nanyang Technological University (Singapore), ²Harbin University of Science and Technology (China)

Many fields of research rely on optical trapping, whose limits are dictated by diffraction. We report the trapping of multiple cold atoms in four super-resolved traps and demonstrated the control of the reshuffling of atoms among traps. We also provide a simple and quantitative modelling of the atom dynamics.

12:20 : **Invited talk**

Classical-quantum Correspondence In Photonic Temporal Crystals

Bumki Min

KAIST (Korea)

We present a quantum electrodynamics model of photonic temporal crystals (PTCs) that connects classical and quantum pictures. A localization-delocalization phase transition takes place in a Floquet-photonic synthetic lattice, causing a two-level atom's Rabi oscillations to irreversibly decay into a mixed state, driven by photonic delocalization.

10:50 - 12:40 — Alamos

Session 1A3

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jerome Plain, Alexander Govorov, Davy Gerard and Pedro Hernandez Martinez

Chaired by: Jerome Plain and Alexander Govorov

10:50 : **Invited talk**

Magnetic Micro- And Nanorods For Viscosity Imaging Using Heterodyne Holography

Clémence Gentner¹, Zhu Zhang¹, Jean-François Berret², pascal Berto¹, Hadrien Robert¹, Robert Kuszelewicz³, Gilles Tessier¹

¹Sorbonne Université (France), ²Université Paris Cité (France), ³Korea University (France)

An external magnetic field forces the oscillation of superparamagnetic iron oxide nanorods, which cease to rotate above a frequency related to the local viscosity. The blinking of the scattered light is analyzed at high frequencies by heterodyne holography, and 3D rod superlocalization provides high resolution viscosity imaging.

11:10 : **Invited talk**

Multiplexed, Label-free Biosensing With Plasmonic Nanoparticles

Stephan Kastner¹, Andre Heewig¹, Florian Seier¹, Andrea Csaki¹, Wolfgang Fritzsche²

¹Leibniz IPHT (Germany), ²Leibniz Institute of Photonic Technology (IPHT) (Germany)

A biosensing platform using gold nanoparticle sensors immobilized in an array of spots is described, allowing after biofunctionalization to detect the respective target analyte molecules in a multiplexed assay. For detection, the shift in localized surface plasmon resonance (LSRP) peak due to the change in refractive index is utilized.

11:30 : **Keynote talk**

Wavefront Microscopy For Nanophotonics

Guillaume Baffou

Institut Fresnel / CNRS (France)

Cross-grating wavefront microscopy (CGM) consists of the association of a 4-wave diffraction grating and a camera separated by millimeter distance. We show how CGM can be used to measure the optical properties of nanoparticles, 2D material a metasurfaces, such as the complex optical polarizability, conductivity, refractive indices, and cross-sections.

12:00 : **Invited talk**

Plasmonic Nanostructures On Paper Lateral Flow Assays For Point-of-care Testing

Nianqiang Wu

University of Massachusetts Amherst (USA)

This talk will introduce three types of plasmonic probes used in paper lateral flow assays. It will show how to utilize plasmonic nanostructures to amplify fluorescence and surface-enhanced Raman scattering signals. It will also demonstrate our effort to incorporate plasmonic nanostructure into paper lateral flow assays.

12:20 : **Invited talk**

Colloidal Synthesis Of Chiral Plasmonic Nanocomposites Via Circularly Polarized Light Irradiation

Koichiro Saito¹, Yoshihiro Nemoto², Yoshie Ishikawa¹

¹*National Institute of Advanced Industrial Science and Technology (AIST) (Japan)*, ²*National Institute for Materials Science (Japan)*

The synthesis of chiral plasmonic nanoparticles using circularly polarized light as a chiral source has attracted attention because it does not require any chiral molecules. In this presentation, we will report a novel method for colloidal synthesis of chiral plasmonic nanocomposites including AuNR@MnOx.

10:50 - 12:40 — Playamar

Session 1A4

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Eugene Kamenetskii

10:50 : Invited talk

A Qed Theory Of Discriminatory Ret Mediated By One Or Two Polarisable Molecules

Akbar Salam

Wake Forest University (USA)

QED theory is employed to study the influence of one or two mediator particles on the resonance energy transfer rate between a pair of chiral molecules. It is found that direct and relayed rates are discriminatory, maximised for collinear geometry, and require the bridging species to be multi-levelled systems.

11:10 : Invited talk

Theory Of Unidirectional Magnetoresistance In Nanoscale Bilayers

Xiangrong Wang

The Chinese University of Hong Kong (China)

Unidirectional magnetoresistance (UMR) of bilayers arises from the influence of magnetization present in the magnetic material and the interfacial potential inherent in heterostructures. This theory explain unifiedly universal UMR and unusual anisotropic magnetoresistance and capture all experimental features such as dependence on current direction, film thickness, and magnetic field strength.

11:30 : Invited talk

New Topological Magnetic Photonic Crystals

Che Ting Chan

HKUST (Hong Kong)

We introduces several new types of magnetic photonic crystals, specifically photonic alloys and gyromagnetic double-zero-index materials. Photonic alloys can support topological edge states even at very low concentrations of magnetic components. The gyromagnetic double-zero-index photonic crystal exhibits special non-trivial topological characteristics in both near-field and far-field contexts.

11:50 : Invited talk

Terahertz Pulse Shaping And Chirality Control Using Magnetic Heterostructures

Weipeng Wu, Wilder Acuna, Zhixiang Huang, Xi Wang, Lars Gundlach, Matthew Doty, Joshua Zide, Benjamin Jungfleisch

University of Delaware (USA)

We demonstrate a hybrid THz source with pulse shaping capability and chirality control of the emitted radiation without external components. This hybrid THz source integrates a spintronic emitter and a semiconductor photoconductive antenna into one single device in which each of the two emitters respond independently to external parameters.

12:10 : Band Structure Evolution in Quaternary Magnetic Semiconductors for Photonic and Spintronic

Applications

Oksana Yastrubchak¹, N. Tataryn¹, S. Mamykin¹, V. Romanyuk¹, O. Kondratenko¹, L. Borkovska¹, L. Khomenkova¹, X. Liu², B. A. Assaf², J. Furdyna², Y. Ichiyanagi³, M. Sawicki⁴, J. Sadowski⁴

¹V.E. Lashkaryov Institute of Semiconductor Physics (Ukraine), ²University of Notre Dame (USA), ³Yokohama National University (Japan), ⁴Polish Academy of Sciences (Poland)

The impact of Bi, P, and Mn on GaAs layers was studied using MBE-grown (Ga,Mn)(P,As) and (Ga,Mn)(Bi,As) films. P widens the band gap, while Bi and Mn narrow it. Mn enhances hole density and influences magnetic properties. Energy band diagrams were proposed for all structures.

12:25 : Planar Dielectric Structures With Mirror Symmetry Broken By Substrate As Versatile Sources Of Chiral Light

Alena Mamonova¹, Polina Kovaleva², Alexander Antonov³, Maxim Gorkunov¹

¹NRC "Kurchatov Institute"(Russia), ²Lomonosov Moscow State University (Russia), ³Ludwig-Maximilians-Universität München (Germany)

Planar dielectric structures with mirror symmetry broken by substrate exhibit strong circular dichroism for normally and obliquely incident light. We demonstrate that these structures implemented on different material platforms, such as perovskites or noncentrosymmetric semiconductors, perform as efficient luminescent and second harmonic sources of circularly polarized light.

10:50 - 12:30 — Bajondillo

Session 1A5

Metamaterials: novel trends and applications

Organized by: Tatjana Gric

Chaired by: Tatjana Gric

10:50 : Invited talk

Dynamic In-Situ Photoluminescence Lifetime Imaging of Halide Anion Exchange in CsPbBr₃ Nanocrystals

Petr Liška¹, Pavel Klok¹, Jan Král², Tomáš Musálek¹, Rebeka Kuželová¹, Petr Viewegh¹, Tomáš Šikola¹

¹Brno University of Technology (Czech Republic), ²Czech Technical University in Prague (Czech Republic)

Lead halide perovskites, with their unique structural and optical properties like bright photoluminescence and highly tunable band gap have gathered significant attention due to their enormous number of optoelectronic applications. In this work, we demonstrate in-situ photoluminescence lifetime imaging and describe the kinetics of halide anion exchange inside CsPbBr₃ nanocrystals.

11:10 : Invited talk

Anisotropic Response Of Hybridized Collective Plasmon Modes Of 2d-metal Nanoparticle Arrays Assembled On Periodically Corrugated Sapphire Substrates.

Maciej Wiesner, Ephraim Thomas Matthew, Andriy Serebryannikov, Jacek Jenczyk, Igor Iatsunskyi, Szymon Murawka, Mikolaj Lewandowski

Adam Mickiewicz University (Poland)

Anisotropic 2D metal nanoparticles of radius r , which form arrays on corrugated sapphire, show in-phase longitudinal plasmon hybridization from strong inter-particle coupling. This hybridization includes anisotropic plasmonic responses dependent on the inter-particle distance S , excitation polarization angle σ , pumping wavelength, making the substrates suitable for applications requiring tunable plasmonic properties.

11:30 : Invited talk

Etching-free Rare Earth Doped Meta-surfaces Made By Pulsed Laser Deposition

Antoine Bernard¹, Antonio Pereira¹, Hai-Son Nguyen², Sébastien Cuffe², Tam-Trong Nguyen², Christian Seassal², Etienne Cleyet-merle¹, Yannick Guyot¹, Alban Gassenq¹

¹Institut Lumière Matière (France), ²Institut des Nanotechnologies de Lyon (France)

Etching is a complex and costly method for making nano-structuration in photonics. In this work, we present an innovative approach to fabricate meta-surfaces without etching, using Pulsed Laser Deposition combined with liftoff processing to enhance rare earth emission.

11:50 : Invited talk

Lattice Resonances In Bipartite Arrays Of Nanostructures For Tailored Optical Responses

Juan Jose Alvarez Serrano¹, Juan R. Deop-Ruano¹, Luis Cerdán¹, V. Aglieri², A. Toma², Alejandro Manjavacas¹

¹*IQF-CSIC (Spain)*, ²*Istituto Italiano di Tecnologia (Italy)*

Bipartite, two-dimensional periodic arrays stand as promising platforms for photonic applications. By controlling the nanoparticle positioning within the unit cell, we demonstrate that these systems can be exploited to achieve perfect absorption and to excite out-of-plane lattice resonances at normal incidence, which exhibit outstanding quality factors.

12:10 : Invited talk

Design Of Complex Liquid Crystal Photonic Devices

Peter Ropač¹, Yu-Tung Hsiao², Žiga Černe¹, Brecht Berteloot², Yera Ussembayev², Inge Nys², Jeroen Beeckman², Kristiaan Neyts², Miha Ravnik¹

¹*University of Ljubljana (Slovenia)*, ²*Ghent University (Belgium)*

We demonstrate and discuss two approaches to designing complex liquid crystal (LC) photonic devices - shape and topology optimization. The methods are applied to LC filters, holograms and waveguides. The latter two were manufactured using photopatterning. With these design and manufacturing techniques we design high performance liquid crystal photonic devices.

10:50 - 12:40 — Carihuela

Session 1A6

Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and Noé Jiménez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

10:50 : Invited talk

Acoustic Lattice Resonances and Generalised Rayleigh-Bloch Waves

Malte Peter¹, Luke Bennetts², Gregory Chaplain³, Stuart Hawkins⁴, Kei Matsushima⁵, Tim Starkey³

¹*University of Augsburg (Germany)*, ²*University of Adelaide (Australia)*, ³*University of Exeter (United Kingdom)*, ⁴*Macquarie University (Australia)*, ⁵*University of Tokyo (Japan)*

Rayleigh-Bloch waves are modes localised to periodic arrays of scatterers with unbounded unit cells. We study them for line arrays of sound-hard scatterers embedded in an acoustic medium above the cut-off, both theoretically and experimentally, in which we observe the first generalised Rayleigh-Bloch waves in the radiative regime.

11:10 : Invited talk

Reconfigurable Topological Insulators And Acoustic Devices Based On An Electroacoustic Material Platform

Michael Leamy

Georgia Tech (USA)

We present recent work on reconfigurable, electroacoustic topological insulators as a platform for enabling acoustic devices such as multiplexers/demultiplexers, transistors, logic gates, and single-bit memory. The theoretical underpinnings of the reconfigurable topological insulator will be discussed together with experimental results confirming multiple device operation.

11:30 : Invited talk**Periodic Infilled Trench Barriers For Rayleigh Wave Attenuation In Saturated Soil****Zhifei Shi, Shuyin Cai, An Chen***Beijing Jiaotong University (China)*

This paper designed periodic infilled trench barriers for attenuating Rayleigh waves with frequencies between 10 to 30 Hz. The saturated soil model is adopted and the waste rubber tire is used as filling material. Both the dispersion curves and the performance of some periodic infilled trench barriers are obtained.

11:50 : Wave Dispersion Analysis Of Frame-shear Wall Building Structures Based On The Periodic Structure Theory**Zhibao Cheng, Jiaming Li, Peng Pan, Jing Sun***Beijing Jiaotong University (China)*

Introducing the periodic structure theory developed in the field of solid-state physics into the field of civil engineering, this paper investigates the wave dispersion properties of frame-shear wall building structure, a typical structural system for high-rise building structure, through theoretical and numerical analysis.

12:05 : Numerical And Experimental Investigation Of Multi-stable Metastructures Endowed With Free-standing Bistable Locally Resonant Unit Cells**Tugberk Guner, O. S. Bursi, M. Broccardo***University of Trento (Italy)*

We have conceived new locally resonant bistable unit cells for passive vibration attenuation and chaos control. Notably, bistability is introduced into each main cell, using novel slender pre-buckled beams. It is shown how the presence of resonators can improve the elastodynamic response of unit cells both numerically and experimentally.

12:20 : Invited talk**A Template-aided Versatile Approach For Creating Metamaterials****Rui Xu, Denys Makarov***Helmholtz-Zentrum Dresden-Rossendorf (Germany)*

By employing customizable anodic aluminum oxide templates, we achieve precise geometrical control of nanostructures, including their sizes, in-plane/out-of-plane shapes, and spatial arrangements. This approach offers a cost-effective, scalable method for fabricating metamaterials.

10:50 - 12:30 — Montemar**Session 1A7****Symposium II: New Trends in Nanophotonics and Advanced Materials**

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Tigran Shahbazyan

10:50 : Invited talk**Superconducting Nanowire Single Photon Detectors for photon counting applications in the mid-infrared****Dmitry Morozov¹, Daniel Kuznesof¹, Ciaran Lennon², Umberto Nasti³, Robert H. Hadfield¹**¹ *University of Glasgow (United Kingdom)*, ² *Oxford Instruments Plasma Technology (United Kingdom)*, ³ *Heriot-Watt University (United Kingdom)*

This study focuses on developing mid-infrared superconducting nanowire single-photon detector (SNSPD) arrays. Using optimised NbN films, the research analyses electrical, optical, and temporal performance, alongside pixel performance uniformity. The study explores potential applications in the single-photon regime, including imaging, laser ranging, medical imaging, and astronomy.

11:10 : Invited talk

Exploration Of Optical Chirality Based On The Orbital Angular Momentum Of Light Using A Single Chiral Metallic Nanostructure As A Probe

Shun Hashiyada¹, An'an Wu², Yoshito Tanaka¹

¹Hokkaido University (Japan), ²The University of Tokyo (Japan)

Optical chirality (OC) is traditionally tied to spin angular momentum, but chiral dichroism (ChD) in chiral materials may also arise from orbital angular momentum. We study ChD in a twisted gold nanorod dimer using circularly polarized optical vortices, revealing wavelength-dependent ChD at the beam center, indicative of orbital OC.

11:30 : **Invited talk**

Optical Picometry

Kevin F. MacDonald¹, Thomas A. Grant¹, Cheng-Hung Chi¹, Huanli Zhou¹, Anton N. Vetlugin², Eric Plum¹, Stefan Rotter³, Nikolay I. Zheludev¹

¹University of Southampton (United Kingdom), ²Nanyang Technological University, Singapore (Singapore), ³TU Wien (Germany)

The information content of a scattered field increases orders of magnitude with topologically structured (as opposed to unstructured) light, and plasmonic effects can enhance/redirect information flow. On this basis, picometric precision and accuracy can be achieved in optical metrology and imaging.

11:50 : **Invited talk**

Nanophotonics For Integrated Chiroptical Sensing Of Drug Solutions

Raju Adhikary¹, Ambaresh Sahoo¹, Massimiliano Aschi¹, Isabella Daidone¹, Matteo Silvestri¹, Matteo Venturi¹, Giovanna Salvitti¹, Carino Ferrante², Paola Benassi¹, Davide Tedeschi¹, Andrea Marini¹

¹University of L'Aquila (Italy), ²CNR-SPIN (Italy)

We theoretically investigate new chiroptical sensing techniques in nano-scale drug volumes by modelling the bi-anisotropic linear response of rebarixin, ladarixin and levodropropizine solutions through molecular dynamics, time-dependent density functional theory and Perturbed Matrix Method, and by obtaining an analytical expression for the macroscopic optical parameters from first principles.

12:10 : **Invited talk**

Rapid, Full-wafer Fabrication Of All-inorganic, High-efficiency Metaoptics And Ar Waveguides Via Additive Nanoimprint Lithography

James Watkins

University of Massachusetts (USA)

We fabricate all-inorganic, high-efficiency, metalenses, metasurfaces, DOEs and waveguides on full-wafer platforms with cycle times of less than 5 minutes/wafer via additive nanoimprint lithography using TiO₂ nanoparticle dispersion inks for applications in the visible and near IR.

10:50 - 12:10 — **Litoral**

Session 1A8

Functional materials for tunable and reconfigurable photonics

Organized by: Sébastien Cueff and Yael Gutierrez

Chaired by: Yael Gutierrez

10:50 : **Invited talk**

Programmable Polariton Nanophotonics With Phase-change Materials

Lukas Conrads, Thomas Taubner

RWTH Aachen University (Germany)

We exploit the non-volatile insulator-to-metal transition of the plasmonic phase-change material In₃SbTe₂ for optical programming surface polariton resonators on polar crystals and doped semiconductors. The strongly confined resonance modes are investigated with scanning near-field optical microscopy. This study enables

rapid prototyping of reconfigurable polariton resonators even with anisotropic 2D-materials.

11:10 : Invited talk

Hybrid Integration of Ferroelectric Oxides in Silicon Photonics Platform

Ana-Maria Statie¹, Pablo Bedoya-Ríos¹, Clément Ben Braham¹, Alicia Ruiz-Caridad², Ali El Boutaybi¹, Roy Prosopio¹, Sebastian Alvarez Ortega¹, Jonathan Peltier¹, Daniele Melati¹, Etienne Herth¹, Samson Edmond¹, Ali Belarouci³, Eric Cassan¹, Delphine Marris-Morini¹, Panagiotis Karamanis², Michel Rérat², Guy Aubin¹, Regis Orobitchouk³, Léopold Virost⁴, Yohan Désière⁴, Carlos Alonso-Ramos¹, Philippe Lecoœur¹, Sylvia Matzen¹, Thomas Maroutian¹, Laurent Vivien¹

¹Université Paris Saclay (France), ²Université de Pau et des Pays de l'Adour (France), ³Université de Lyon (France), ⁴Université Grenoble Alpes (France)

To overcome the limitations of silicon, hybrid integration of materials is required including ferroelectric oxides to develop efficient Pockels based optical modulators.

11:30 : Invited talk

Multifunctional materials for plasmonics in extreme conditions

Arrigo Calzolari

CNR-NANO Istituto Nanoscienze (Italy)

By combining thermodynamics approaches, first principles simulations and experimental techniques we investigate and discover multifunctional materials (nitrides and high-entropy carbides) that combine tunable plasmonic properties in the near-IR/vis range and high mechanical and thermal resistance for applications in extreme and harsh conditions.

11:50 : Invited talk

Tunable Conducting Polymer Mid-ir Plasmonic Microantenna Arrays

Pravallika Bandaru, Mohammad Shaad Ansari, Aleksandr Poliakov, Suraya Kazi, Magnus Jonsson

Linköping University (Sweden)

Actively tunable mid-IR plasmonic antennas show prospects for a broad range of applications, which rely on efficiently switchable materials. Here, we investigate the tunable mid-IR plasmonic response of conducting polymer microantenna arrays and demonstrate efficient and reversible on/off switching capability.

10:50 - 12:40 — Manantiales

Session 1A9

Symposium VI: Advanced Techniques for Computational Electromagnetics

Organized by: Maha Ben Rhouma

Chaired by: Maha Ben Rhouma

10:50 : Invited talk

Near-field shaping by ray-caustic synthesis at microwaves and millimeter waves

Federica Anfuso, Ahsan Ullah Khan, Gino Sorbello, Santi Concetto Pavone

University of Catania (Italy)

We present a method for synthesizing focused electromagnetic beams by manipulating ray caustics at microwave and millimeter wave frequencies. In ray optics, caustics are high-intensity ray trajectories where rays converge, allowing for precise near-field beam focusing. This approach has significant potential for advanced communication systems and near-field launcher design.

11:10 : Invited talk

Spin-mediated Radiative Caloritronics

Philippe Ben Abdallah

CNRS- Institut d'Optique (France)

The Spin Hall and inverse Spin Hall effects involve interplay between charge and spin currents. Here i in-

produce the thermal analogs of these effects based on the interplay between photon spin and heat flux in magneto-optical systems to control heat transfer.

11:30 : **Invited talk**

Retrieving Optical Properties of Biological Multilayers using Symbolic Regression

Julian Sierra-Velez¹, Alexandre Vial¹, Marco A. Giraldo², Demetrio Macias¹

¹ *Université de Technologie de Troyes (France)*, ² *Universidad de Antioquia (Colombia)*

We use Symbolic Regression to recover a closed-form expression that models the dielectric function of one of the materials that make up the wing of the Morpho helenor butterfly. This scheme provides a reliable alternative for characterizing the properties of materials from experimentally measured spectral data.

11:50 : **Invited talk**

A Gain Route To Reversed Cherenkov Radiation

Ruoxi Chen, Xiao Lin

Zhejiang University (China)

We find precise conditions to enable reversed Cherenkov radiation from a positive-index gain isotropic slab under which the backward-propagating Cherenkov radiation is maintained while the forward-propagating one is suppressed. Counterintuitively, the intensity and the angular spread of reversed Cherenkov radiation can be made robust to the slab thickness.

12:10 : **Keynote talk**

Beyond the Voigt lineshapes: Efficient statistics-convolved approximants in the time domain

L. J. Prokopeva, Alexander V. Kildishev

Purdue University (USA)

We present a minimax-based approach for efficient time-domain modeling of optical responses from materials with disorder. The utility of our approach, generally applicable to symmetric and non-symmetric disorder statistics, is demonstrated by the non-classical oscillator, relaxation, and conductivity models, achieving the shortest possible numerical stencil for a given controlled accuracy.

10:50 - 12:35 — Veselago

Session 1A10

Plasmonics and Nano-Optics

Chaired by: Mahmoud Rasras

10:50 : **Tamm Plasmon for the enhancement of Light Matter Interaction**

Andrea Rossini¹, F. Marangi², C. Florindi², A. Pianetti¹, F. Lodola², F. Scotognella³, G. Lanzani¹, Giuseppe Maria Paternò¹

¹ *Politecnico di Milano (Italy)*, ² *Istituto Italiano di Tecnologia (Italy)*, ³ *Politecnico di Torino (Italy)*

Tamm Plasmon (TP) modes, formed at the plasmonic layer-DBR interface, enable strong light confinement and coupling. This work explores TP modes ability to detect and modulate phenomena at the biotic-antibiotic interface, demonstrating their potential for advanced photonics and biological applications.

11:05 : **Acoustically Driven Soft Metasurfaces**

Skyler P. Selvin, Johan D. Carlstrom, Mohammad Taghinejad, Mark L. Brongersma

Stanford University (USA)

We utilize mechanically compliant materials in a nanophotonic resonator designed to trap light at dimensions comparable to gigahertz-scale acoustic displacements. This configuration enables rapid modulation and sculpting of optical fields, paving the way for fast, adaptable metasurfaces poised to advance future photonic technologies.

11:20 : **Surface Enhanced Raman Spectroscopy (sers) Based On A Polarization-insensitive Nanoparticle-on-a-slit Cavity With Dielectric Waveguide.**

Daniel Arenas Ortega¹, Javier Redolat¹, Ángela Barreda², Amadeu Griol¹, Elena Pinilla Cienfuegos¹, Alejandro Martínez¹

¹ *Universidad Politécnica de Valencia (Spain)*, ² *Carlos III University of Madrid (Spain)*

Nanoparticle on a slit (NPoS) is a nanometer cavity for extreme light confinement. In this work we present the simulation and characterization of a NPoS to work in the visible and infrared range with polarization-insensitive fashion for surface enhanced Raman spectroscopy (SERS).

11:35 : Experimental Observation Of Bound States In The Continuum In Fully Semiconductor Subwavelength Gratings

Weronika Glowadzka¹, Tomasz Fas², Kartik Gaur³, Floriana Laudani³, Sarthak Tripathi³, Niels Heermeier³, Jan Suffczyński², Stephan Reitzenstein³, Tomasz Czystanowski⁴

¹ *Lukasiewicz - IMIF (Poland)*, ² *University of Warsaw (Poland)*, ³ *Technische Universität Berlin (Germany)*, ⁴ *Lodz University of Technology (Poland)*

Subwavelength Gratings (SGs) support Bound States in the Continuum (BICs), enabling high-quality factor resonances. To improve mechanical stability, vertically nonsymmetric SGs (VN-SGs) are formed by placing a GaAs membrane on an AlAs substrate. We demonstrate the first experimental observation of BICs in GaAs-AlAs SG, advancing toward future electrically pumped devices.

11:50 : Mems-Tunable Multifunctional Optical Metasurfaces For Advanced Imaging

Zhihao Zhu¹, Chao Meng¹, Mingwei Tang², Sergey I. Bozhevolnyi¹, Kai Wei²

¹ *University of Southern Denmark (Denmark)*, ² *Zhejiang University (China)*

The latest progress of piezoelectric MEMS tunable multifunctional optical metasurfaces (OMS) for advanced imaging is presented. Switching between different imaging modes can be achieved by varying the MEMS actuation voltages.

12:05 : Evolution Of Quantum Plasmonics In Relatively Large Doped Quantum Dots

D. Subedi, D. Dada, Mogus Mochena

Florida AM University (USA)

Two model Hamiltonians have been employed to investigate the evolution of plasmonics as a function of number of electrons confined in a potential well in the first case¹ and a jellium model² in the second case. Here, we present results of DFT+U_{3,4} and TDDFT studies on discrete crystal lattice.

12:20 : Optical Characterization Of Barium Titanate From The Visible To Mid-infrared Range By Using Mueller-matrix Spectroscopic Ellipsometry

Jiwon Kang¹, Nina Hong², Martin Thomaschewski³, Prachi Thureja³, Sangjun Han¹, Harry Atwater³, Min Seok Jang¹

¹ *Korea Advanced Institute of Science and Technology (Korea)*, ² *J.A. Woollam Company (USA)*, ³ *California Institute of Technology (USA)*

Barium titanate (BTO) displays diverse exotic characteristics, therefore, various studies on its engineering have been conducted. However, accurate optical constants of BTO have not been reported. Here, we firmly determined the complex refractive index of BTO from the visible to the mid-infrared range by using Mueller-matrix spectroscopic ellipsometry on BTO.

10:50 - 12:30 — Maxwell

Session 1A11

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Atsushi Taguchi

10:50 : Invited talk

Characterizing the mechanical properties of single bacteria in air by multimode tracking nanomecha-

nical resonators

Alicia Aparicio Millán, Elena Sentre Arribas, Jose Jaime Ruz, Sergio García López, Priscila Monteiro Kosaka, Montserrat Calleja, Javier Tamayo, Eduardo Gil Santos

Instituto de Micro y Nanotecnología (IMN-CNM, CSIC) (Spain)

Nanomechanical resonators are powerful biosensing tools. While the mass and mechanical properties of individual human cells have been characterized in liquid, smaller entities, including bacteria, viruses, and proteins, have only been reliably analysed in vacuum. We demonstrate the characterization of single bacterial cells' mass and mechanical properties under ambient conditions.

11:10 : Invited talk**Negative Frequency Generation And Temporal Diffraction**

Euan Hendry

University of Exeter (United Kingdom)

Temporal modulation of graphene using ultrafast pulses can be incredibly fast compared to the period of a transmitted THz field. We demonstrate that this gives rise to distinct signatures in the transmission spectrum arising from generation of negative frequency components. We then discuss several temporal diffraction experiments using graphene modulation.

11:30 : Invited talk**Enhanced Sensing With Ultrastrong Coupling Condition**

Wen-Hui (Sophia) Cheng, Alexis Angelo R. Garcia, Cheng-An Mao

National Cheng Kung University (Taiwan)

Raman spectroscopy can detect molecules through their vibrational modes, and its efficiency is enhanced by localized electric field. The proposed ANA heterostructure, combining gold nanoparticles and nickel oxide, achieves ultrastrong coupling and significantly improves Raman sensing, demonstrating over 20-fold enhancement for tetracycline detection.

11:50 : Invited talk**Efficient Modeling Of Particle Acceleration In Structured Dielectric Waveguides Driven By Short-pulse Laser Excitation**

Andrea Locatelli¹, Gino Sorbello², Davide Guarnera², Roberta Palmeri³, Giorgio Mauro⁴, Giuseppe Torrisi⁴, Nunzio Salerno², Davide Rocco¹, Luca Vincetti⁵

¹University of Brescia (Italy), ²University of Catania (Italy), ³University Mediterranea of Reggio Calabria (Italy),

⁴Southern National Laboratories - National Institute for Nuclear Physics (Italy), ⁵University of Modena and Reggio Emilia (Italy)

We present an optimization technique for sub-relativistic acceleration in guided-wave dielectric accelerators. Our approach exploits fast modal analysis of the guiding structure to explore geometric dependencies. Laser pulse propagation is then simulated using the Beam Propagation Method, while single-particle beam dynamics calculations are used to determine energy gain.

12:10 : Invited talk**Multilayer Structures For Broadband Switchable Absorption And Switchable Radiative Cooling Based On Phase-change Materials**

Georgios Veronis¹, Md Tanvir Emrose¹, Ming Zhou², Shanhui Fan²

¹Louisiana State University (USA), ²Stanford University (USA)

We introduce multilayer structures with the phase-change material germanium-antimony-tellurium (GST) for use as broadband switchable absorbers in the infrared wavelength range. We also introduce multilayer structures with GST for switchable radiative cooling.

10:50 - 12:30 — Fresnel

Session 1A12

Plasmonics and Nanophotonics: Fundamentals and Applications

Organized by: Hong Wei

Chaired by: Hong Wei

10:50 : **Invited talk****Plasmonic Effects On The Crystal Transformation And Emission Control Of Luminescence Particles**
Hairong Zheng, Huan Chen, Chengyun Zhang, Zhenglun Fu, Zhenglong Zhang*Shaanxi Normal University (China)*

Plasmonic effects produced by the metal nanostructures have presented potential applications in the field of spectral regulation including the intensity enhancement and lifetime reduction. It is also found that the plasmonic effect can help to drive fast in-situ crystal structure transformation.

11:10 : **Invited talk****Chiral Plasmonic Nanoparticle-molecule Hybrids For Circularly Polarized OLEDs****Lei Shao***Sun Yat-sen University (China)*

We demonstrate circularly polarized organic light-emitting diodes with an emission dissymmetry factor of 0.31 based on the assembly of chiral plasmonic nanoparticles and supramolecular aggregates. The chiral nanoparticles serve as the chiral scaffold and chiral optical nanoantenna to modulate the circularly polarized absorption and emission of the supramolecular chromophores.

11:30 : **Invited talk****Electrically Driven Functional Plasmonic Nanocavities****Pan Wang***Zhejiang University (China)*

In this work, based on single-crystal metallic building blocks, we demonstrate electrically driven functional plasmonic nanocavities with multifunctionality.

11:50 : **Invited talk****Exploring Mesoscopic Plasmonics by Integrating Transformation Optics and Feibelman d Parameters****Fan Yang***Sichuan University (China)*

Classical electrodynamics falls short in capturing plasmonic responses at the mesoscopic scale. Therefore, we introduce an innovative analytical framework that synergizes transformation optics with Feibelman d parameters. This approach offers a more efficient pathway to explore electronic nonclassical effects in complex nanostructures, surpassing the limitations of traditional density functional methods.

12:10 : **Invited talk****Near-field Spacetime Imaging of THz Surface Plasmon Polaritons in Graphene****Simon Anglhuber¹, Martin Zizlsperger¹, Eva A. A. Pogna², Yaroslav A. Gerasimenko¹, Anastasios D. Koulouklidis¹, Imke Gronwald¹, Svenja Nerreter¹, Leonardo Viti³, Miriam S. Vitiello³, Rupert Huber¹, Markus A. Huber¹**¹ *University of Regensburg (Germany)*, ² *Consiglio Nazionale delle Ricerche (CNR-IFN) (Italy)*, ³ *CNR - Istituto Nanoscienze and Scuola Normale Superiore (Italy)*

Field-resolved terahertz near-field microscopy enables direct spatiotemporal mapping of polariton dynamics in graphene with subcycle temporal resolution. The spacetime maps yield key parameters of the polariton, like group and phase velocities as well as its damping. Femtosecond control of non-equilibrium polariton propagation is achieved by optical excitation.

Lunch

12:30 - 14:00

14:00 - 15:50 — Torremolinos

Session 1A13

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Nikolay Zheludev

14:00 : **Invited talk****High-Speed Self-Biased 2d Ins Photodetector****Srinivasa Tamalampudi, Ghada Dushaq, Mahmoud Rasras***New York University Abu Dhabi (United Arab Emirates)*

We demonstrate a high-speed, self-powered InSe Schottky photodetector featuring a 2.5 MHz response time at 785 nm. Through integration with a SiN platform and the application of strain modulation, we extend its detection capability to 1550 nm and attain an ultrafast response time of 4.5 ns under 974 nm excitation.

14:20 : **Invited talk****Non-lorentzian Effects For Exciton-plasmon Systems At Strong Coupling****Tigran Shahbazyan***Jackson State University (USA)*

We study non-Lorentzian effects in the scattering spectrum of quantum emitters strongly coupled to surface plasmons in metal nanoparticles. We develop a semiclassical approach incorporating optical dispersion and losses in the metal to show that non-Lorentzian effects cause a shift of the spectral weight towards the lower energy polaritonic band.

14:40 : **Invited talk****Scalable Integration Of Multiple Single-photon Sources For Fiber Quantum Network****Woong Bae Jeon¹, Donghyun Park¹, Jongsung Moon¹, Kyu-Young Kim¹, Mohamed Benyoucef², Je-Hyung Kim¹**¹*Ulsan National Institute of Science and Technology (Korea)*, ²*University of Kassel (Germany)*

We present a novel approach to a tunable array of fiber-integrated single-photon sources. By developing a versatile fiber platform that integrates multiple cavity-coupled quantum dot devices using a pick-and-place technique, we achieve high-efficiency, scalable, and tunable quantum light sources for telecom-based quantum networks and protocols.

15:00 : **Keynote talk****Silicon Quantum Photonics****Vladimir Shalaev***Purdue University (USA)*

We discuss scalable quantum photonics circuitry based on room-temperature single-photon emitters in silicon nitride that we recently discovered in this technologically important material platform. We also consider integration of SiN single-photon emitters with waveguides as well as the quantum emission enhancement through integration with resonant cavities and plasmonic nanostructures.

15:30 : **Invited talk****Cavity-Induced Attractive Interactions in Van der Waals Quantum Material****F. Helmrich, T. F. Nova, H. S. Adlong, I. Khanonkin, E. Jöchl, M. Kroner, G. Scalari, J. Faist, Atac Imamoglu***ETH Zurich (Switzerland)*

We present the creation of a cavity-induced excitonic bound state in a dual gated hBN-encapsulated Bernal bilayer graphene device coupled to a meta material-inspired THz cavity. The bound state originates solely from ultrastrong coupling of a continuum of interband transitions to the cavity, and not from standard Coulomb interactions.

14:00 - 16:00 — Alamos**Session 1A14****Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy**

Organized by: Jerome Plain, Alexander Govorov, Davy Gerard and Pedro Hernandez Martinez

Chaired by: Jerome Plain and Alexander Govorov

14:00 : Invited talk**From Hairy Particles To Particle-Based Metamaterials****Andreas Fery***Technical University Dresden (Germany)*

Metallic nanoparticles exhibit optical and electronic effects, such as localized surface plasmon resonance (LSPR), enabling control over electromagnetic near-fields. Combining nanoparticles with polymeric shells enhances inter-particle distance and electronic coupling. Self-assembly techniques enable ordered particle arrays, offering novel plasmonic coupling effects and potential for advanced materials in a circular economy.

14:20 : Invited talk**Colloidal Quantum Optoelectronics****Hilmi Volkan Demir***NTU Singapore (Singapore)*

In this talk, we present the development and optoelectronic applications of atomically flat, quasi-2-dimensional quantum wells for lighting and displays. Here we report record high efficiency from their colloidal LEDs and record high gain coefficients and record low lasing thresholds from their colloidal laser media.

14:40 : Invited talk**Reconfigurable Integrated Photonics For Next-Generation Optical Computing And Quantum Technologies****Alina Karabchevsky***Ben-Gurion University of the Negev (Israel)*

My talk will overview recent breakthroughs in reconfigurable integrated photonics, focusing on the development of dynamically tunable optical components that enable ultra-fast signal processing, optical memory storage, and quantum photonic applications. Special emphasis will be placed on the integration of photochromic materials, metasurfaces, Fabry-Pérot resonators to achieve adaptive optical functionality.

15:00 : Invited talk**Sensing 3d Electromagnetic Landscapes With Enhanced Quantum Light-matter Interaction At The Single-molecule And Nanometer Resolution****R. Margoth Cordova Castro***University of Ottawa (Canada)*

We apply single molecule super-resolved measurements to observe the fine details of quantum light-matter interaction at the nanoscale, simultaneously mapping the position of the emitters and its spontaneous emission decay rate modified by the enhanced density of photonic states in unique engineered material platforms.

15:20 : Invited talk**Surface Plasmon Enhanced Photocatalysis****Dongling Ma***Institut National de la Recherche Scientifique (INRS) (Canada)*

Plasmonic nanostructures can enhance photon harvesting of semiconductor materials via hot carrier injection, near-field effects and/or enhanced scattering, which has significant implications for the realization of cost-effective high-performance solar utilization technologies. In this talk, I will overview some of our recent progress on the development of plasmonic nanostructures for photocatalysis.

15:40 : Invited talk

Highly Efficient And Reversible Chirality Transfer Between Protein And Achiral Plasmonic Assemblies

Ziwei Zhou¹, Ningwei Sun¹, Nina Tverdokhle¹, Artur Movsesyan², Anja Maria Steiner¹, Patrick T. Probst¹, Vaibhav Gupta¹, Bo Yin³, Nicolás Pazos-Peréz⁴, Ramón A. Álvarez-Puebla¹, Mirjam Hofmaier¹, Martin Müller¹, Holger Merlitz¹, Olga Guskova¹, Yaroslava G. Yingling⁵, Franziska Lissel¹, Tobias A. F. König¹, Zhiming Wang², Alexander O. Govorov⁶, Nicholas A. Kotov⁷, Andreas Fery¹

¹Leibniz-Institut für Polymerforschung Dresden (Germany), ²University of Electronic Science and Technology of China (China), ³Ansys Inc. (USA), ⁴Universitat Rovira i Virgili (Spain), ⁵Technische Universität Dresden (Germany), ⁶Ohio University (USA), ⁷University of Michigan (USA)

Based on the assembly of Au@protein nanoparticles, we enhance and modulate plasmon-coupled circular dichroism (PCCD) by in-situ stretching of biomolecules between plasmonic nanoparticles, achieving a 1.18-degree circular dichroism and 0.2 dissymmetry factor. Unlike hotspot-based methods, our approach enables reversible PCCD switching over 100+ cycles with significant amplitude changes.

14:00 - 16:10 — Playamar

Session 1A15

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Eugene Kamenetskii

14:00 : **Keynote talk**

Quantum Aspects Of Light Propagation In Time-varying Media

John Pendry

Imperial College London (United Kingdom)

Recent experiments demonstrate ultra-fast modulation of refractive indices opening up the field of space-time modulation [1-3]. Breaking time invariance presents new challenges to theory with the removal of conservation of energy/frequency. New conservation laws are emerging which deepen our understanding of these systems.

14:30 : **Invited talk**

Optical Quasiparticles Induced Structured Materials

Takashige Omatsu

Chiba University (Japan)

Optical quasiparticle carries topologically protected polarization textures in a 2- or 3-dimensional space. We herein demonstrate the direct imprint of polarization textures of optical quasiparticles on a material.

14:50 : **Invited talk**

Topological Magneto-optical Effect In Skyrmion-hosting Mott Insulator

Yoshihiro Okamura, R. Shimizu, K. Okigami, S. Okumura, N. Kanazawa, Y. Tokura, T. Morimoto, Y. Takahashi

University of Tokyo (Japan)

We demonstrate the magneto-optical Kerr effect (MOKE) induced by the skyrmion formation, i.e., topological MOKE, in insulating GaV₄Se₈. The observed optical rotation is comparable to the that reported for itinerant systems, which establishes the significant impact of emergent magnetic field even on the Mott insulator driven by strong electron correlation.

15:10 : **Invited talk**

Coherent Dynamics Of A Magnon Bose–einstein Condensate – Temporal Coherence And Correlation Characteristics

Oleksandr Serha

University of Kaiserslautern-Landau (Germany)

Nonlinear interactions in externally excited magnetic media can lead to Bose-Einstein condensation of spin-

wave quanta-magnons. Using frequency- and time-resolved microwave detection techniques, we have observed the spontaneous formation of a coherent magnon BEC phase at the ferromagnetic resonance frequency in a perpendicularly magnetized magnetic film.

15:30 : Invited talk

Electron-phonon Interaction In Chiral Crystal: Angular Momentum And Phonon Chirality

Junichiro Kishine, T. Tateishi, A. Kato

The Open University of Japan (Japan)

Chiral phonons in helical crystals enable angular momentum transfer in quantum materials. We establish a framework incorporating conserved crystal momentum and crystal angular momentum, deriving electron-phonon interactions. Examining Lipkin's Zilch and macroscopic angular momentum, we reveal insights into chiral systems, impacting optoelectronic, thermoelectric, and spintronic material design.

15:50 : Invited talk

Experimentally Testing The Spontaneous Disentanglement Hypothesis Using A Ferri-magnetic Resonator

Eyal Buks

Technion (Israel)

The spontaneous disentanglement hypothesis makes the collapse postulate of quantum mechanics redundant, and enables meta-stability in finite quantum systems, which is otherwise excluded. We report on an experiment performed using a ferri-magnetic resonator, which indirectly supports the spontaneous disentanglement hypothesis.

14:00 - 16:00 — Bajondillo

Session 1A16

Metamaterials: novel trends and applications

Organized by: Tatjana Gric

Chaired by: Tatjana Gric

14:00 : Invited talk

Meta-cracks In Thin Films For Ultrasensitive Strain Monitoring

Jae-Hwan Lee, Seung-Kyun Kang

Seoul National University (Korea)

Mechanical metamaterials enable novel behaviors like tunable crack openings in thin metal films. These "meta-crack" sensors, combining high sensitivity and conformal contact, outperform conventional sensors. Leveraging Poisson-induced contraction and metamaterials, they offer adjustable sensitivity and strain range, with applications in bio-diagnostics like real-time stroke detection, revolutionizing healthcare innovations.

14:20 : Invited talk

Strong Field Tunable Light-generating Metasurfaces

Euclides Almeida, Matthew Feinstein, George Trivizas

City University of New York (USA)

We present a new class of all-optically tunable, light-generating metasurfaces. By coupling virtual excitons in two-dimensional semiconductors with off-resonant photons from a strong field, we attain ultrafast spectral and amplitude control of harmonic generation in nonlinear metasurfaces. Our work represents a significant advancement in the development of compact light sources.

14:40 : Invited talk

An all AI Terahertz Metasurface with Friedrich-Wintgen Bound States in the Continuum

Tenyu Aikawa¹, Gustavo Rodriguez Barrios², Zairui Li³, Andrey Baydin², Junichiro Kono², Wesley Sims³, Pai-Yen Chen¹, Thomas Searles¹, Zizwe Chase¹

¹University of Illinois Chicago (USA), ²Rice University (USA), ³Morehouse College (USA)

An all AI metasurface, through numerical evaluation and THz-TDS spectroscopy, shows enhanced light-matter interaction via the presence of multimode ultra strong coupling (USC) with FW-BIC's occurring near the anti-crossings.

15:00 : Invited talk

300-GHz-band metasurface technology for wireless communication and sensing

Adam Pander¹, Hibiki Kagami², Daisuke Kitayama², Haruka Matsunaga², Hiroyuki Takahashi²

¹NTT Device Technology Laboratories (Japan), ²NTT Device Technology Labs., NTT Corporation (Japan)

300-GHz-band transmission-type metasurfaces for signal coverage extension in wireless communication and high-resolution sensing applications were designed, fabricated, and evaluated. Gradient beamforming devices with steering angles between 18° and 38° and collimating lenses based on 3-bit quantization were fabricated as self-standing devices which makes them perfect candidates for future sub-THz applications.

15:20 : Invited talk

Tunable beamsplitter based on continuous transition between a planar metasurface and a Brewster metafilm

Yasuhiro Tamayama, Yugo Shibata

Nagaoka University of Technology (Japan)

We develop a method for realizing a beamsplitter with a tunable splitting ratio using a metamaterial with deep subwavelength thickness. We numerically verify that the splitting ratio can be controlled by the arrangement of the constituent meta-atoms without changing the structure of the meta-atoms.

15:40 : Invited talk

Plasmonic Enhanced Si-based Hot Electron Photodetector For Swir Range

Dana Cristea, Roxana Tomescu, Gabriel Craciun, Adrian Dinescu

IMT Bucharest (Romania)

We explored various architectures for plasmonic-enhanced Si Schottky photodetectors for SWIR, aiming at enhancing light absorption, hot electron generation and collection. The combination of grating-like electrodes with a nanostructured thin metal layer demonstrated the most promising results, with responsivities reaching the range of tens of mA/W at telecom wavelengths.

14:00 - 16:10 — Carihuela

Session 1A17

Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and Noé Jiménez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

14:00 : Invited talk

Simulation Of Acoustic Metamaterial Lens Imaging Under Complex-frequency Excitation In A Real-frequency Solver

Tuo Liu

Chinese Academy of Sciences (China)

This summary presents a method for complex-frequency acoustic simulation implementable in real-frequency solvers based on a conversion of the imaginary frequency component into effective material properties. The method is subsequently applied to evaluating the complex-frequency subwavelength imaging of an acoustic holey-structured metamaterial lens with inherent thermal-viscous loss.

14:20 : Invited talk

Vibrational Dynamics Of Single Supported Plasmonic Nanodisks

Nathan Berrit¹, Clément Panais¹, Noelle Lascoux¹, Sylvie Marguet², Natalia Del Fatti¹, Aurélien Crut¹

¹ Université de Lyon (France), ² CEA (France)

The vibrational dynamics of single substrate-supported gold nanodisks were investigated using optical methods and numerical simulations, allowing to address the dependence of vibrational frequencies and quality factors on both nanodisk and substrate characteristics. The transient optical response caused by nanodisk vibrations was also studied.

14:40 : Keynote talk

Spectral Frequency Response Of Hypersonic Phonons In A Non-Trivial Topological Waveguide

O. R. Ranjbar-Naeini¹, O. Florez², M. D. Koijam³, B. Djafari-Rouhani³, Y. Pennec³, T. Makkonen⁴, O.M.E. Ylivaara⁴, S. Pourjamal⁴, J. Ahopelto⁴, Clivia M. Sotomayor Torres¹

¹ International Iberian Nanotechnology Laboratory (Portugal), ² Catalan Institute of Nanoscience and Nanotechnology-ICN2 (Spain), ³ University of Lille (France), ⁴ VTT Technical Research Centre of Finland Ltd. (Finland)

The spectral frequency response of a hypersonic phononic wave propagating along a non-trivial topological waveguide is obtained by laser Doppler vibrometry. The guided mode at 2.115 GHz is shown to propagate with minimal loss.

15:10 : Invited talk

Elastic-wave Control Based On Non-hermitian Metasurfaces

Bing Li, Bochen Ren, Jiali Cheng

Northwestern Polytechnical University (China)

Beyond the traditional paradigm of Hermitian physics, the concept of non-Hermiticity has recently inspired a surge of nontrivial principles and applications. In this work, we propose several active and passive non-Hermitian metasurfaces that enable unprecedented elastic-wave manipulations, including skin-like effects, asymmetric wave propagation, and perfect absorption.

15:30 : Invited talk

Acoustic Metasurfaces For High-resolution Imaging Of Additively Manufactured Metals

Irshikesh Danawe¹, Raguez Taha², Talha Khan², Didem Ozevin², Serife Tol¹

¹ University of Michigan (USA), ² University of Illinois Chicago (USA)

This study explores a 3D-printed Helmholtz resonator (HR)-based metasurface lens for high-resolution imaging microscale defects in 4mm metal plates. Enhancing resolution over twofold with MHz-frequency acoustic transducers, the lens improves defect detection in extreme applications like nuclear reactors, advancing scanning acoustic microscopy for early fault identification.

15:50 : Invited talk

Skewing Of Guided Waves In Anisotropic Plates Close To Zero-group-velocity Points

Daniel Kiefer, Sylvain Mezi, Claire Prada

ESPCI Paris (France)

In anisotropic media the power flux of waves is usually skewed, i.e., it is not collinear to the wave vector. We describe how this effect impacts the measurable dispersion spectrum of guided elastic waves in plates. The theory is generally applicable to linear wave propagation in anisotropic media.

14:00 - 16:00 — Montemar

Session 1A18

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Kerry Vahala

14:00 : Invited talk

Momentum-Direct Infrared Interlayer Exciton and Photodetection in WSe₂/InSe Heterostructures

Jiong Yang, Chao Zhang*Soochow University (China)*

Momentum-direct interlayer excitons (IX) in the infrared are crucial for excitonic devices but remain underexplored. We construct a WSe₂/InSe heterostructure that hosts momentum-direct IX and manifests near-infrared interlayer absorptions at room temperature, realizing photodetection at 1150 nm with an optimal photoresponsivity and response time of 33 A/W and 3.7 μ s.

14:20 : Invited talk**Probing Nanoscale Light-matter Interactions With Fast Electrons And Near-field Optical Probes****Carlos Maciel Escudero¹, Ermin Malic¹, Rainer Hillenbrand², Javier Aizpurua³**¹*Philipps-Universität Marburg (Germany)*, ²*CIC nanoGUNE BRTA (Spain)*, ³*Donostia International Physics Center (Spain)*

We investigate the excitation and probing of hybrid light-matter electromagnetic modes (polaritons) using a fast electron beam and a metallic tip. By employing these localized probes, we are able to excite and spatially map strongly coupled systems that are challenging to access using conventional far-field optical spectroscopy techniques.

14:40 : Invited talk**Sub-wavelength Optical Lattice In 2d Materials****Supratik Sarkar, Mahmoud Jalali Mehrabad, Daniel G. Suarez-Forero, Liuxin Gu, You Zhou, Mohammad Hafezi***University of Maryland (USA)*

Conventional schemes for exploring light-induced phenomena rely on uniform and diffraction-limited free-space optics, which limits spatial resolution and efficiency of light-matter interaction. We overcome these challenges using metasurface plasmon polaritons to form a sub-wavelength optical lattice which allows efficient near-field modulation of excitons with on-chip pump rejection and thermal management.

15:00 : Invited talk**High-resolution photothermal imaging using mid-infrared photo-induced force microscopy - modeling and experiment****Maryam Ali, Shohely T. Anindo, Robin Schneider, Christin David, Daniela Täuber***Friedrich Schiller University Jena (Germany)*

Mid-IR photo-induced force microscopy (PiF-IR) provides unprecedented spatial and high spectral resolution of the chemical composition in surfaces in the Materials and Life Sciences. We model the near-field-enhanced interaction of nanostructured materials with metallic atomic force microscopy tips enabling a qualitative evaluation of experimental results in PiF-IR and related methods.

15:20 : Invited talk**Harmonic Generation From Aluminium And Gold Nanolayers And Nanogratings: Bound And Hot Electron Contributions****Shroddha Mukhopadhyay¹, Crina Cojocaru¹, Maria Antonietta Vincenti², Kent Hallman³, Michael Scalora⁴, Jose Trull¹**¹*Universitat Politècnica de Catalunya (Spain)*, ²*University of Brescia (Italy)*, ³*PeopleTec. (USA)*, ⁴*US Army CCDC (USA)*

We report a combined experimental-theoretical investigation on the second and third harmonic generation from aluminium and gold nanolayers and nanostructures, with specific focus on bound and hot electron contributions. Our experimental results are validated by our unique microscopic, hydrodynamic model for linear and nonlinear interactions in metal surfaces.

15:40 : Invited talk**Large-diameter Infrared Si Metalenses through Deep-UV Lithography****Kai Sun¹, Xingzhao Yan¹, Jordan Scott¹, James Monks², Jun-Yu Ou¹, Otto Muskens¹**¹*University of Southampton (United Kingdom)*, ²*Teledyne Qioptiq (United Kingdom)*

We report our latest works on large-diameter infrared silicon metalenses manufactured using production-ready Deep UV scanning lithography.

14:00 - 16:10 — Litoral

Session 1A19

Functional materials for tunable and reconfigurable photonics

Organized by: Sébastien Cueff and Yael Gutierrez

Chaired by: Sébastien Cueff

14:00 : **Invited talk****Reconfigurable Nonlocal Metasurfaces****Andrea Alu***City University of New York (USA)*

In this talk, I will discuss my group's recent work in the area of nonlocal metasurfaces, with an emphasis on reconfigurability and temporal transformations.

14:20 : **Invited talk****Dynamic Optical Control with VO₂ Metasurfaces****Rocio Camacho-Morales***The Australian National University (Australia)*

We design reconfigurable VO₂-based metasurfaces for tuneable optics and imaging. By leveraging the phase transition of VO₂, we achieve a high transmission contrast ($\Delta T = 0.73$) at telecommunication wavelengths and demonstrate switchable imaging between phase contrast and brightfield modes, enabling dynamic control for advanced optical and computational imaging applications.

14:40 : **Invited talk****Deep Learning Enabled Programmable Silicon Photonics Using Low-Loss Phase Change Material Sb₂Se₃**

Otto Muskens¹, Sophie Blundell¹, Thomas Radford¹, Daniel Lawson¹, Idris Ajia¹, Latif Rozaqi¹, Priya Deoli¹, Daniel-Iosif Trubacs¹, Peter Wiecha², Alberto Politi¹, David Thomson¹, Ioannis Zeimpekis¹

¹University of Southampton (United Kingdom), ²LAAS-CNRS (France)

The ability to program optical devices using non-volatile phase change materials with low losses is of importance in a wide range of applications. An overview will be presented of the developed materials platform together with proposed strategies of designing programmable devices using a deep learning neural network.

15:00 : **Invited talk****VO₂ Nanoparticles: Phase-transition Properties and Optical Memory Demonstration****Filip Ligmajer, Peter Kepič, Michal Horák, Jiří Kabát, Martin Hájek, Andrea Konečná, Tomáš Šikola***Brno University of Technology (Czech Republic)*

In our work, we analyze phase transitions in single VO₂ nanoparticles, revealing statistical variations in their transition temperature, steepness, and phase stability. We also demonstrate a multilevel optical memory near room temperature. Our findings clarify nanoscale hysteresis mechanisms and establish VO₂ nanoparticles as a promising platform for advanced nanophotonic devices.

15:20 : Combining Phase Change Materials With Soft-nil Dielectric Metasurfaces For Large-scale Tunable Optics

Magali Putero¹, Oumaïma Meskini¹, Yudha Ramanda¹, Jacopo Remondina¹, Victor Malgras¹, Beniamino Sciacca¹, Florian Schenk², Maksym Yarema², David Grosso¹

¹Aix Marseille University (France), ²ETH Zurich (Switzerland)

Metasurfaces, composed of sub-wavelength nanostructures, enable precise light control but are typically static. Integrating Phase Change Materials (PCMs) allows tunability for real-time photonic devices. However, conventional fabrication is costly and complex. This work explores combining soft Nano Imprint Lithography with other methods to create low-cost, large-area tunable metasurfaces.

15:35 : Programmable Infrared Geometric Phase Metasurfaces with the Plasmonic Phase-Change Material In₃SbTe₂

Lukas Conrads, Thomas Taubner
RWTH Aachen University (Germany)

We exploit the non-volatile insulator-to-metal transition of the plasmonic phase-change material In₃SbTe₂ for optical programming metasurfaces for infrared beam-shaping. We tailor the geometric phase of metasurfaces with rotated crystalline In₃SbTe₂ rod antennas to achieve beam steering, lensing, optical vortex beams and holography. Our approach enables rapid-prototyping of customized infrared meta-optics.

15:50 : Invited talk

Metasurface Tuning Based On Carrier Manipulation

Andrea Tognazzi
University of Palermo (Italy)

Tuning the optical response of nanoscale objects can be achieved through different carrier types. We demonstrate two distinct approaches: all-optical modulation via free-carrier injection in silicon metasurfaces and iontronic tuning in organic mixed conductors. These strategies enable fast, broadband, and energy-efficient control, paving the way for next-generation tunable photonic devices.

14:00 - 16:00 — Manantiales

Session 1A20

Symposium VI: Advanced Techniques for Computational Electromagnetics

Organized by: Maha Ben Rhouma

Chaired by: Philippe Ben Abdallah

14:00 : Invited talk

Near-field Optoelectronic Heat Engines And Thermal Emission Of Subwavelength Objects

Julien Legendre¹, Thomas Chatelet², Kyriaki Kontou², Jose Sojo-Gordillo³, Ahmed Alwakil², Azeddine Tellal⁴, Taha Benyattou⁴, Olivier Merchiers², P-Olivier Chapuis²

¹ICFO (Spain), ²CNRS - INSA Lyon (France), ³University of Basel (Switzerland), ⁴INSA Lyon (France)

First, a novel class of heat engines based on the radiative exchange between hot and cold pin junctions is studied by coupling the drift-diffusion equations for heterostructures to fluctuational electrodynamics. Then we address thermal emission of objects of size smaller than the wavelength, including spheres, nanowires and discs on surface.

14:20 : Invited talk

The Effective Refractive Index Of Resonant Particulate Media Depends On The Shape Of The Particule Arrangement

Cédric Blanchard¹, Timothée Guerra², Jean-Paul Hugonin³, Christophe Sauvan³

¹Université d'Orleans (France), ²University Grenoble Alpes (France), ³Université Paris-Saclay (France)

The effective properties of random particulate media must be extracted on volumes large enough to include all kind of interactions between the scatterers. We show that for resonant interactions, this so-called representative volume element may also depend on the shape of the geometrical boundary of the particle suspensions.

14:40 : Invited talk

Beam Dynamics Induced By The Quantum Metric Of Exceptional Rings

Z. Zhang¹, I. Septembre², Z. Liu¹, P. Kokhanchik², S. Liang¹, F. Liu¹, C. Li¹, H. Wang¹, M. Liu¹, Y. Zhang¹, M. Xiao³, G. Malpuech², Dmitry Solnyshkov²

¹Xi'an Jiaotong University (China), ²University Clermont Auvergne (France), ³University of Arkansas (USA)

We study experimentally and theoretically the dynamics of wave packets at exceptional rings stemming from Dirac points in a photonic honeycomb lattice. We demonstrate a new effect: the transverse non-Hermitian drift in the reciprocal space, useful for beam steering. Its description is based on biorthogonal quantum metric.

15:00 : Invited talk

Directional Near Fields Generated By Small Particles**Shubo Wang***City University of Hong Kong (China)*

Controlling the directionality of light radiation and scattering is essential to various optical applications. We show that small particles can be employed to generate directional near fields with broad applications in light routing, non-Hermitian sensing, and optical force manipulations.

15:20 : Invited talk**Focusing of Heat Flux Radiated by Magneto-Optical Nanoemitters in the Presence of a Magnetic-Field****Louis Rihouey, Philippe Ben-Abdallah, Riccardo Messina***Laboratoire Charles Fabry (France)*

We describe the near-field heat flux radiated by magneto-optical nanoemitters close to a substrate in the presence of a magnetic field. We demonstrate that this can induce an amplification of the flux and a focusing of the Poynting field at the substrate interface, opening promising perspectives for heat-assisted magnetic-recording technology.

15:40 : Invited talk**Photothermal Engineering In Graphene Nanoplasmonics****Joel Cox***University of Southern Denmark (Denmark)*

We theoretically explore the photothermal response of localized plasmons supported by graphene nanostructures. Our simulations reveal intriguing possibilities to achieve unity-order optical modulation, strong nonlinear light-matter interactions, and chiral-optic effects by resonantly exciting plasmons sustained by absorbed photothermal energy.

14:00 - 15:30 — Veselago**Session 1A21****Photonic Crystals and Electromagnetic Bandgap Structures**

Chaired by: Alexander Itin

14:00 : Impact of Realistic 3D Hole Shapes on Photonic Crystal Surface Emitting Laser (PCSEL) Performance**Ana Vukovic¹, Phillip Sewell¹, Ben Lang¹, Karl Boyan², Samir Rihani², David Moodie², Nannicha Hattasan², Graham Berry²**¹ *University of Nottingham (United Kingdom)*, ² *Huawei Technologies Research and Development (United Kingdom)*

PCSEL lasers utilise a photonic crystal layer to scatter the light in the vertical direction. However, practical etching limitation result in hole scatterers not having an ideal cylindrical shape. Using a 3D numerical method the paper investigates the impact of realistic hole shapes on PCSEL characteristics and performance.

14:15 : From Photonic Time-Crystals to Gravitational Waves**Martin McCall, Stefanos Koufidis***Imperial College London (United Kingdom)*

Building on the band structure and optical response of synthetic photonic time crystals, we explore the temporal analogs of quasi-crystals and optical activity via coupled-wave theory. We thence extend this framework to investigate the interaction of light waves with Nature's quintessential space-time grating: the gravitational wave.

14:30 : Multiple Unidirectional Chiral Zero Modes Arising From A Large Chern Number In 2d Photonic Crystals**Weiyuan Tang¹, Hsun-Chi Chan¹, Shaojie Ma², Chuang Tan¹, Biye Xie³, Kazuki Hasebe¹, Nicholas X. Fang¹, Shuang Zhang¹**

¹The University of Hong Kong (China), ²Fudan University (China), ³The Chinese University of Hong Kong (China)

We experimentally demonstrate the presence of four unidirectional chiral zero modes originating from large Chern numbers in 2D gyromagnetic topological photonic semimetals. Our findings experimentally validate the intrinsic connection between the chiral zero modes and topological fermions, offering the potential to advance large-capacity and highly efficient photonic devices.

14:45 : Demonstration Of A Broadband Polarization Control Device For Terahertz Waves Using Silicon Photonic Crystals

Hidemasa Yamane¹, Yoshiharu Yamada¹, Yusuke Kondo¹, Takuya Ehiro¹, Masayuki Fujita², Shuichi Murakami¹

¹Osaka Research Institute of Industrial Science and Technology (Japan), ²Osaka University (Japan)

A broadband, high-efficiency terahertz polarization converter is developed using a silicon photonic crystal with elliptical through-holes. Experimental and numerical results demonstrate its broadband half-wave plate function (0.30-0.50 THz). The device achieves high transmission with minimal loss due to biaxial anisotropy, enabling efficient terahertz polarization control using all-silicon structures.

15:00 : Topological Line Singularities In Scattering Matrix And Bound States In The Continuum

Wenzhe Liu¹, Yuan-Song Zeng², Geng-Bo Wu², C. T. Chan³

¹Fudan University (China), ²City University of Hong Kong (Hong Kong), ³The Hong Kong University of Science and Technology (Hong Kong)

We reveal that bound states in the continuum function as robust chain points pinning together nodal lines in scattering matrices. These singularities induce observable phase vortices and persist even when symmetry is broken, providing a new framework for understanding topological protection in open photonic systems.

15:15 : Laser Generation With Metal-free Carbogenic Quantum Dots

David Hernández Pinilla¹, Barun Kumar Barman², Tadaaki Nagao²

¹Universidad Autonoma de Madrid (UAM) (Spain), ²International Center for Materials Nanoarchitectonics (MANA-NIMS) (Japan)

Different types of newly synthesized eco-friendly, low-cost carbon quantum dots (CDs) are evaluated to achieve carbon-based laser devices utilizing planar micro-cavities. The results constitute a step forward towards developing alternative eco-friendly carbon-based light-emitting devices aimed to replace current ones based on costly rare-earth and toxic metal elements.

14:00 - 16:00 — Maxwell

Session 1A22

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Khaled Mnaymneh

14:00 : Invited talk

Two-dimensional Semiconductors For On-chip Polarization-sensitive Photodetectors

Marcos Guimaraes

University of Groningen (The Netherlands)

Optical communication of information through light polarization provides a viable route to overcome the interconnect problem in modern ICT architecture. In this talk I will show how atomically-thin semiconductors can be used for photodetectors with sensitivity to light polarization.

14:20 : Invited talk

Continuous Translational Symmetry Breaking Metamaterial Design For Photonic Integrated Circuits To Free Space Outcouplers

Alexei Azarov, Dhriti Maurya, Daron Westly, Vladimir Aksyuk

National Institute of Standards and Technology (USA)

Simulated and experimentally demonstrated photonic metamaterial antennas capable of emitting one or multiple »300 μ m diameter optical beams with customizable direction, intensity, phase, and polarization state (new result) at 460nm. Single transverse electric (TE) slab mode scatters from weak continuous perturbations superimposed on translationally-symmetric slab metamaterial.

14:40 : Invited talk

Optimization Of Photonic Structures For CMOS Image Sensors Using Adjoint Sensitivity

Rishad Arfin¹, Jeongwoo Son², Jens Niegemann³, Dylan McGuire³, Mohamed H. Bakr¹

¹McMaster University (Canada), ²Anslys Korea (Korea), ³Anslys Canada Ltd. (Canada)

This work presents a systematic optimization approach to develop efficient photonic structures with enhanced optical performance for CMOS image sensors. Adjoint sensitivity analysis (ASA) is used to optimize the structure for improved focusing and collection of light. The adjoint-optimized structure demonstrates enhanced performance compared to the conventional designs.

15:00 : Invited talk

Unconventional Phenomena From Space-time Modulation Of Dispersive Media

Carlo Rizza¹, Alessandra Contestabile¹, Maria Antonietta Vincenti¹, Giuseppe Castaldi², Michael Scalora³, Vincenzo Galdi²

¹University of L'Aquila (Italy), ²University of Sannio (Italy), ³U.S. Army CCDC (USA)

We investigate a time-varying dispersive interface. We discuss unconventional effects supported by this system: the generation of frequencies at the system's natural resonances, the direct excitation of confined wave modes, and unusual spin-dependent effects.

15:20 : Invited talk

Effect Of Disorder In 3d Photonic Networks On Their Photonic Band Gaps

Florin Hemmann, Vincent Glauser, Ullrich Steiner, Matthias Saba

University of Fribourg (Switzerland)

Complete photonic band gaps are frequency domains where light cannot enter a material from any angle. Here, we generate network-like photonic crystals with varying coordination numbers and correlate their photonic density of states to local and global statistical quantifiers that characterize the structural variations.

15:40 : Invited talk

Resonant hybrid nanostructures based on 2D semiconductors for advanced optoelectronics

Isabelle Staude, Zlata Fedorova

Friedrich-Schiller-Universität Jena (Germany)

We present advances in integrating 2D semiconductors (TMDs) with resonant nanostructures for optoelectronics. Our work explores hybrid architectures combining 2D TMDs with dielectric metasurfaces, plasmonic nanoantennas, and nanopatterning strategies preserving optical properties. We discuss fabrication challenges, performance, and light-matter interactions in these systems, highlighting their prospects for next-generation optoelectronics.

14:00 - 16:00 — Fresnel

Session 1A23

Plasmonics and Nanophotonics: Fundamentals and Applications

Organized by: Hong Wei

Chaired by: Xiulai Xu

14:00 : Invited talk

Birefringence-Driven Chiral Resonances in Lithium Niobate Metasurfaces

Bo Wang, Tingyue Zhu, Junjie Li

Institute of Physics-Chinese Academy of Sciences (China)

We demonstrate that the birefringence of lithium niobate (LN) material can induce strong coupling between two resonant modes of an LN metasurface, leading to hybridized elliptically polarized modes with opposite chirality. This achieves a giant chiral optical response, even though both the material and structure are achiral.

14:20 : Invited talk

Thermal Emission Control And Applications Of Metasurfaces

Xiaohe Shang¹, Ye Zhang¹, Fan Zhong², Shining Zhu¹, Hui Liu¹

¹Nanjing University (China), ²Southeast University (China)

We propose an integrated metasurface-based thermal emission chip with multi-degree-of-freedom control (wavelength, polarization, direction) and advanced detection. These innovations enable precise infrared emission and detection for industrial inspection, medical diagnosis, and environmental monitoring by leveraging bound states in the continuum, micro-area thermal imaging, and AI-assisted signal analysis.

14:40 : Invited talk

Quantum Beam Splitting On Metasurfaces: Principles And Applications

Yu Tian¹, Qi Liu¹, Xuan Liu², Zhaohua Tian¹, Shuyun Su¹, Guixin Li³, Xifeng Ren⁴, Qihuang Gong¹, Ying Gu¹

¹Peking University (China), ²Beijing University of Technology (China), ³Southern University of Science and Technology (China), ⁴University of Science and Technology of China (China)

We reveal the properties of quantum beam splitting on local and nonlocal metasurfaces, functioning as a series of parallel two-port beam splitters and a set of independent four-port beam splitters, respectively, which can manipulate various quantum states. We further demonstrate quantum logic gates on a single metasurface.

15:00 : Invited talk

Hyperbolic Photonic Topological Insulators And Quantum Sources

Lu He, Xiangdong Zhang

Beijing Institute of Technology (China)

In this talk, we will introduce hyperbolic photonic topological insulators and their application. We experimentally realize hyperbolic photonic topological insulators on silicon chips using coupled ring resonators and hyperbolic topological quantum sources. They show the higher utilization efficiency of resonators, showing great potential for integrated quantum chips.

15:20 : Invited talk

Particle-in-cell (PIC) Simulations For Next-gen Nanoscopic Photonics And Plasmonics

Lin Wu

Singapore University of Technology and Design (SUTD) (Singapore)

Room-temperature metals and semi-metals, acting as cold quantum plasmas, enable Particle-in-Cell (PIC) simulations for next-gen nanoscopic studies in photonics and plasmonics. Our recent work examines graphene antennas and nonlinear electron transport in graphene plasmon resonators, revealing novel even-order nonlinearities for frequency-tunable infrared upconversion.

15:40 : Invited talk

Memristive Nanogaps With Biophoton-like Properties As A Building Block For Advanced Nanophotonic Applications

Maciej Ćwierzona¹, Diana Singh², Konstantin Malchow², Sarah Hamdad², Alexandre Bouhelier²

¹Nicolaus Copernicus University (Poland), ²Université de Bourgogne Europe (France)

We demonstrate that memristive nanogaps can emit light during resistive switching, replicating key properties of biophotons observed in neurons. This dual electronic-photonic functionality enables new approaches for on-chip light generation, high-speed optical communication, and nanoscale optoelectronic integration, expanding the role of memristors in neuromorphic computing and advanced nanophotonic applications.

Coffee Break
Session 1P2
Poster session II
16:00 - 16:40

P1: Infrared Spectroscopy Of Heavily Doped Germanium Crystals

Sergey Pavlov¹, Aravind N. Subramanian², R. Radhakrishnan Sumathi², S. Bin Anooz², Nikolay V. Abrosimov², Mariia Sidorova³, Heinz-Wilhelm Hübers¹

¹German Aerospace Center (Germany), ²Leibniz-Institut für Kristallzüchtung (Germany), ³Humboldt Universität zu Berlin (Germany)

Infrared reflectance, Raman light scattering and X-ray rocking curve imaging analytics have been applied to characterize optical and structural properties of heavily doped bulk germanium crystals.

P2: Biocompatible Plasmonic Nanoparticle-doped Hydrogel For Facile Optical Detection Of Cortisol

Alexandra Nicolae-Maranciuc¹, Dan Chicea¹, Andreea Campu²

¹Lucian Blaga University (Romania), ²Babes-Bolyai University (Romania)

Nowadays, the population is subject to a lot of stress, being one of society's most encountered problems affecting people worldwide. Cortisol is one of the main indicators of stress, long-term exposure to cortisol can lead to severe medical conditions, thus its rapid, facile and effective real-time monitorization is highly desired.

P3: Plasmonically Enhanced Solar Water Splitting with TiO₂/Au/Pt Nanoparticles in three-dimensional porous PDMS Substrates

Nicolas Albenge, F. Laible, S. Glocker, M. Fleischer

Eberhard Karls University of Tübingen (Germany)

Green hydrogen can be generated in a water-splitting process using solar energy and photocatalytic titanium dioxide. When this is brought into contact with gold and platinum nanoparticles and assembled on inner surfaces of transparent three-dimensional PDMS substrates for high absorption, the efficiency of the hydrogen generation reaction can be enhanced.

P4: Design Of Tunable Bound States In The Continuum For Flexural Waves In Elastic Waveguide

Weihan Wang¹, Shixuan Shao¹, Rongyu Xia², Zheng Li¹

¹Peking University (China), ²Sun Yat-sen University (China)

In this research, a tunable Friedrich-Wintgen bound state in the continuum (FW BIC) is designed to achieve an elastic waveguide with a high-quality factor. Numerical simulations and experimental tests are conducted to verify the formation of FW BIC. Furthermore, a perfect absorption of flexural waves can also be realized.

P5: Broadband Field Prediction Via Parameter-efficient Electromagnetic Surrogate Solver

Chanik Kang, Joonhyuk Seo, Changkyun Lee, Haejun Chung

Hanyang University (Korea)

We propose a parameter-efficient electromagnetic surrogate solver that predicts broadband field distributions from discrete wavelength data. Using wave-informed multiplicative encoding and Fourier group convolutional shuffling, our approach reduces parameters by 74 % and improves the accuracy of untrained wavelength prediction by 80.5 %, outperforming state-of-the-art models.

P6: Semiconductor Microcavity Lasers For Unidirectional And Single Mode Lasing

Youling Chen

Institute of semiconductors-Chinese academy of sciences (China)

A dual-port square microresonator for single-mode lasing has been fabricated, capable of providing two optical sources simultaneously for optical signal processing. Moreover, a deformed circular-side triangular microresonator is fabricated with unidirectional light emission, which has potential applications in portable and highly sensitive far-field detection of nanoparticles.

P7: Monte Carlo Simulation For Dense Nanoparticle Dispersion With Rigorous Treatment Of Particle Types And Distributions

Changgyun Noh, Seokhwan Min, Jonghwa Shin*Korea Advanced Institute of Science and Technology (Korea)*

We develop Monte Carlo-based optical simulation for nanoparticle dispersion with high accuracy and versatility. Our approach incorporates dependent scattering with structure factor and rigorously accounts for particle types and distributions. It is applicable to various structures, including multimodal probability density functions, multi-shell configurations, and multi-composition structures, enabling comprehensive optical analysis.

P8: A Reconfigurable Coding Acoustic Metasurface Based On Coiling Units**Jie Hu, Hao Zhou, Haoxiang Li***Nanjing Forestry University (China)*

In this paper we design a reconfigurable coding metasurface comprising two types of encoding coiling units that can manipulate the acoustic waves arbitrarily over a certain frequency. The multi-functional performance of our scheme is numerically verified via the demonstration of two distinctive examples of beam splitting and acoustic focusing.

P9: Nanoscale Time-Resolved Photoluminescence Mapping of CsPbBr₃ Nanocrystals via Near-Field Optical Microscopy**Pavel Klok, Petr Viewegh, Petr Liška, Vlastimil Křápek, Zdeněk Nováček, Matouš Kratochvíl, Filip Ulč, Jan Čecháček, Jiří Spousta, Tomáš Šikola***Brno University of Technology (Czech Republic)*

We demonstrate time-resolved photoluminescence (tr-PL) mapping with sub-diffraction resolution (~ 150 nm) in aperture-type scanning near-field optical microscopy (a-SNOM) of CsPbBr₃ nanocrystals. This method allows to correlate structural and optoelectronic properties, revealing the impact of nanoscale heterogeneities on recombination dynamic and enhancing nanoscale characterization for optoelectronic applications.

P10: All-Optical Phase Modulation of mm-waves for Beam Steering Applications**George Neville White¹, Ian Hooper¹, Fraser Burton², Dave Phillips¹, Euan Hendry¹**¹ *University of Exeter (United Kingdom)*, ² *BT Group (United Kingdom)*

6G technologies will require fast and efficient mm-wave beam steering, yet methods to achieve this are still evolving. Here, we experimentally demonstrate a novel mm-wave spatial light modulator based on an optically controlled metasurface. Our system is capable of arbitrary beam shaping - including multicasting and orbital angular mode generation.

P11: Ultrastrong Coupling of Si(1-x) Ge Parabolic Quantum Wells to Terahertz Microcavities**Sara Cibella¹, Maria Gambelli¹, Leonetta Baldassarre², Tommaso Venanzi², Fritz Berkmann³, Enrico Talamas Simola⁴, Luciana Di Gaspare⁴, Elena Campagna⁴, Cedric Corley⁵, Giovanni Capellini⁶, Michele Virgilio⁷, Giacomo Scaleri⁸, Michele Ortolani², Monica De Seta⁴**¹ *IFN CNR (Italy)*, ² *Sapienza University of Rome (Italy)*, ³ *Experimental Physics and Functional Materials BTU Cottbus (Italy)*, ⁴ *University Roma TRE (Italy)*, ⁵ *ESRF - The European Synchrotron (France)*, ⁶ *University Roma TRE, IHP (Germany)*, ⁷ *Università di Pisa (Italy)*, ⁸ *ETH Zurich (Switzerland)*

Using semiconductor-metal patch cavities, we demonstrate ultrastrong coupling at room temperature between conduction sub-band states in Si(1-x) Ge heterostructures and THz cavity photons. At the resonant frequency of 3.1 THz, we observe an anticrossing splitting of 1.4 THz, corresponding to a coupling ratio in excess of 0.2

P12: Atomistic multiscale modeling of surface-enhanced IR absorption**Sveva Sodomaco¹, Piero Lafiosca¹, Tommaso Giovannini², Chiara Cappelli¹**¹ *Scuola Normale Superiore (Italy)*, ² *University of Rome Tor Vergata (Italy)*

We present a multiscale quantum mechanics (QM)/classical approach to model surface-enhanced IR absorption (SEIRA) spectra of molecules near plasmonic nanostructures. Frequency-dependent ω FQ and Ω fqf.

P13: Phase-Matched Second-Harmonic Generation from Metasurfaces Inside Multipass Cells**Madona Mekhael¹, Timo Stolt², Anna Vesala², Heikki Rekola³, Tommi Hakala³, Robert Fickler², Mikko Huttunen²**¹ *Tampere University (The Netherlands)*, ² *Tampere University (Finland)*, ³ *University of Eastern Finland (Finland)*

We demonstrate scalable enhancement of second-harmonic generation (SHG) from metasurfaces using mul-

tipass cells, where the pump interacts multiple times with the metasurface. We achieve phase matching with superlinear dependence on the number of passes, promising applications in diverse nonlinear optics.

P14: Terahertz metasurface for realizing high-Q chiral BICs

Xinyue Liang, Jian Liu, Xumin Ding

Harbin Institute of Technology (China)

We propose a metal metasurface design for terahertz chiral sensing systems, leveraging symmetry-protected bound states in the continuum (BICs) to realize high Q-factor transmissive terahertz (THz) chiral response. This provides new perspectives into the creation of novel BICs in terahertz, advancing terahertz spectroscopy, polarization optics, and biochemical sensing applications.

P15: Application of micro-CT technology in performance characterization of composite materials under extreme temperatures

Xiaoyang Ren, Yaguang Dai, Meiying Zhao, Heyuan Huang

Northwestern Polytechnical University (China)

This paper delves deep into the application of Micro-CT technology in the performance characterization of composite materials. It elaborately expounds how this technology precisely reveals the internal structures and defects, and analyzes its vital significance for accurately evaluating composite properties.

P16: Harnessing Anisotropic Photonic Crystals for Advanced Chiral Mirrors

Andrea Alessandrini¹, Leone di Mauro Villari¹, Luca Assogna¹, Matteo Silvestri¹, Matteo Venturi¹, Carino Ferrante², Paola Benassi³, Davide Tedeschi¹, Andrea Marini³

¹University of L'Aquila (Italy), ²CNR - SPIN (Italy), ³University of L'Aquila / CNR - SPIN (Italy)

We leverage the optical torque from anisotropic media for polarization control, designing ultra-compact uniaxial layered stacks that form chiral photonic crystals with >99 % reflectance for one circular polarization depending on the reciprocal orientation of the extraordinary axes of neighboring layers.

P17: Tunable curved piezoelectric metasurface for flexural wave manipulation in cylindrical shells

Jie Xu, Youqi Zhang, Weihai Wang, Zheng Li

Peking University (China)

A tunable curved piezoelectric metasurface is proposed here, which is attached on the surface of host cylindrical shell to achieve anomalous refraction of flexural waves. This study extends the research on elastic metasurfaces from planar structures to non-planar structures, and provides a new method for wave manipulation in cylindrical shells.

P18: Large area metalenses for the generation of vector beams

Daniele Bonaldo¹, Andrea Vogliardi¹, Gianluca Ruffato¹, Simone Dal Zilio², Vittorio Apolloni¹, Filippo Romanato¹

¹University of Padova (Italy), ²CNR-IOM Istituto Officina dei Materiali (Italy)

Given their unprecedented control over the degrees of freedom of light, metalenses showed great potential for structuring light. In this work centimeters-wide metalenses for the generation of self-accelerating vector beams are designed, fabricated and characterized.

P19: Bound states in the continuum of underwater phononic crystals

Yuzhen Yang, Han Jia

Institute of Acoustics - Chinese Academy of Sciences (China)

This study focuses on the bound states in the continuum of underwater phononic crystals, specifically examining symmetry-protected bound states and Fabry-Perot bound states. These bound states in the continuum enhances the potential for developing high-Q acoustic devices, which are of paramount importance for applications in underwater communication, imaging, and detection.

P20: Analysis of the temperature sensitivity of split ring resonator metamaterials

Michael Töffler, Alexander Schossmann, Alexander Bergmann

Graz University of Technology (Austria)

The temperature sensitivity of a metamaterial in the millimeter-wave regime is analyzed. Split-ring resonators are manufactured on two glass substrates, with a dielectric spacer between them. The sensor effect is the tuning of the resonance frequency due to a temperature change. The experiment shows a sensitivity of

(10.5+-1.0) MHz/°C.

P21: Thermal-Mechanical Coupling Performance of the Printable Al-Si Alloy Antisymmetric Lattice Metastructure

Jiaqi Yan, Youdao Gao, Heyuan Huang

Northwestern Polytechnical University (China)

This study investigated the mechanical behavior of four lattice structures using AlSi12Fe2.5Ni3Mn4, a newly developed alloy. A novel antisymmetric anti-buckling lattice cell (ASLC-B) based on a rotation reflection multistage design was developed. Quasi-static compression tests showed that ASLC-B outperformed the other three types in energy absorption, and heat transfer efficiency.

P22: Polarization-Independent Huygens' Metasurfaces based on Split Ring Resonator for Highly Efficient Wavefront Formation at sub-THz bands

Hibiki Kagami, Daisuke Kitayama, Adam Pander, Haruka Matsunaga, Hiroyuki Takahashi

NTT Device Technology Laboratories (Japan)

A polarization-independent design for Huygens' metasurfaces at sub-THz bands is proposed. Metasurfaces designed using an electric LC resonator exhibited 2p phase controllability and low transmission loss. With a cell size below 0.5λ even for polarization-independent design, a 38° beam deflection angle with 2-bit wavefront formation was achieved.

P23: Germanium Metalenses for Long-Wavelength Infrared Spectroscopy Applications

Jesus Hernan Mendoza Castro¹, Giovanni Piscopo², Artem Vorobev², Tomasz Piwonski², Antonella D'orazio³, Giovanni Magno³, Bernhard Lendl¹, Liam O'Faolain²

¹ *Technische Universität Wien (Austria)*, ² *Munster Technological University (Ireland)*, ³ *Politecnico di Bari (Italy)*

We report the design and anticipated fabrication of Germanium metalenses on Ge and ZnSe platforms in the long-wavelength infrared (12-15 μm). Integrated into indirect absorption spectroscopy systems, they enable miniaturization for BTEX detection (Benzene, Toluene, Propane), addressing the need for compact optical components in the LWIR range.

P24: Liquid Crystal-Based Asterisk-Shaped Millimeter-Wave Reflectarray for Reconfigurable Intelligent Surfaces

Junaid Ahmed Uqaili¹, Dayan Perez-Quintana², David Osuna Ruiz¹, Miguel Beruete¹

¹ *Public University of Navarra (UPNA) (Spain)*, ² *University of Siena (Italy)*

This study introduces a low-cost, single-layer unit cell for reconfigurable reflectarray effectively targeting the frequency bands from 90 GHz to 120 GHz. The results demonstrate a reflection phase tunability of 208° and low loss of 3.9 dB. The reflectarray is simulated as proof of concept for 1-D beam-steering applications.

P25: Aperiodic tiling-based metasurface design for angle- and polarization-tolerant structural color

Minyeul Lee¹, Suwan Jeon², Jonghwa Shin¹

¹ *Korea Advanced Institute of Science and Technology (Korea)*, ² *Korea Institute of Machinery and Materials (Korea)*

In this study, we present a novel metasurface design based on the 'Einstein' tile for achieving robust structural color under varying incident light conditions. Simulation results demonstrate that the aperiodic metasurface based on aperiodic unit cell exhibits improved incident angle and polarization tolerance compared to periodic metasurface.

P26: High-Contrast Ratio Optical Switching in multilayer Fabry-Perot Cavities with Phase Change Materials

Ruhao Pan, Bo Wang, Zhiyang Tang, Junjie Li

Institute of Physics - Chinese Academy of Sciences (China)

This work proposed a multilayer Fabry-Perot (FP) cavity to achieve optical switches with high contrast ratio by introducing the Ge₂Sb₂Se₄Te (GSST) as phase change material. Due to the distinctive FP resonances for the amorphous and crystalline GSST, a high contrast ratio of 2410/735 can be obtained by simulation/experiment.

P27: Meta-DRA Array for Mm-Wave Wearable ETA Radar Applications

Lara Prendes Suarez, Maria Elena de Cos Gómez, Fernando Las-Heras Andrés

Universidad de Oviedo (Spain)

A wearable artificial magnetic conductor backed dielectric resonator antenna array is designed for operation in 24.05-24.25 GHz band. The overall device' size is 24 x 24 x 7.37 mm³. The target application is collision avoidance in aid to visually impaired people at short-medium distance.

P28: Green Metasurface for Wearable ETA Radar Antenna Protection

Maria Elena de Cos Gómez, Alicia Flórez Berdasco, Fernando Las-Heras Andrés

Universidad de Oviedo (Spain)

An Eco-friendly metasurface solution to protect a wearable grid array antenna in 24.05-24.25 GHz band is designed. The overall device' size is 40 x 40 x 1.94 mm³. The target application is collision avoidance to assist visually impaired individuals at short-medium distance.

P29: Strong Light-matter Coupling Of Photosynthetic Chlorophyll-a Molecules On Plasmonic Arrays

Yadav Rohit Umashankar, Parinda Vasa

Indian Institute of Technology Bombay (India)

Here, we demonstrate strong exciton-photon coupling between photosynthetic light-harvesting complexes i.e. Chlorophyll-a molecules, and a surface lattice resonance of periodically patterned Silver nanodisk arrays. The high-quality factor and delocalized field modes of lattice resonances enable efficient studies of optical responses and energy transfer in strongly coupled photosynthetic pigments.

16:40 - 18:50 — Torremolinos

Session 1A24

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Changzhi Gu

16:40 : Keynote talk

Photonic Metamaterial Time Crystals And Timetronics

Nikolay Zheludev

University of Southampton (United Kingdom)

We discuss recent developments in understanding functionalities and developing applications of time crystals - a new state of matter, a many-body interacting system that exhibits a spontaneous mobilization transition to the robust state of oscillation, breaking time translation symmetry under an infinitely small change of the external driving force.

17:10 : Invited talk

Second Harmonic Generation of High-Coherence Light in Si₃N₄ Microresonators

Kerry Vahala¹, Z. Yuan¹, B. Li¹, J. Ge¹, P. Liu¹, M. Li¹, J.-Y. Liu¹, Y. Yu¹, H.-J. Chen¹, J. Bowers²

¹Caltech (USA), ²University of California Santa Barbara (USA)

High-coherence visible and near-visible light is generated by combining second-harmonic generation (SHG) with self-injection locking (SIL) of a pump laser. Both SIL and SHG processes occur within high-Q Si₃N₄ microresonators. SHG is enabled by the photogalvanic effect together with all-optical poling, which induces a second-order nonlinearity in the Si₃N₄ microresonator.

17:30 : Invited talk

Automated Design Of One-dimensional Photonic Crystals For Surface Wave Enhanced Chiroptical Spectroscopy

Jonathan Barolak¹, Francesco Michelotti², Agostino Occhicone², Marco Finazzi³, Paolo Biagioni³, Giovanni Pellegrini¹

¹University of Pavia (Italy), ²University of Rome "La Sapienza"(Italy), ³Politecnico di Milano (Italy)

In this work, a multi-objective, automated design process is presented to optimize one-dimensional photonic crystals for the purpose of exciting planar fields with enhanced optical chirality over a range of wavelengths.

Using this procedure, we show the surprising result that designs composed of polymeric materials offer significantly superior performance.

17:50 : Invited talk

Nano-Optomechanical Disk Resonators: Operating Principles And Sensing Applications

Elena Sentre-Arribas¹, Alicia Aparicio-Millán¹, Ivan Favero², Aristide Lemaître², Oscar Malvar¹, Jose Jaime Ruz¹, Montserrat Calleja¹, Javier Tamayo¹, Eduardo Gil-Santos¹

¹IMN-CNM/CSIC (Spain), ²Université Paris-Cité (France)

Nano-optomechanical disks are great candidates for sensing applications due to their capacity of simultaneously support very high quality optical and mechanical modes. In the last decade, different applications have been proposed. In this talk, we will review these applications, explain their operating principles, and discuss their future potential.

18:10 : Invited talk

Photonic Antiferromagnetic Topological Insulator With A Single Surface Dirac Cone

Yihao Yang

Zhejiang University (China)

We report on the realization of a three-dimensional (3D) photonic antiferromagnetic topological insulator (AF TI) configured as a z-directional stack of two-dimensional (2D) Chern insulators. This photonic AF TI features symmetry-protected single-Dirac-cone surface states, which have been demonstrated to be resilient against random disorder of any type on the surface.

18:30 : Invited talk

Real-Space Renormalization Group On Topological Scattering Under Strong Disorder

Zhe Zhang, Romain Fleury

EPFL (Switzerland)

Strong disorder typically induces trivial Anderson insulating phases. We introduce a real-space renormalization group approach for unitary scattering networks, uncovering robust scattering attractors that distinguish trivial from anomalous Floquet Anderson insulators hosting chiral edge states. Numerical and microwave experiments confirm our method, enabling prediction and design of topologically resilient photonics.

16:40 - 19:00 — Alamos

Session 1A25

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jerome Plain, Alexander Govorov, Davy Gerard and Pedro Hernandez Martinez

Chaired by: Davy Gerard

16:40 : Invited talk

Single-particle Chiral Optical Microscope With High Precision

Wei-Shun Chang¹, Angel Thomas¹, Vidhi Singla¹, Oscar Avalos Ovando², Trang Nguyen¹, Tamie Vo¹, Alexander Govorov²

¹University of Massachusetts Dartmouth (USA), ²Ohio University (USA)

Characterizing the chirality of nanostructure at the single-particle level is essential for understanding the relationship between morphology and chirality. Here, we present our recent development of a single-particle chiral optical microscope, which enables high-precision and high-throughput characterization of chiral nanostructures.

17:00 : Invited talk

Meta-atoms Based On Self-assembly Of Gold Nanoparticle On Polymer Microspheres

Hiroshi Yabu

Tohoku University (Japan)

Fabrication of gold nanoparticle decorated polymer microspheres and their applications as sensors and metamaterials will be shown.

17:20 : Invited talk

Hot-electron Dynamics And Speciality Optical Fibres For Quantum Applications

Kristina Rusimova

University of Bath (United Kingdom)

I will discuss two experimental systems - the first uses a scanning tunnelling microscope (STM) to capture the ultrafast dynamics of hot electrons that are relevant to energy applications, the second integrates atomic vapors within speciality optical fibres for quantum technologies.

17:40 : Invited talk

Photoluminescence-based Polarization Conversion In Quantum Rods Aggregate-containing Hybrid Polymer System

Yutaka Okazaki, Yoshihiro Kawahara, Shoma Kimura, Hayaki Shimizu, Kan Hachiya, Takashi Sagawa

Kyoto University (Japan)

We fabricated various hybrid linearly polarized luminescent films containing different aggregation states of quantum rods in dilute condition. In this presentation, we discuss about the correlation between aggregation states of QRs and polarization converting properties.

18:00 : Invited talk

Topological Thermal Emitters

Said Ergoktas

University of Bath (United Kingdom)

The ability to control thermal emission has scientific and technological importance and profound implications for thermal management. We introduce a new concept that offers unconventional manipulation of thermal emission by controlling the reflection topology of a surface, achieving the near unit emissivity at the boundary of two topologically distinct surfaces.

18:20 : Invited talk

Hyperdoped silicon nanocrystals embedded in a silica matrix for infrared plasmonics

Clavel Berclis Kengne, Xavier Devaux, Mathieu Stoffel, Michel Vergnat, Hervé Rinnert

Université de Lorraine (France)

Highly-phosphorus-doped silicon nanocrystals obtained from P-doped SiO/SiO₂ multilayers show a localized surface plasmon resonance (LSPR) in the infrared range. The dependence of the LSPR with temperature and nanocrystal size can be modeled in the framework of the Mie theory, using the Drude model and a size-dependent scattering of free carriers.

18:40 : Invited talk

Experimental Measurement Of Nanoscale Circular Dichroism In Plasmonic Chiral Structures Using Electron Beams

Malo Bézard¹, Simon Garrigou², Yves Auad¹, Jérémie Béal³, Hugo Lourenço-Martins², Davy Gérard³, Mathieu Kociak¹

¹ Université Paris-Saclay (France), ² Université de Toulouse (France), ³ Université de Technologie de Troyes (France)

Measuring and understanding optical polarization at the nanometer scale is usually a complex problem. Here, we present recent nanometer-scale measurements using cathodoluminescence, demonstrating highly localized circular dichroism in canonical 3D plasmonic chiral objects. The relationship between local dichroism and global chirality is discussed.

16:40 - 18:40 — Playamar

Session 1A26

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Oleksandr Serha

16:40 : **Invited talk****Spin Polarization Induced By Nonequilibrium Fluctuation Near The Surface In Chiral Metals****Yusuke Kato***The University of Tokyo (Japan)*

We theoretically address spin polarization induced by the fluctuating electric fields, i.e., noises in chiral metals, with the Boltzmann transport theory. Based on these results, we discuss chirality-induced spin selectivity (CISS) without biased inputs and the enantio-selective interaction between chiral materials and a magnetic substrate.

17:00 : **Invited talk****Nano-squeezing Of Optical Chirality Via Topology-optimized 3d Nanogap Antennas****Atsushi Taguchi***Hokkaido University (Japan)*

We numerically investigated optical chirality flowing in a topology-optimized 3D chiral dielectric nanostructure. From the near-field analysis, we observed that chirality flux concentrates and eventually leads to a local enhancement of chirality density at the nanogap. This finding has important implications for better controlling chiral light-matter interactions at the nanoscale.

17:20 : **Invited talk****Thz Metastructures Using Spintronic Thz Emitters****Christian Bohley¹, Ramaz Khomeriki², Vakhtang Jandieri³, Dominik Schulz¹, Benjamin Schwager¹, Björn Niedzielski¹, Jamal Berakdar¹**¹Martin-Luther University (Germany), ²Tbilisi State University (Georgia), ³Center for Nanointegration Duisburg-Essen (Germany)

We show that textured spintronic emitters may function as THz metamaterials for steering vectorial and topological properties of emitted fields. The proposed metastructures are shown to control the sub-wavelength characteristics of propagating modes with the possibility for novel applications, as demonstrated for the non-destructive supercurrent generation in Type-II superconductors.

17:40 : **Invited talk****Tunable Of Universal Quantum States At Weyl Semimetal Interstitial Interfaces With Magnetic Textures****Eklavya Thareja, Gina Pantano, Ilya Vekhter, Jacob Gayles***University of South Florida (USA)*

Magnetic multilayers combining Weyl and skyrmionic topologies enable tunable electronic states with novel functionalities. We model Fermi-arc-like bound states at interfaces, demonstrating tunability via magnetic and electrostatic potentials. Using CoGe/FeGe interfaces, we show enhanced spin-orbit coupling and transport phenomena, optimizing Weyl-skyrmion interactions for next-generation spintronic devices.

18:00 : **Invited talk****Nonlinear Chiral Quantum Photonics****Nir Rotenberg***Queen's University (Canada)*

This talk explores the physics of coherent interactions of differently coloured photons with a chirally-coupled single quantum emitter. We focus on how these interactions control the phase and amplitude of the scattered photons, observing surprising trends when compared to the more standard symmetric (i.e., not chiral) or single-beam configurations.

18:20 : **Invited talk**

Symmetry In Magnetoelectric Electromagnetism**Eugene Kamenetskii***Ben Gurion University of the Negev (Israel)*

When studying the relationship between electromagnetism and magnetoelectricity, one of the main questions is how to unite these two entities of different symmetry properties. There are claims that quantum vacuum can asymmetrically transfer momentum to ME structures. Conversely, dynamic processes in ME structures cause asymmetric transfer of momentum to vacuum.

16:40 - 18:20 — Bajondillo**Session 1A27****Metamaterials: novel trends and applications**

Organized by: Tatjana Gric

Chaired by: Tatjana Gric

16:40 : Invited talk**Tailoring The Rf Fields In Mri: A New Compact Multi-layer Metamaterial Design Combining A Hexagonally-structured Artificial Dielectric With Electric And/or Magnetic Dipoles****Rita Schmidt***Weizmann Institute of Science (Israel)*

We established a new framework of MRI-beneficient artificial materials to tailor the RF transmit and receive fields, combining an artificial dielectric with a set of electric and/or magnetic dipoles. This combination provides high flexibility to plan the possible enhancement, as well as a higher efficiency and a very compact structure.

17:00 : Invited talk**Breaking The Diffraction Limit: Far-field Super-resolution Imaging Via Metasurfaces And Holography****Pooria Salami¹, Leila Yousefi²**¹ *University of Tehran (Iran)*, ² *University of Sussex (United Kingdom)*

In this presentation, we discuss the innovative methods we have developed to surpass the diffraction limit using metasurfaces. By designing metasurfaces to transform evanescent waves into propagating modes and utilizing holography, we achieve super-resolution imaging. Full-wave simulations demonstrate that our proposed techniques can retrieve feature sizes as small as $\lambda/14$.

17:20 : Invited talk**Terahertz Collimating Metalens Antenna Based On Polarization-independent Isotropic Metasurface With High Refractive Index And Low Reflectance Mounted On A Resonant Tunneling Diode****Yuki Saito¹, Kento Sato¹, Kazuisao Tsuruda², Takehito Suzuki³**¹ *Tokyo University of Agriculture (Japan)*, ² *ROHM Co., Ltd. (Japan)*, ³ *Tokyo University of Agriculture and Technology (Japan)*

Measurements demonstrate that a terahertz collimating metalens antenna based on a polarization-independent isotropic metasurface with a high refractive index and low reflectance collimates terahertz waves from a resonant tunneling diode (RTD) in the 0.3-THz band. Our results could pave the way for integrating metalens antennas with RTDs as on-chip devices.

17:40 : Invited talk**Near-unity Index Meta-surfaces and Design of Thermally Emitting Meta-surfaces for Catalysis****Joel Y.Y. Loh***University of Manchester (UK)*

Metamaterial of index less than 1 achieves near-perfect absorption over 400nm range in visible spectrum, enhancing CO₂ adsorption through broadband plasmonic fields. Further, adjoint optimization of thermal metamaterials enable coupling with CO₂ vibrational modes. Atomic simulations confirm the enhanced gas ab-

sorption due to CO₂ activation energy barrier decrease to 0 eV.

18:00 : Invited talk

Relative Illumination Of Metalens

Qiu-Chun Zeng¹, Chen-Yi Yu¹, Wei-Lun Hsu¹, Che-Chin Chen², Chih-Ming Wang¹

¹National Central University (Taiwan), ²National Applied Research Laboratories (Taiwan)

The relative illumination of traditional lenses generally follows the Cosine Fourth Power Law. We proposed a metalens consisting of hybrid meta-units to modulate the relative illumination. It is experimentally shown that the relative illumination at 30° is twice compared to normal incidence. Our metalens offers potential applications requiring specific illumination.

16:40 - 18:55 — Carihuela

Session 1A28

Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and Noé Jiménez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

16:40 : Invited talk

Topological Phase Transitions And Edge States In Ssh-type Elastic Systems With Periodic And Disordered Non-hermitian Modulations

Runcheng Cai¹, Yabin Jin², Yan Pennec³, Xiaoying Zhuang¹, Bahram Djafari Rouhani⁴

¹Tongji University (China), ²East China University of Science and Technology (China), ³Université de Lille (France), ⁴IEMN (France)

Based on a generalized Su-Schrieffer-Heeger model, we design a non-Hermitian periodic or disordered elastic platform with feedback control where we theoretically study the topological phase diagrams and edge states. Considering both one and two-dimensional structures, we demonstrate in theory and simulations the relative effects of non-Hermiticity and disorder.

17:00 : Invited talk

Nanocrystalline Silicon For Optomechanical Metamaterials

Gloria Conte¹, Omid Reza Ranjbar Naeini¹, Cristiana Alves¹, Oliver Schraidt¹, Oili Ylivaara², Sara Pourjamal², Jouni Ahopelto², Clivia Mafra Sotomayor Torres¹

¹INL - International Iberian Nanotechnology Laboratory (Portugal), ²VTT - Technical Research Centre of Finland Ltd. (Finland)

Nanocrystalline silicon is a promising material for nano-opto-electro-mechanical metamaterials to be integrated into information and communication technology. The fabrication of nanocrystalline silicon has an impact on properties associated to grain sizes and grain boundaries, which influence the mechanical quality factor of one-dimensional nanoresonators.

17:20 : Invited talk

Tailoring Ghz Surface Acoustic Waves By Spatial Modulation Of Ultrashort Light Pulses

Olga Boyko, F. Soldevila, V. Bochkarev, L. Belliard

Institut des Nanosciences de Paris (INSP) (France)

We demonstrate the spatial and spectral manipulation of GHz surface acoustic waves (SAWs) using an ultrafast laser setup integrated with a Spatial Light Modulator. Arbitrary acoustic wavefronts and point-source distributions are dynamically created on flat substrates, providing versatile, non-invasive control critical for acoustic signal processing and phononic circuits.

17:40 : Invited talk

Mechanically time-modulated 2D phononic crystal

Dmitrii Shymkiv¹, Matthew Li¹, Ying Wu², Arkadii Krokhin¹

¹University of North Texas (USA), ²King Abdullah University of Science and Technology (Saudi Arabia)

A periodic arrangement of bimetallic rods in solid matrix is proposed as time-modulated phononic crystal. The rods oscillate along their axes. High elastic contrast between the constituents provides deep time modulation. A band structure with mixed gaps formed from coalescence of energy and momentum gaps is calculated and analyzed.

18:00 : Invited talk

Enhanced ultrasound focusing through dense barrier

Zhongming Gu, Jie Zhu

Tongji University (China)

The substantial impedance mismatch between dense materials and the surrounding medium poses a challenge to the transmission of ultrasound waves through dense barriers. To address this challenge, we propose an inverse design scheme aimed at achieving ultrasound focusing through dense layers with multiple foci, resulting in significantly enhanced transmission efficiency.

18:20 : Invited talk

Optomechanical Photonic Crystal Cavities Based on Silicon and Hybrid Nanopillars for Integrated Force Sensing

Daniel Navarro Urrios

University of Barcelona (Spain)

We present novel optomechanical (OM) photonic crystal cavity geometries based on either monolithic silicon or hybrid silicon/silicon oxide nanopillars integrated with adjacent waveguides. These structures enable optical transduction of cantilever-like modes with OM coupling rates exceeding 1 MHz. We also demonstrate sensitivity to local forces by tracking mechanical resonance shifts.

18:40 : Momentum-resolved Studies Of Plasmon – Acoustic Phonon Interactions In An Acoustoplasmonic Metamaterial

Anuj Kumar Dhiman, Hritika Dongre, Karol Zaleski, Piotr Graczyk, Bartłomiej Graczykowski, Thomas Vasileiadis

Adam Mickiewicz University (Poland)

We perform momentum-resolved studies of acoustic phonons in an acoustoplasmonic metamaterial (APM) using Brillouin light scattering and finite-element-method calculations. The APM is a square lattice of nanoholes on a gold-covered SiO₂-on-Si wafer. For certain modes, the acoustic and plasmonic fields are localized in the nanoholes leading to plasmon-enhanced optomechanical interactions.

16:40 - 18:20 — Montemar

Session 1A29

Functional materials for tunable and reconfigurable photonics

Organized by: Sébastien Cueff and Yael Gutierrez

Chaired by: Thomas Taubner

16:40 : Invited talk

Metasurface Tuning Based On Carrier Manipulation

Andrea Tognazzi

University of Palermo (Italy)

Tuning the optical response of nanoscale objects can be achieved through different carrier types. We demonstrate two distinct approaches: all-optical modulation via free-carrier injection in silicon metasurfaces and iontronic tuning in organic mixed conductors. These strategies enable fast, broadband, and energy-efficient control, paving the way for next-generation tunable photonic devices.

17:00 : Invited talk**Zero-static-power Photonics Using Chalcogenide Metacoatings With Engineered Volatile And Non-volatile Transitions****Behrad Gholipour, Avik Mandal, Joshua Perkins, Mahirah Zaini, Abbas SheikhAnsari, Yihao Cui, Kwanghyun Kim***University of Alberta (Canada)*

We show that non-resonant, subwavelength nanoscale patterning that enables dispersion engineering of chalcogenide glasses through lithography-free, bottom-up growth and patterning techniques, paves the way to the realization of metacoatings with tunable optoelectronic properties without any stoichiometric changes to chemical composition through glancing angle deposition and interlayer nanostructuring techniques.

17:20 : Invited talk**Phase Change Material Programmed Photonics: Plasmonic, Dielectric, and Interband Resonances****Robert Edward Simpson¹, Eleanor Gaggs¹, Daniel Chambers-Sims¹, Nur Qalishah Adanan², Simon Wredh², Ting Yu Teo², Li Lu², Liu Yan³, Zhaogang Dong², Joel Yang²**¹ *University of Birmingham (United Kingdom)*, ² *Singapore University of Technology and Design (Singapore)*,³ *A*STAR (Singapore)*

Chalcogenide phase change materials are being actively developed to tune the optical response of 3D displays, beam steering, and optical trap devices. We are studying dynamic control of metasurfaces through three different types of resonances, namely dielectric, plasmonic, and interband.

17:40 : Invited talk**Scalable Architectures for Photonic Compute-In-Memory Using Nonvolatile Optical Materials****Sadra Rahimi Kari¹, Paolo Pintus², Nathan Youngblood¹**¹ *University of Pittsburgh (USA)*, ² *University of Cagliari (Italy)*

Photonic processors offer a route to analog computation with ultra-low latency and high efficiency. By combining nonvolatile optical materials (both phase-change and magneto-optic) with integrated photonics, we enable scalable photonic compute-in-memory architectures for high-speed matrix-vector operations in machine learning applications.

18:00 : Invited talk**Semimetal-based nanostructured thin films for sustainable reconfigurable plasmonics and photonics****Fernando Chacon-Sanchez, Marina Garcia-Pardo, Johann Toudert, Rosalía Serna***CSIC (Spain)*

Elemental semimetal nanostructures (Bi, Sb) offer sustainable platforms for plasmonics and photonics, extending spectral range beyond that of noble metals. They enable advanced functionalities such as perfect absorption, structural coloration, and tunable optical responses via phase transitions, positioning them as versatile materials for next-generation optoelectronic and nanophotonic applications.

16:40 - 18:40 — Litoral**Session 1A30****Symposium II: New Trends in Nanophotonics and Advanced Materials**

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Pan Wang

16:40 : Invited talk**Single Crystals of Two-Dimensional Layered Perovskite Heterostructures****Alexander Schleusener¹, Mehrdad Faraji¹, Martina Borreani¹, Linhan Li², Miao-Ling Lin², PingHeng Tan², Sirous Khabbaz Abkenar¹, Giorgio Divitini¹, Roman Krahne¹**¹ *Italian Institute of Technology (Italy)*, ² *Chinese Academy of Sciences (China)*

Two-dimensional metal-halide perovskite microcrystals with homogeneous and regular rectangular are fabri-

cated by a solution-based process. These light-emitting semiconductor crystals can act as photonic cavities and feature strong light-matter interaction. Extending the solution growth employing various materials allows to obtain heterostructures defining regions with different band gap.

17:00 : Invited talk

Optimising Cross-polarisation Conversion Of Ghost Hyperbolic Polaritons With A Twist

Mark Cunningham, Rair Macêdo

University of Glasgow (United Kingdom)

We demonstrate tuning and optimisation of cross-polarisation conversion in multilayered hyperbolic systems by introducing a twist angle between layers (i.e. their anisotropy orientations). Using a transfer matrix method, we show significant enhancement of polarisation conversion efficiency due to Ghost Hyperbolic Polaritons. This could influence next-generation, direction-dependent infrared optical devices.

17:20 : Invited talk

Hyperbolic Plasmon Polaritons In Van A Der Waals Crystal At Visible Frequencies

Andrea Mancini, Giacomo Venturi, Nicola Melchioni, Stefano Chiodini, Antonio Ambrosio

Italian Institute of Technology (Italy)

We demonstrate low-loss, in-plane hyperbolic plasmon polaritons in MoOCl₂ thin films at visible and near-infrared frequencies. Predicted using biaxial media theory and confirmed via nano-imaging, MoOCl₂ hyperbolic plasmons enable extreme light confinement in the visible for applications like hyperlensing and super-resolution imaging, overcoming the losses and limitations of traditional metamaterials.

17:40 : Invited talk

Unified Framework For Enhancing Chiral Light-matter Interactions

Chloe Doiron

Sandia National Laboratories (USA)

While nanophotonics can enhance, typically weak, chiral light-matter interactions, the absence of a unified theory for understanding the flow of energy and chirality prevents a complete understanding of ultimate performance limits and requirements. Here, we present a unified framework for simultaneously understanding energy and chirality flows in resonant nanophotonic systems.

18:00 : Invited talk

Multipartite Light-Matter Interactions In Hybrid 2d-Material Nanophotonic Cavities

Chenjiang Qian¹, Viviana Villafañe², Pedro Soubelet², Andreas V. Stier², Jonathan J. Finley²

¹*Institute of Physics - Chinese Academy of Sciences (China)*, ²*Technische Universität München (Germany)*

We fabricated hybrid nanobeam cavities with high Q-factor and integrate the pristine hBN-encapsulated 2D materials with controllable cavity-material overlap. This allows the observation of novel light-matter interactions for the unique quantum emitters in 2D materials.

18:20 : Invited talk

Van Der Waals Polaritonic Crystals And Their Applications In Thz Detection

Huanjun Chen, Ximiao Wang, Shaojing Liu, Hongjia Zhu, Shaozhi Deng

Sun Yat-Sen University (China)

In this presentation, I will briefly review the roadmap of polaritonic van der Waals crystals. Subsequently, I will introduce our recent work on the plasmon polariton properties of graphene and its nanostructures. Following that, I will share our recent results on multiparameter THz detection using these graphene plasmonic nanostructures.

16:40 - 18:40 — Manantiales

Session 1A31

Symposium VI: Advanced Techniques for Computational Electromagnetics

Organized by: Maha Ben Rhouma

Chaired by: Costantino De Angelis

16:40 : Invited talk**Effect Of Top Metallic Contacts On Energy Conversion Performances For Near-field Thermophotovoltaics****Mauro Antezza***University of Montpellier (France)*

We study Effect of top metallic contacts on energy conversion performances for near-field thermophotovoltaics. We find behaviors differing substantially from those predicted by previous simplistic approaches, with significant impact on the net radiative power absorbed by the cell and, consequently, on the generated electrical power.

17:00 : Invited talk**Exploiting Radially Polarized Beams To Excite Bound States In The Continuum In Periodic Arrays Of Dipoles****Luis Cerdán¹, Juan Ramón Deop-Ruano¹, Miguel Angel Martín¹, Rosario Martínez-Herrero², Alejandro Manjavacas¹**¹*Instituto de Química Física Blas Cabrera (CSIC) (Spain), ²Universidad Complutense de Madrid (UCM) (Spain)*

The exploitation of Bound States in the Continuum (BICs) -resonant eigenmodes with infinite Q-factors- promise the implementation of novel devices for many nanophotonic applications, but they are notoriously difficult to excite from the far-field. Here, we report their efficient excitation in periodic arrays of polarizable objects using radially polarized beams.

17:20 : Invited talk**Coupling Quantum Mechanical Molecular Excitations With Localized Surface Plasmons Using Boundary Element Methods In The Time-domain****Stefano Corni***University of Padua (Italy)*

Boundary element methods are powerful numerical tools to solve Maxwell equations, also involving plasmonic nanostructures. We have developed models where such electromagnetic descriptions are coupled with a quantum mechanical description of nearby molecules, specifically in the time domain, so to disclose basic mechanisms of the time-resolved process of molecular nanoplasmonics.

17:40 : Invited talk**The Fourier Modal Method, Equipped With Adaptive Spatial Resolution, Simplified For Shallow Gratings****Brahim Guizal***Montpellier University (France)*

We present a simplification of the Fourier Modal Method equipped with Adaptive Spatial Resolution for shallow gratings. We show that it is possible to compute the S matrix by solving only one eigenvalue problem, which reduces the most expensive computational part of the algorithm.

18:00 : Invited talk**Deep Learning Based inverse Design Approach for Infrared Phonon-Polariton Microstructures: a SiC-Array Toy Model****Emmanuele Cannavò¹, Oscar K. C. Jackson², Davide Baiocco¹, Ecem Bozdogan¹, Simone De Liberato², Alessandro Tredicucci¹**¹*University of Pisa (Italy), ²University of Southampton (United Kingdom)*

We present a one-shot deep-learning approach to the inverse design of microstructures whose absorption spectra are tuned to allow the selective detection of a specific chemical species. We test the approach in a

periodic array of silicon carbide surface phonon polariton microresonators.

18:20 : Invited talk

Inverse Design And Knowledge Discovery In Nanophotonics Through Integration Of Shape Optimization And Machine Learning Algorithms

Reza Marzban, Ali Adibi

Georgia Tech (USA)

This talk is focused on a new approach for inverse design and knowledge discovery in large-scale nanostructures by combining topological optimization and machine-learning algorithms to enable the optimization of all structural and physical parameters while providing better visualization of the input-output relationship for knowledge discovery through dimensionality reduction.

16:40 - 19:00 — Veselago

Session 1A32

Optical antennas and metasurfaces: fundamentals and applications of enhanced light-matter interactions

Organized by: Guillermo Acuna, Peter Zijlstra and Hiroshi Sugimoto

Chaired by: Guillermo Acuna and Peter Zijlstra

16:40 : Invited talk

Chiral Symmetry Breaking In Chiral Crystallization On Mie-resonant Metasurface

Hiromasa Niinomi¹, Kazuhiro Gotoh², Naoki Takano¹, Miho Tagawa³, Iori Morita⁴, Akiko Onuma¹, Hiroshi Y. Yoshikawa⁵, Ryuzo Kawamura⁶, Tomoya Oshikiri¹, Masaru Nakagawa¹

¹*Institute of Multidisciplinary Research for Advanced Materials (Japan)*, ²*Niigata University (Japan)*, ³*Nagoya University (Japan)*, ⁴*Tohoku University (Japan)*, ⁵*Osaka University (Japan)*, ⁶*Saitama University (Japan)*

We found that approximately 18 % of large crystal enantiomeric excess (CEE) is observed in sodium chlorate chiral crystallization from a solution on a Mie-resonant silicon (Si) metasurface excited by circularly polarized light. Numerical analyses implied that the CEE was caused by chiral optical force acting on chiral crystalline clusters.

17:00 : Invited talk

Purcell Broadening And Lamb Shift For Dna-assembled Near-infrared Quantum Emitters

Sachin Verlekar¹, Maria Sanz-Paz², Mario Zapata-Herrera³, Mauricio Pilo-Pais², Karol Kolataj², Ruben Esteban³, Javier Aizpurua³, Guillermo Acuna², Christophe Galland¹

¹*EPFL (Switzerland)*, ²*University of Fribourg (Switzerland)*, ³*CFM-MPC San Sebastian (Spain)*

We harness the precision of DNA origami to assemble single fluorophores within plasmonic nanocavities. We observe an interplay of quantum effects, including giant Purcell broadening and pronounced Lamb shifts. These effects enable substantial spectral reshaping by redirecting the single molecule's emission into detuned near-infrared plasmonic modes.

17:20 : Invited talk

Enhanced Linear And Nonlinear Single-particle Spectroscopy Within Plasmonic Nanocavities

Femi Ojambati

University of Twente (The Netherlands)

Plasmonic nanocavities localize and enhance optical fields in sub-diffraction-limited mode volume. Here, we harness the nanocavity to reveal linear and nonlinear optical signatures of sub-10 nm particles. The beauty of our approach is that it also enables label-free spectroscopy of freely diffusing single proteins, elucidating parameters that modify the dynamics.

17:40 : Invited talk

Solving Maxwell Equations Using Polarimetry Alone

Jorge Olmos-Trigo*UCM (Spain)*

In this talk, we solve Maxwell's equations for a set of objects widely used in Nanophotonics using the Stokes parameters alone. Our method for solving Maxwell's equations endows the Stokes parameters an even more fundamental role in the electromagnetic scattering theory.

18:00 : Invited talk**Multivalency Studied At The Single Molecule Level Via Plasmon Enhanced Fluorescence****Kasper Okholm¹, Sjoerd Nooteboom², Peter Zijlstra², Duncan Sutherland¹**¹Aarhus University (Denmark), ²Eindhoven University of Technology (The Netherlands)

Plasmon enhanced fluorescence was used to allow the study of weak dynamic interactions during multivalent binding at the single molecule level at the microsecond timescale. Molecular architecture changes the interactions and here we extend the concept of effective concentration to separate effects from size and structure/flexibility.

18:20 : Invited talk**Controlling The Light Emission Of Quantum Emitters Using Plasmonic Nanoantennas****Mario Zapata-Herrera¹, José Luis Montaño-Priede², Nerea Zabala³, Rubén Esteban², Javier Aizpurua³**¹Donostia International Physics Center (Spain), ²Materials Physics Center CSIC-UPV/EHU (Spain), ³University of the Basque Country (UPV/EHU) (Spain)

We investigate light emission control from single emitters using plasmonic nanostructures. Analyzing various plasmonic configurations, we offer general insights into the enhancement of the emitted photoluminescence and other key parameters like radiative decay rates, Purcell factors and quantum yields, to guide the design of novel devices for future nanophotonic applications.

18:40 : Invited talk**Plasmonic Nanoparticles And Wgm Single-Molecule Sensing****Frank Vollmer***University of Exeter (United Kingdom)*

I will present advances in plasmonic nanorods and nanoparticle assemblies for sensing DNA and chiral molecules from monolayers to chiral shells. I will also report on plasmonic nanorods in WGM sensing, enabling detection of key biomolecules like neurotransmitters.

16:40 - 18:20 — Maxwell**Session 1A33****Symposium II: New Trends in Nanophotonics and Advanced Materials**

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Bing Li

16:40 : Invited talk**Advanced Self-powered Room-temperature Nir Plasmonic Photodetection And Reconstructive Spectroscopy****Eslam Abubakr¹, Shiro Saito², Hironori Suzuki², Tetsuo Kan¹**¹The University of Electrocommunications (Japan), ²IMRA Japan CO. (Japan)

Combining metal's plasmonic properties with the interface characteristics of a Schottky junction, we demonstrated effective broadband filter-free NIR spectroscopy. A single tunable device delivers excellent responsivity, wavelength-specific detection, and enhanced spatial resolution. Scaling down infrared spectroscopy to chip level enhances the device's adaptability for environmental monitoring and gas detection applications.

17:00 : Invited talk**Enhancing Brightness And Directional Control Of Dark Excitons Via All-dielectric Metasurfaces**

Angela Barreda¹, Sebastian Klimmer², Giancarlo Soavi², Isabelle Staude²

¹University Carlos III of Madrid (Spain), ²Friedrich Schiller University (Germany)

We investigate an all-dielectric metasurface featuring two symmetrically protected quasi-bound states in the continuum, designed to enhance both the excitation and emission of dark excitons in a tungsten diselenide monolayer. Simulations reveal a significant photoluminescence signal enhancement (~ 520) accompanied by directional emission, presenting clear advantages for optoelectronic and valleytronic applications.

17:20 : Invited talk

Mems-tunable Metasurfaces For Dynamic Vortex Beam Generation

Chuanshuo Wang¹, Chao Meng¹, Lili Gui¹, Paul C. V. Thrane², Xianglong Mei¹, Hao Chen¹, Fei Ding², Kun Xu¹, Sergey I. Bozhevolny²

¹Beijing University of Posts and Telecommunications (China), ²University of Southern Denmark (Denmark)

We present two electrically-driven MEMS-tunable metasurfaces for dynamic vortex beam generation: a single-layer optical metasurface for mode-switchable vortex lasers, and a double-layer metasurface for dynamic vortex wave plates, showcasing high mode purity and fast response at 1030 nm wavelength.

17:40 : Invited talk

Metasurface-Enhanced Single-Shot 3D Imaging for High-Precision Biological and Industrial Applications

Huijie Hao, Jian Liu, Xumin Ding

Harbin Institute of Technology (China)

We present a metasurface-enabled microscope for single-shot three-dimensional (3D) imaging, leveraging double-helix point spread function (DH-PSF) to achieve high axial localization accuracies in both 4f and 2f systems. This compact system facilitates rapid, high-precision 3D reconstruction of biological specimens and industrial samples, advancing meta-microscopy for bioimaging and semiconductor inspection.

18:00 : Invited talk

New Materials For Metaoptics From Infrared (ir) To Deep-ultraviolet (duv)

Zeng Wang

A*STAR (Singapore)

We focus on cavity-enhanced excitonic metaoptics utilizing 2D materials for visible and IR applications, showcasing significant advancements in tunability, absorption enhancement, and excitonic effect control. Additionally, we demonstrate the use of aluminum nitride (AlN) for DUV metaoptics, highlighting its suitability for applications in this challenging spectral regime.

16:40 - 18:10 — Fresnel

Session 1A34

Plasmonics and Nanophotonics: Fundamentals and Applications

Organized by: Hong Wei

Chaired by: Hairong Zheng

16:40 : Invited talk

Strong Coupling With Excitons And One-dimensional Photonic Crystal Modulated Plasmonic Nanocavities

Xiulai Xu

Peking University (China)

Strong light-matter interaction with plasmonic nanocavities with challenges like Ohmic losses, low quality factor and precise emitter positioning, makes it difficult for real applications. Here, we demonstrate room-temperature strong coupling by integrating plasmonic nanostructures with 2D materials, photonic crystals, and quantum dots, resulting in reduced exciton numbers and improved stability.

17:00 : Invited talk

Plasmon-Modified Light Emission from Monolayer Semiconductors

Hong Wei

Chinese Academy of Sciences (China)

The extraordinary properties of surface plasmons in metal nanostructures make it possible to enhance and manipulate light-matter interaction at the nanoscale. In this talk, I will present our work on the interaction between plasmonic nanostructures and monolayer transition metal dichalcogenides, with the focus on the light emission properties.

17:20 : Keynote talk

Exotic Exciton Phases in Two-Dimensional Quantum Materials

Wenkai Lou, Kai Chang

Zhejiang University (China)

Exciton insulator phases has attracted intensive interests in 2D systems. We demonstrate the existence of topological exciton in InAs/GaSb quantum wells resilient to intense in-plane magnetic fields, identify conventional and novel topological exciton density waves in van der Waals systems, and propose light-engineered exciton supersolidity in heterostructures.

17:50 : Invited talk

Control Of Polaritons In Low-dimensional Nanomaterials

Xiaoxia Yang¹, Qing Dai²

¹*National Center for Nanoscience and Technology (China)*, ²*Shanghai Jiao Tong University (China)*

Our research explores the manipulation of polaritons in low-dimensional nanomaterials for efficient on-chip optoelectronic interconnects. Key advances include enhanced excitation in van der Waals materials, precise transmission control in heterostructures, and graphene-plasmonic infrared sensing, providing novel solutions for nanoscale optical manipulation and advanced sensing applications.

Wednesday 23rd July, 2025

08:30 - 09:40 — Torremolinos

Session 2A1

Plenary Session II

Chaired by: Sir John Pendry

08:30 : **Plenary talk**

Nanoplasmonic Quantum Photonics

Ortwin Hess

Trinity College Dublin (Ireland)

Nanoplasmonic quantum photonics revolutionizes quantum information technologies by enabling room-temperature quantum operations through extreme nanoscale field confinement and strong photon-emitter coupling. This facilitates ultrafast single-photon emission, multipartite entanglement, near-field coupling, and quantum sensing, enhanced by quantum nanoplasmonic coherent perfect absorption, paving the way for practical quantum devices operable at ambient conditions.

09:05 : **Plenary talk**

What I Wish I Had Known, as I Searched for the First 3d Photonic Bandgap

Eli Yablonovitch

UC Berkeley (USA)

The first 3-dimensional Photonic Bandgap was found by Edison-ian search, trial-and-error, guided by physical intuition. The 4-year search was beset by pseudo-gaps, and required deep physical insights to find the right geometry (diamond unit cell in a face-centered-cubic lattice). Nonetheless, there do exist mathematical techniques for 3d geometry optimization that could have led to the right structure more quickly.

Coffee Break

Session 2P1

Poster session III

9:40 - 10:20

P1: Energy And Momentum Distribution Of Surface Plasmon-induced Hot Carriers

Christopher Weiß¹, Tobias Eul², Eva Prinz¹, Benjamin Stadtmüller³, Martin Aeschlimann¹

¹University of Kaiserslautern-Landau (Germany), ²University of Kiel (Germany), ³University of Augsburg (Germany)

Spectroscopic differences between photoexcited and surface plasmon polariton-induced hot electrons reveal distinct energy and momentum distributions. Time-resolved photoemission electron spectroscopy captures their dynamics in real- and momentum-space, enabling a clear separation of both carrier types. These results provide new insights into plasmonic energy conversion and hot electron generation.

P2: Vibration And Sound Radiation Reduction By Meta-plate With Rainbow Reflection Effect

Feng Liu, Yan-Feng Wang, Yue-Sheng Wang

Tianjin University (China)

A meta-plate with a rainbow reflection effect is proposed to suppress vibration and sound radiation. Results show significant broadband suppression with extremely low structural damping. The suppression mechanism is attributed to vibration redistribution and systematic reduction, driven by the slowing-down velocity and energy enhancement effects of the rainbow reflection phenomenon.

P3: Learning Higher-order Interactions With Factorization Machine For Material Design**Sanghyo Hwang¹, Chaeyoung Park¹, Seongmin Kim², Tengfei Luo³, Eungkyu Lee⁴**¹Kyunghee University (Korea), ²Oak Ridge National Laboratory (USA), ³University of Notre Dame (USA),⁴Kyung Hee University (Korea)

Factorization Machine (FM) has been used for effectively designing optical systems, it is limited in expressing complex systems. To overcome this limitation, we propose higher-order factorization machine (HOFM). Compared to FM, HOFM predict more accurately than FM and find better optimal structures in optical systems.

P4: Super-resolution Imaging Using Photonic Nanojet Generated By A Cylinder**Maya Shor Peled, Alina Karabchevsky***Ben Gurion University of the Negev (Israel)*

We present a sub-diffraction limit imaging approach using the Photonic Nanojet (PNJ) effect in tapered fibers. By analyzing the PNJ generated by upright dielectric cylinders, we achieve extended working distances without compromising resolution. This label-free method enables non-invasive nanoscale imaging, offering new possibilities for biological and material science applications.

P5: Mechanism And Demonstration Of Interference And Multi-port Switching In Silicon Topological Photonics**Xing-Xiang Wang¹, Sho Okada², Towa Maekawa¹, Liyan Hu¹, Xiao Hu¹, Tomohiro Amemiya¹**¹Institute of Science Tokyo (Japan), ²National Institute of Information and Communications Technology (Japan)

We demonstrate the principle of manipulating topological states towards a multi-port interferometric switch, leveraging the geometric phase degree of freedom in a silicon photonics platform with Dirac-type dispersions.

P6: The Generation Of Two Distinct Berry Phases On The Surface Of A Twisted Triangular Möbius Cavity Resonator**Emma Paterson, Michael Tobar, Maxim Goryachev, Jeremy Bourhill***University of Western Australia (Australia)*

We present the observation of distinct Berry phases ($\Pi = \pm 2\pi/3$) on the surface of a microwave Möbius cavity resonator supporting the TE₁₀ mode. These phases arise from self-interference-induced helicity H . This resonator consists of a twisted, hollow equilateral triangular prism with mirror asymmetry, bent around on itself to form a ring.

P7: Real-time Manipulation Of Spoof Surface Acoustic Waves Via A Reconfigurable Coding Metasurface**Haoxiang Li, Jie Hu***Nanjing Forestry University (China)*

In this paper, we design a tunable acoustic metasurface composed of Helmholtz-resonator-like digital-coding meta-atoms to realize the dynamic manipulation of spoof surface acoustic waves (SSAWs). By mechanically adjusting the resonator depth, we demonstrate a multifunctional and adaptive wavefront manipulation including acoustic focusing and Airy beam's generation.

P8: Enhancement Of Light-matter Interaction In Topological Waveguides And Resonators**Michael Brauckmann, E. Narvaez Castaneda, D. Siebert, B. Brecht, J. Forstner, T. Zentgraf***Paderborn University (Germany)*

The quantum valley Hall effect is used to arrange different topological areas with specific topological properties and customize waveguides and resonators to study enhanced light-matter interactions.

P9: Optical Characterization Of Periodic Subwavelength Structures Composed Of Polycyclic Aromatic Hydrocarbons**Ken Morita¹, Hiromi Okamoto², Kohei Imura¹**¹Waseda University (Japan), ²Institute for Molecular Science (Japan)

Perylene crystals were irradiated by electron-beam to induce chemical reactions. Mass spectrum shows oligomerization of the molecules. Raman spectroscopic analysis of the product indicates that dimers are produced. Periodic subwavelength structure was fabricated on perylene crystals. Scattering spectrum of the structure shows a peak originated from the diffraction effect.

P10: Design Principle And Application Exploration Of Water-to-air Vibroacoustic Metasurfaces**Hong-Tao Zhou, Yan-Feng Wang, Yue-Sheng Wang***Tianjin University (China)*

We propose and experimentally validate the concept of a vibroacoustic metasurface to enhance sound transmission across the water-air interface. Furthermore, we explore the potential application of encapsulating airborne loudspeakers with optimized vibroacoustic metasurfaces to function as sound sources underwater.

P11: Multiphysics Calculation Of Plasmonic Photothermal Effects In Gold Nanorod Dimers: Influence Of Size Mismatch**Tong Zhou, Maria Vanessa Balois-Oguchi, Kotaro Kajikawa***Institute of Tokyo Science (Japan)*

This study investigates the optical and photothermal behavior of gold nanorod dimers using finite element method. Our findings highlight the anti-correlation between near-field enhancement and photothermal efficiency resulting from size mismatch in gold nanorod dimers, providing valuable insights for optimizing the nanostructure design in plasmonic applications.

P12: Observation Of Oriented Landau Levels And Helical Zero Modes In Berry Dipole Acoustic Crystals**Qingyang Mo¹, Riyi Zheng², Cuicui Lu¹, Xueqin Huang², Zhengyou Liu³, Shuang Zhang¹**¹ *The University of Hong Kong (Hong Kong)*, ² *South China University of Technology (China)*, ³ *Wuhan University (China)*

We experimentally demonstrate unconventional oriented Landau levels in acoustic Berry dipole systems, wherein by reversing the orientation of the pseudomagnetic field, the system exhibits distinct Landau spectra. Remarkably, we observe a new type of helical zero modes whose existence critically depends on the magnetic field's orientation.

P13: Optimized bilayer meta-substrate for hyper-sensitive strain monitoring**Jae-Hwan Lee¹, Junsang Lee², Seung-Kyun Kang¹**¹ *Seoul National University (Korea)*, ² *Purdue University (USA)*

We present an optimized bilayer meta-substrate for hyper-sensitive strain sensing, achieving a near-ideal Poisson's ratio of -1. By tuning the geometrical factors of auxetic structures, we maximize gauge factor performance beyond conventional designs. Experimental validation confirms enhanced sensitivity, demonstrating the potential for precision biomechanical monitoring and next-generation flexible sensors.

P14: Ito-based Heterostructures Toward Tunable Windows And Radiative Cooling**Ermes Peci¹, Marangi Fabio², Emma Spotorno¹, Scotognella Francesco², Maurizio Canepa¹, Francesco Bisio³, Michele Magnozzi¹**¹ *Università di Genova (Italy)*, ² *Politecnico di Torino (Italy)*, ³ *CNR-SPIN (Italy)*

Solution-processed ITO-based thin films and heterostructures are investigated by spectroscopic ellipsometry for application as metamaterials in the visible and near-infrared spectral ranges. Effective medium approximations are used to assess their optical and structural properties, optimizing their design for smart windows. This study advances active photonic crystals for on-demand photonic devices.

P15: Integration Of Single-defect Carbon Nanotube Photon Sources Into Waveguide Circuits For Quantum Applications**Clement Deleau¹, Chee Fai Fong¹, Finn L. Sebastian², Jana Zaumseil², Yuichiro Kato¹**¹ *RIKEN (Japan)*, ² *Universität Heidelberg (Germany)*

In this research, functionalized carbon nanotube single photon emitters are implemented in waveguide circuits for the development of chip-integrated quantum photonic applications at room temperature. Carbon nanotubes are drop-coated or deterministically positioned on waveguide cavities after which autocorrelation study and photoluminescence spectra demonstrate both single photon propagation and cavity enhancement.

P16: Dynamic Control Of Bound States In The Continuum By Mems-enabled Hybridization Of 1d And 2d Metasurfaces**Fedor Kovalev¹, Mariusz Martyniuk¹, Andrey Miroshnichenko², Ilya Shadrivov¹**¹ *The Australian National University (Australia)*, ² *University of New South Wales Canberra (Australia)*

We propose a tunable metasurface composed of coupled 1D and 2D metasurfaces. Our study demonstrates

that this hybrid structure supports an ultranarrow quasi-BIC resonance, which can be tuned over 60 nm while maintaining a constant quality factor. This tuning is achieved through MEMS-enabled horizontal and vertical displacements within the structure.

P17: Transport Properties Of Coupled-resonator Phononic Graphene Ribbons

Rafael Méndez-Sánchez, Yael Hernández-Espinosa, Edgar Sotelo-Parra, Angel M. Martínez-Argüello
Universidad Nacional Autónoma de México (Mexico)

We study the transport properties of honeycomb-like elastic ribbons composed of resonators and finite phononic crystals called coupled resonator phononic waveguides. Spectra for ribbons with zigzag and armchair edges were obtained for various ribbon widths. Although zigzag ribbons are gapless, armchair ribbons display a gap depending on the ribbon width.

P18: Optimization Of Symmetric Disordered Metastructures For Near-perfect Broadband Transmission

Zhazira Zhumabay¹, Clement Ferise¹, Vincent Pagneux², Stefan Rotter³, Matthieu Davy¹

¹ IETR (France), ² Université du Maine (France), ³ Vienna University of Technology (Austria)

We leverage the symmetry of optimized disorders to enable near-perfect broadband transmission. Utilizing coupled dipole approximation, we strategically position dielectric and metallic cylinders within multimode waveguides to realize reflectionless exceptional points, broadband single-mode transmission, and near-perfect transmission around a barrier. Numerical results are verified with measurements in the microwave range.

P19: Tailoring The Design Space Of Structurally Colored Stretchable Materials

Bilel Abdennadher¹, Matthias Saba¹, Ullrich Steiner¹, Mathias Kolle²

¹ Adolphe Merkle Institute (Switzerland), ² MIT (USA)

Large scale-structural colored stretchable material was recently developed. We aim to parametrize its design space using two surface roughness parameters: the autocorrelation length and the Root Mean Square. By tuning roughness, we control diffuse and specular scattering, enhancing light diffusion and minimizing iridescence for improved sensing applications.

P20: Nanocomposite Materials For Biosensors Made By A Dual Pulsed Laser Source

Manon Gireau¹, Fusheng Du², Joelle Youssef¹, Georges Humbert¹, Shuwen Zeng², Corinne Champeaux¹, Frédéric Dumas-Bouchiat¹

¹ Université de Limoges (France), ² Université de Troyes (France)

Nanomaterials with complex architectures were engineered using a dual pulsed laser source. Silver nanoparticles embedded in aluminum oxide thin films exhibit concentration-dependent maximum absorption, shifting from 432 nm at 2 % vol. to 465 nm at 8 % vol. Their integration with gold unlocks promising applications for sensing.

P21: Nonlinear Enhancement From Epsilon-near-zero Material-based Metasurface structure

Shakti Mahato, Vipul Rastogi

IIT Roorkee (India)

We numerically investigate nonlinear responses produced by Epsilon-near-zero (ENZ) material-based metasurface structure. Here we show that our proposed structure can produce a large nonlinear response with the change in refractive index, Δn , exceeding 2 near the ENZ wavelength range, even at very low pump fluence in the near-infrared spectral range.

P22: Thermal Dissipation In Pillar-based Optomechanical Resonators: Comparing Monolithic Silicon And Hybrid Silicon-silicon Dioxide Nanopillars

Víctor González Morote¹, David Alonso-Tomás¹, Martín Poblet¹, Néstor Eduardo Capuj², Albert Romano-Rodríguez¹, Daniel Navarro-Urrios¹

¹ Universitat de Barcelona (Spain), ² Universidad de La Laguna (Spain)

We study thermal dissipation in pillar-based optomechanical crystal geometries with monolithic silicon and hybrid silicon/silicon dioxide nanopillars. Finite-element simulations and a pump-probe technique reveal 11 MHz and 2 MHz thermal relaxation rates for monolithic and hybrid nanopillars, respectively, enabling accurate calibration of thermal effects in photonic crystal for force sensing applications.

P23: Technology Of Formation And New Areas Of Application Of Composite Metastructures Based

On Aluminum Oxide**Ekaterina Muratova, Dmitry Kozodaev, Anton Bobkov, Maxim Mesh, Vyacheslav Moshnikov***NT-MDT BV (The Netherlands)*

A systematic ordering of the main technological parameters determining the formation of porous membranes based on alumina by electrochemical anodizing of aluminum foil with parameters of pore of nanoscale sizes is carried out. The paper considers new areas of application of composite metastructures based on aluminum oxide.

P24: Strong Near-field Enhancement Through Sphp And Lsp Coupling On Cdo Gratings**Pablo Ibáñez Romero¹, Maria Villanueva Blanco¹, Eduardo Martinez Castellano¹, Javier Yeste², Fernando Gonzalez-Posada³, Vicente Muñoz-Sanjosé², Thierry Taliercio³, Miguel Montes Bajo¹, Adrian Hierro¹**¹ *Universidad Politécnica de Madrid (Spain)*, ² *Universitat de València (Spain)*, ³ *Montpellier University (France)*

The coupling between plasmonic modes and phonons enables new approaches for tailoring optical properties and controlling light at the nanometer scale. Here, we demonstrate the dramatic amplification of the near-field driven by the coupling of sapphire's localized surface phonon polaritons and localized surface plasmons in CdO gratings.

P25: Phononic Hyperbolic Metamaterial With ZnO/(zn,mg)o Heterostructures**Julia Inglés Cerrillo¹, Pablo Ibáñez Romero¹, Rajveer Fandan¹, Jorge Pedrós¹, Nolwenn Le Biavan², Denis Lefebvre², Maxime Hugues², Jean-Michel Chauveau², Miguel Montes¹, Adrián Hierro¹**¹ *Universidad Politécnica de Madrid (Spain)*, ² *Université Côte d'Azur (France)*

We design a phonon-driven negative index metamaterial (NIM) using ZnO/(Zn,Mg)O heterostructures, demonstrating tunable hyperbolic behaviour via Mg content and layer thicknesses. Experimentally, we achieve type I hyperbolic dispersion in four samples. Spectroscopic characterization and calculations of modes dispersion and isofrequency curves confirm the negative frequency dispersion.

P26: Designing Impedances Surfaces For Simultaneous Anomalous Reflection And Polarisation Conversion**Jonathon Smith¹, Calvin Hooper¹, Nathan Clow², Alastair Hibbins¹, Ian Hooper¹, Simon Horsley¹**¹ *University of Exeter (United Kingdom)*, ² *Defence Science and Technology Laboratory (United Kingdom)*

We present a method for deriving the tensorial impedance distributions required for arbitrary anomalous reflections, with polarisation conversion. We demonstrate this by converting a normally incident Transverse Magnetic polarised plane wave into a 30° anomalously reflected plane wave that is also polarisation converted to both Transverse Electric and Circular polarisations.

P27: Theoretical Analysis Of Recoil Force Generated By Stimulated Emission Of Higher-order Optical Vortices**Yoshiki Umekawa, Takao Horai, Masaaki Ashida, Hajime Ishihara***Osaka University (Japan)*

The mechanical recoil force generated in a material by stimulated emission occurs in the direction opposite to the propagation of light. In this study, we theoretically elucidate the rotational motion of nanoparticles induced by recoil force from higher-order optical vortices, considering nonlinear optical responses.

P28: Plasmon-enhanced Circular Dichroism For Chiral Drugs Enantiomeric Discrimination**Matteo Venturi¹, Raju Adhikary¹, Ambaresh Sahoo¹, Carino Ferrante², Matteo Silvestri¹, Giovanna Salvitti¹, Davide Tedeschi¹, Isabella Daidone¹, Francesco Di Stasio³, Andrea Toma³, Francesco Tani⁴, Hatice Altug⁵, Antonio Mecozzi¹, Massimiliano Aschi¹, Andrea Marini¹**¹ *University of L'Aquila (Italy)*, ² *CNR-SPIN (Italy)*, ³ *Istituto Italiano di Tecnologia (Italy)*, ⁴ *Max Planck Institute (Germany)*, ⁵ *EPFL (Switzerland)*

This paper focuses on the surface plasmon polaritons potential at noble metals interface for enhancing chiroptical sensing of dilute chiral drug solutions. Circular dichroism is amplified by plasmonic resonances in a nano-scale drug volumes, showing relevant results for sensitive analysis of solvated repaxin, enabling advanced chiroptical sensor development.

P29: Plasmonic Metasurfaces As Solar Absorption Enhancers For The Perovskite Thin Film Solar Cells

Sergii Mamykin¹, Iryna Mamontova¹, Roman Redko¹, Olexandr Shtykalo¹, Tetiana Lunko¹, Igor Dmytruk², Oleg Yeshchenko², Oles Fedotov², Natalia Berezovska², Anatoliy Pinchuk³

¹*V.E. Lashkaryov Institute of Semiconductor Physics (Ukraine)*, ²*Taras Shevchenko National University of Kyiv (Ukraine)*, ³*University of Colorado (USA)*

Perovskite thin films are promising materials for next-generation photovoltaic technologies, but their widespread adoption is limited by stability issues and lead toxicity. This study proposes plasmonic perovskite solar cells with Au@SiO₂ core-shell nanoparticles, which enhance efficiency, reduce the active layer thickness, and improve stability under real-world conditions.

10:20 - 12:40 — Torremolinos

Session 2A2

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Wen-Di Li

10:20 : **Invited talk**

Plasmonic nanohole array for tumor cell and tissue biosensing

Alfredo Franco¹, Dolores Ortiz¹, Carlos Velásquez², Víctor García-Milán², Sara Marcos², Rubén Martín-Laez², Fernando Moreno¹, José Luis Fernández-Luna²

¹*University of Cantabria (Spain)*, ²*Hospital Universitario Marqués de Valdecilla (Spain)*

Accurate detection of single tumor cells in liquid biopsies and tumor tissues in brain is crucial for diagnostics and surgery, respectively. We present a label-free plasmonic biosensor for tumor discrimination in complex biological samples, based on the extraordinary optical transmission from nanoholes arrays in gold films.

10:40 : **Invited talk**

Wavefront Engineering Of Microcavity-empowered Multi-resonant Metasurfaces

Shih-Hsiu Huang¹, Hsiu-Ping Su¹, Zijin Yang², Yuzhi Shi³, Qinghua Song², Pin Chieh Wu¹

¹*National Cheng Kung University (Taiwan)*, ²*Tsinghua University (China)*, ³*Tongji University (China)*

We report a microcavity-assisted metasurface with a gradient-thickness DBR substrate that achieves 15 high-Q resonances across the visible to NIR spectrum, enabling efficient amplitude and phase modulation for advanced optical control.

11:00 : **Invited talk**

Reconfigurable Plasmonics Enabled by Phase Change Materials

Yael Gutierrez¹, Gonzalo Santos¹, Capucine Laprais², Lofti Berguiga², Saul Vazquez Miranda³, Mateusz Rebarz³, Shirley Espinoza³, Sebastien Cuffe², Maria Losurdo⁴

¹*Universidad de Cantabria (Spain)*, ²*Université Lyon (France)*, ³*ELI Beamlines (Czech Republic)*, ⁴*CNR-ICMATE (Italy)*

The dynamic tunability of the optical response in plasmonic systems through optical, mechanical, and electrical stimuli is pivotal for advancing reconfigurable nanophotonic applications. In this work, we present an innovative approach to achieve tunable plasmonic properties using ultrafast laser pulses by integrating phase-change materials (PCMs) with plasmonic nanostructures.

11:20 : **Invited talk**

Material Aspects For Ultra-stable Laser Interferometers

Nico Wagner¹, Bess Fang², Sebastian Häfner¹, Michael Hartman², Michael Jetter³, Thomas Legero⁴, Mateusz Naroznik⁵, Michael Zimmer³, Stefanie Kroker¹

¹*Technische Universität Braunschweig (Germany)*, ²*Université PSL (France)*, ³*Universität Stuttgart (Germany)*, ⁴*Physikalisch-Technische Bundesanstalt (Germany)*, ⁵*Nicolaus Copernicus University (Poland)*

We present an overview of state-of-the-art materials for ultra-stable laser interferometers, focusing on thermal noise in various components. Investigated materials include NEXCERA for spacers, GaAs for highly reflective

mirrors, metamirrors for ultra-low noise mirrors, and Eu³⁺:Y₂SiO₅ for spectral-hole burning experiments.

11:40 : Invited talk

Freestanding Ultra-thin Bic Membrane Metasurface For High-q Surface Emission In The Visible

Chih-Zong Deng, Ya-Lun Ho

National Institute for Materials Science (Japan)

The freestanding dielectric membrane metasurface, with a thickness of 36 nm, has been demonstrated to achieve a bound state in the continuum (BIC) mode, exhibiting spontaneous emission with a high Q-factor over 2037 in the visible regime.

12:00 : Invited talk

Engineered Single-photon Emitters In Materials For Integrated Quantum Photonics

Alexander Senichev, Zachariah O. Martin, Samuel Peana, Pranshu Maan, Artem Kryvobok, Demid Sychev, Alexei S. Lagutchev, Alexandra Boltasseva, Vladimir M. Shalaev

Purdue University (USA)

We report our progress on single-photon emitters in materials for integrated quantum photonics, focusing on silicon nitride (SiN) and aluminum nitride (AlN) photonic platforms. We study emitter characteristics, defect origins, and site-controlled fabrication. We also discuss coupling emitters with resonant nanostructures to enhance emission efficiency.

12:20 : Invited talk

Recognition of Shiga Toxins by Plasmonic SERS Metasurface PCA Assisted

Massimo Rippa¹, Alessia Milano¹, Valentina Marchesano¹, Domenico Sagnelli¹, Bryan Guilcapi¹, Amalia D'Avino¹, Maurizio Brigotti², Stefano Morabito³, Joseph Zyss⁴, Lucia Petti¹

¹*Institute of Applied Sciences and Intelligent Systems .E. Caianiello CNR (Italy)*, ²*Università di Bologna (Italy)*,

³*Istituto Superiore di Sanita (Italy)*, ⁴*Université Paris Saclay (France)*

A plasmonic biosensor based on a nanopatterned metasurface is presented for recognition and differentiation of Shiga toxins (Stx1a, Stx2a, Stx2a-cl). Using Surface-Enhanced Raman Spectroscopy (SERS) and principal component analysis (PCA), the system enables highly sensitive, label free identification, offering a promising tool for improved diagnostic of STEC infections.

10:20 - 12:30 — Alamos

Session 2A3

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jerome Plain, Alexander Govorov, Davy Gerard and Pedro Hernandez Martinez

Chaired by: Davy Gerard

10:20 : Invited talk

Rhodium Nanospheres For Expanding Plasmonic Applications With Uv And Visible Light

Vincenzo Amendola

University of Padova (Italy)

Rhodium nanospheres synthesized via laser ablation in liquid address the UV plasmonic gap left by gold and silver and can be easily functionalized with thiols. The spherical morphology enables UV-visible optical sensing and benchmarking with classical electrodynamic models. Rh stability at high temperature and against acids outperforms Au and Ag.

10:40 : Invited talk

Hybrid Tmdc/plasmonic Systems

Ernes Peci¹, Emma Spotorno¹, Michele Magnozzi¹, Lorenzo Ramò¹, Valentina Venturino¹, Maria Caterina Giordano¹, Maurizio Canepa¹, Francesco Bisio²

¹ *Università degli Studi di Genova (Italy)*, ² *CNR-SPIN (Italy)*

We discuss the fabrication and the exploitation of hybrid systems composed by plasmonic optical resonators coupled with 2D materials. We provide examples of TMDC transfer onto plasmonic nanostructures and of nanofabrication of plasmonic systems on top of TMDC layers. Different applications are discussed.

11:00 : Invited talk

Statistical Evaluation And Dipole Determination By Polarimetric Spectroscopy Yielding The Orientation Of Gold Nanorods

P. Christian Simo, Annika Mildner, Michaela Zbytovska, Dieter P. Kern, Monika Fleischer

University of Tübingen (Germany)

Within just four measurements the presented technique acquires the azimuthal orientation of gold nanorods of various aspect ratios. An analytical dipole model in tandem with dark-field spectroscopy enables the extraction of phase shift information to determine the azimuthal orientations.

11:20 : Invited talk

Collective Behavior Of A Plasmonic Particle Array With A Chiral Arrangement Under Modal Coupling Regime

Tomoya Oshikiri

Tohoku University (Japan)

We fabricated a cluster of isotropic gold nanodisks with a chiral arrangement on the Fabry-Pérot (FP) nanocavities of TiO₂/Au film. We demonstrate that collective mode formation under modal coupling regime between localized surface plasmon resonances with a chiral arrangement and Fabry-Pérot (FP) nanocavity modes can induce chiroptical responses.

11:40 : Invited talk

Photocatalysis And Local Growth Driven By Plasmonic Hot Electrons

Eva Yazmin Santiago

Universidade de Vigo (Spain)

This study explains a phenomenon intrinsic to plasmonic nanomaterials: the efficient generation of hot carriers on their surface that drive secondary processes, such as photocatalysis. This can lead to a photogrowth process that constructs nanostructures with a controlled and asymmetric optical response that depends on the incident light polarization.

12:00 : Keynote talk

Hybrid Plasmonic Nanosystems Based On Weak And Strong Coupling

Minyu Chen¹, Yuqing Zhao¹, Sylvie Marguet², Safi Jradi¹, Ali Issa¹, Anne Laure Baudrion¹, Jerome Plain¹, Christophe Couteau¹, Cuong Dang³, Alexander Govorov⁴, Renaud Bachelot¹

¹ *UTT (France)*, ² *Université Paris Saclay (France)*, ³ *Nanyang Technological University (Singapore)*, ⁴ *Ohio University (USA)*

Hybrid plasmonic nanosystems based on weak or strong coupling are discussed in terms of controlling the spatial distribution, and associated symmetry, of the active medium in the vicinity of the metallic nanocavities.

10:20 - 12:40 — Playamar

Session 2A4

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Eugene Kamenetskii

10:20 : Invited talk

One-Way Transparency At Custom Wavelengths Via A Layered Magnetoelectric Window

Artem Kuzmenko¹, Alexander Mukhin¹, Alexey Shuvaev², Andrei Pimenov², David Szaller³

¹*Prokhorov General Physics Institute-Russian Academy of Sciences (Russia)*, ²*TU Wien (Austria)*, ³*Budapest University of Technology and Economics (Hungary)*

We demonstrate one-way transparency in a tunable artificial structure of split-ring metamaterial and magnetic substrate, overcoming the temperature and resonance limits of multiferroic crystals. This approach enables controllable non-reciprocal light propagation, paving the way for practical applications.

10:40 : Invited talk

Skyrmion Hall Effect In Altermagnets

Zhejunyu Jin, Zhaozhuo Zeng, Yunshan Cao, Peng Yan

UESTC (China)

It is widely believed that the skyrmion Hall effect is absent in antiferromagnets because of the vanishing topological charge. However, the Aharonov-Casher theory indicates the possibility of topological effects for neutral particles. Here, we predict the skyrmion Hall effect in emerging altermagnets with zero net magnetization and zero skyrmion charge.

11:00 : Invited talk

Optically And Magnetically Responsive Metamaterial Capsules For Drug Delivery

Pavel Ginzburg

Tel Aviv University (Israel)

Nanoparticles, with their ability to integrate multiple biomedical modalities, are among the most promising candidates for developing electromagnetically-responsive theranostic carriers. We present the concept of a metamaterial drug delivery capsule based on golden and magnetized vaterite, highlighting its distinct advantages in the emerging field of light-activated theranostics.

11:20 : Invited talk

Microwave Coherent Storage Based On The Long Lifetime Cavity Electromechanical System

Tiefu Li

Tsinghua University (China)

We demonstrate coherent microwave signal storage in a cavity electromechanical system. 55ms storage time has been experimentally realized. This result shows potential of cavity electromechanical systems with high-quality factors for the application in quantum storage devices for quantum computers.

11:40 : Invited talk

A Multiscale Approach To Molecular Nanoplasmonics: From SERS To Chiroptical Spectroscopies

Tommaso Giovannini

University of Rome Tor Vergata (Italy)

We present a multiscale approach combining a fully atomistic approach to nanoplasmonics and quantum mechanics to model plasmon-enhanced spectroscopies, from SERS to chiroptical response.

12:00 : Invited talk

Excitations And Light-matter Interactions In Polar Topologies

Suyash Rijal, Yousra Nahas, Sergei Prokhorenko, Laurent Bellaiche

University of Arkansas (USA)

Polar topological textures such as polar vortices, bubbles and skyrmions, are swirling patterns of electric polarization spontaneously emerging in ultra-thin ferroelectrics. Here, we explore lattice excitations giving rise to polar textures and novel phenomena entailed by non-linear interactions of such excitations with IR light in ultra-thin Pb(Zr,Ti)O₃ films.

12:20 : Invited talk

Spin Current Generation Due To Differential Rotation

Mamoru Matsuo

University of Chinese Academy of Sciences (China)

We theoretically investigate nonequilibrium spin dynamics in differentially rotating systems, deriving an effective Hamiltonian for conduction electrons in the comoving frame. In contrast to conventional spin current generation mechanisms that rely on vorticity, our theory reveals spins and spin currents arising from differentially rotating systems regardless of vorticity-gradient.

10:20 - 12:40 — Bajondillo**Session 2A5****Symposium III: Advanced passive and active metasurfaces and zero-index materials**

Organized by: Howard Lee, Pin-Chieh Wu and Wen-Hui (Sophia) Cheng

Chaired by: Howard Lee and Pin-Chieh Wu

10:20 : Invited talk**Symmetry-breaking And Disorder-assisted Bound States In The Continuum****Qinghua Song***Tsinghua Shenzhen International Graduate School (China)*

In this talk, we discuss recent advances in metasurface singularities based on bound states in the continuum (BICs). We show that BICs with arbitrary polarization can be achieved using a bilayer twisted metasurface. Introducing magnetic materials enables robust circular polarization generation, and structural disorders facilitate real-momentum duality control.

10:40 : Invited talk**Metasurface for Bioimaging and Thermal Radiation Management****Guangwei Hu***NTU (Singapore)*

In this talk, I will discuss our efforts on dispersive metasurfaces for two applications: passive metasurface with advanced bio-imaging that can simultaneously capture and process the bioimages and active metasurface for the thermal camouflage compatible with radiative dissipation channels.

11:00 : Invited talk**Multi-polar High Quality Factor Metasurfaces****Mark Lawrence, Bo Zhao, Shuqin Dai, Samuel Ameyaw, Lin Lin***Washington University in St. Louis (USA)*

Highly resonant phase gradient metasurfaces represent an exciting development for nonlinear and programmable wave shaping, but simultaneous access to spatial, spectral and polarization multiplexing remains limited. Here, we introduce multi-mode high-Q metasurfaces for multi-functional image processing, including multiband and cross-color image thresholding, polarization independent narrowband wave-shaping, and high dimensional color-polarizers.

11:20 : Keynote talk**Space-time Metamaterials****Andrea Alu***City University of New York (USA)*

In this talk, I will discuss my group's recent work in the area of space-time metamaterials, with an emphasis on the use of abrupt time switching and spatio-temporal modulation patterns for efficient frequency translation and energy manipulation.

11:50 : Tunable focus manipulation in multicore meta-fibers through 3D nanoprinted phase-only holograms**Mohammadhossein Khosravi, Torsten Wieduwilt, Matthias Zeisberger, Adrian Lorenz, Markus Schmidt***Leibniz Institute of Photonic Technology (Germany)*

This study presents a novel method for remote focus control in multicore meta-fibers using 3D nanoprinted phase-only holograms. By integrating computationally designed holograms onto single-mode multicore fibers, we achieve precise, crosstalk-free focus manipulation at visible wavelengths. This innovation enhances applications in optics, telecommunications, laser micromachining, and biomedical imaging.

12:05 : Invited talk

Shaping Photon Emission With Emitter-coupled Metasurfaces**Fei Ding***University of Southern Denmark (Denmark)*

We propose general approaches to designing versatile photon sources using on-chip QE-coupled meta-optics that enable direct transformations of QE-excited surface plasmon polaritons into spatially propagating photon streams with arbitrary polarization states, directionality, and amplitudes via designed metasurfaces.

12:25 : Dynamic Multi-Wavelength Coded Aperture Imaging Using Reconfigurable Metasurfaces**Reza Marzban, Hamed Abiri, Ali Adibi***Georgia Institute of Technology (USA)*

We present a reconfigurable coded-aperture imaging platform that harnesses the phase-transition properties of vanadium dioxide integrated with wavelength-selective metasurfaces in the near-infrared wavelength range. Each metasurface pixel is designed for a specific resonant wavelength, allowing the device to generate a spatio-temporal code to improve the imaging performance.

10:20 - 12:45 — Carihuela**Session 2A6****Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals**

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and Noé Jiménez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

10:20 : Keynote talk**Modulating Optical Properties In Time Using Plasmonic Resonances****John Pendry***Imperial College London (United Kingdom)*

Plasmonic effects in Indium Tin Oxide enable rapid switching of transparency which can be exploited to modulate THz radiation on a fs time scale.

10:50 : Invited talk**Time-resolved two-dimensional imaging of GHz acoustic waves in phononic crystals and metamaterials****Osamu Matsuda***Hokkaido University (Japan)*

The all optical time-resolved two-dimensional imaging of GHz surface acoustic waves is efficient to study the GHz acoustic properties of media. Here the principle of the technique is explained briefly, and some applications of the technique to micron-scale phononic crystals and metamaterials are shown.

11:10 : Invited talk**Surface acoustic waves-driven magnon spin Hall effect in atomically thin van der Waals antiferromagnets****Ryotaro Sano¹, Yuya Ominato², Mamoru Matsuo³**¹Kyoto University (Japan), ²Waseda University (Japan), ³University of Chinese Academy of Sciences (China)

Van der Waals antiferromagnets have lacked comprehensive tools for probing their intricate magnetic properties. We propose surface acoustic wave-driven intrinsic magnon spin Hall currents to mechanically detect and manipulate magnetic order in two-dimensional antiferromagnets. This innovative method overcomes weak magnetic responses, offering a promising foundation for future antiferromagnetic spintronics.

11:30 : Invited talk**Spectral Methods For Designing Quasiperiodic Metamaterials****Bryn Davies**

University of Warwick (United Kingdom)

Quasiperiodic metamaterials hold significant potential to unlock novel phenomena. We present convergence analyses of popular methods to approximate their spectra (superspace and supercell methods) and show how they can be used to design new metamaterials.

11:50 : Invited talk

Tunable Phonon-electron Fano Resonance In Si Nanoparticles Via Electromagnetic Confinement And Anharmonic Decay In Engineered Media

Michel Kazan

American University of Beirut (Lebanon)

We introduce strategies for modulating phonon-electron Fano resonance in silicon nanoparticles through a designed nanoparticle environment. By leveraging prolonged laser irradiation and electromagnetic field confinement, the resonance can be enhanced, whereas anharmonic phonon decay provides a mechanism for its attenuation. These findings offer new opportunities in photonics and phononics.

12:10 : Invited talk

Distinct Exceptional Points in Hermitian Phononic Laminates

Ariel Fishman, Ben Lustig, Guy Elbaz, Alan Muhafra, Venkatesh Varma, Gal Shmuel

Technion (Israel)

Breaking Hermitian symmetry creates degenerate states called exceptional points, typically requiring a challenging gain-loss material design. We exploit the unique nature of elastodynamics to obviate the need for gain or loss, enabling access to distinct exceptional points and excitation of anomalous frozen modes and negative refraction in conservative phononic laminates.

12:30 : Customized Inverse Design Of Quasi-zero-stiffness Metamaterials By Topology Optimization

Chao Ma, Kun Wu

Tianjin University (China)

This work presents an inverse design approach for metamaterials with customized quasi-zero-stiffness property. Finite element simulations and experiments are performed on the optimized topological configuration to validate the QZS feature. The proposed inverse-design methodology may pave a new way for low-frequency vibration isolation using compact single-phase solid structure without assembly.

10:20 - 12:20 — Montemar

Session 2A7

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Nir Rotenberg

10:20 : Invited talk

Engineering Complex Structured Beams With Flat Optics

Xianzhong Chen, Hammad Ahmed, Chunmei Zhang

Heriot-Watt University (United Kingdom)

We experimentally demonstrated novel compact optical devices to generate complex structured beams without relying on the complicated optical setup and realize their multifaceted control. The unprecedented design degree of freedom of optical metasurfaces has provided a compact platform to develop ultrathin optical devices for generating complex structured beams.

10:40 : Invited talk

Investigate the Growth of (multi)metallic nanoparticles Synthesized by physical vapor deposition

Julien Ramade, Maël Costes, Sophie Camelio, Sophie Rousselet, Frederic Pailloux, Marc Marteau, Kevin Dusallant, David Babonneau

Institut PPRIME (France)

We investigate the growth dynamics of AuPd nanoparticles produced by electron evaporation through in situ optical spectroscopy. Our results shows that the optical response is dominated by the plasmonic properties of gold and is greatly influenced by the buffer structuring, the deposition angle and the amount of Pd in NPs.

11:00 : Invited talk

Low-loss Resonant Nonlinear Nanophotonics In The Visible Spectral Range Using Wafer-bonded Crystalline AlInP

Radoslaw Kolkowski, Seyed Ahmad Shahahmadi, Serguei Novikov, Jani Oksanen, Andreas Liapis, Huayu Bai, Timo Stolt, Matti Kaivola, Andriy Shevchenko

Aalto University (Finland)

We present AlInP as an attractive alternative to common nonlinear materials used in nanophotonic structures and devices, especially in the visible spectral range. As a demonstration, we show enhanced second-harmonic generation from nanodisks fabricated in a wafer-bonded crystalline AlInP layer.

11:20 : Invited talk

Nonlinear Optics In The Xuv Spectral Range

Luca Assogna¹, Emiliano Principi², Matteo Silvestri¹, Ambaresh Sahoo¹, Giovanni Batignani³, Giuseppe Fumero⁴, Laura Foglia², Riccardo Mincigrucci², Davide Tedeschi¹, Claudio Masciovecchio², Tullio Scopigno³, Andrea Marini¹, Carino Ferrante⁵

¹University of L'Aquila (Italy), ²Elettra-Sincrotrone (Italy), ³Università di Roma "La Sapienza"(Italy), ⁴West Virginia University (USA), ⁵Consiglio Nazionale delle Ricerche (Italy)

Nonlinear effects are fundamental in spectroscopy and ultrafast physics but are limited in the XUV regime due to weak radiation-matter interaction. By means of femtosecond free-electron laser radiation, we report the first observation of self-action nonlinear effects in the extreme ultraviolet.

11:40 : Invited talk

Chiral Semiconductor Nanophotonics

Alberto G. Curto

Ghent University and IMEC (Belgium)

Atomically thin semiconductors such as WS₂ can sustain spin-valley polarization and emit circularly polarized light. Using few-layer WS₂, we investigate the electrodynamic nature of valley-polarized emission using back focal plane imaging. We also demonstrate a Drexhage experiment to enhance and control valley-polarized emission.

12:00 : Invited talk

Permittivity-driven Ultrafast Photonic Bound States In The Continuum

Andreas Tittl

LMU Munich (Germany)

Permittivity-driven bound states in the continuum enable all-dielectric metasurfaces that overcome geometrical symmetry-breaking limits. Recent demonstrations reveal high-Q resonances with exceptional spectral control, dynamic tunability with electro-optical polymers, and all-optical generation via ultrafast pulses, enabling promising applications in adaptive photonics and high-speed modulators.

10:20 - 12:30 — Litoral

Session 2A8

Metamaterials: novel trends and applications

Organized by: Tatjana Gric

Chaired by: Tatjana Gric

10:20 : Invited talk

Hybrid Gold–vanadium-dioxide Tunable Plasmonic Devices

Vlastimil Křápek, Rostislav Řepa, Jiří Liška, Peter Kepič, Jiří Kabát, Michal Horák, Tomáš Šíkola
Brno University of Technology (Czech Republic)

The lateral arrangement of self-assembled VO₂ nanoparticles and gold nanostructures fabricated by electron beam lithography is presented as a suitable platform for hybrid tunable plasmonic devices. Two specific tunable devices are demonstrated: Electric-magnetic switches and resonance-energy switches.

10:40 : Invited talk

Van Der Waals Metamaterials For Photonics Enabled By Fib Lithography

Andreas Liapis, Xiaoqi Cui, Nianze Shang, Henri Kaaripuu, Juan Camilo Arias-Muñoz, Xu Cheng, Zhipei Sun
Aalto University (Finland)

Nanostructured multilayer 2D materials are a promising alternative to traditional bulk nonlinear materials for on-chip photonics. Here we present a universal approach for patterning such materials based on Focused-Ion-Beam lithography. We fabricate high-quality microdisk resonators and other photonic nanostructures and characterize them as a platform for linear and nonlinear optics.

11:00 : Invited talk

Nir To Visible Upconversion Luminescence From Single Rare-earth Doped Nanoparticles On Self-assembled Chiral Metasurfaces

A. Ahmed¹, K. Y. Chiok¹, S. May², A. Baride², R. B. Anderson¹, S. Zhou¹, Steve Smith¹

¹South Dakota School of Mines and Technology (USA), ²University of South Dakota (USA)

We observe circularly polarized NIR-to-visible upconversion luminescence from single β -NaYF₄:Yb³⁺:Tm³⁺ upconverting nanoparticles supported on self-assembled chiral metasurfaces. A circular-polarized luminescence microscope images the left and right circularly polarized emission. We use time-resolved single particle imaging to assess the plasmon-enhanced radiative decay and polarization of upconversion luminescence.

11:20 : Invited talk

Emerging Fabrication Technologies For All-Dielectric Periodic Metastructures

Lina Grineviciute¹, Julianija Nikitina¹, Lukas Ramalis¹, Simonas Indrisiunas¹, Kestutis Staliunas²

¹Center for Physical Sciences and Technology (Lithuania), ²ICREA (Spain)

The method for structuring and oxidizing metallic layers on glass, creating transparent oxide metasurfaces with periodic patterns, is presented. Sub-micrometer periodicity gratings are formed using laser interference patterning of tantalum layers, followed by thermal oxidation. Applications of such metamaterials in laser optics will be discussed.

11:40 : Invited talk

Aluminum Nanoparticles For Photobleaching Resistance Of Quantum Dots In Solution

Jérôme Plain, Théo Duarte, Silvère Schuermans, Thomas Lerond, Jérôme Martin, Davy Gérard, Thomas Maurer, Julien Proust

Université de Technologie de Troyes (France)

We investigated aluminum nanoparticles (2–20 nm) synthesized via ion reduction in alkane solvents. Extinction spectroscopy revealed UV-range plasmon resonances matching Mie theory. These nanoparticles enhanced quantum dot emission by 1.75_{times} and reduced photobleaching, absorbing emitted light. They hold promise as building blocks for nanophotonics and protecting emitters from degradation.

12:00 : Chalcopyrite – Noble Metal Hybrids As Catalytic Nanoscale Metamaterials With Enhanced Interfacial Excitation Transfer

Bjoern Reinhard

Boston University (USA)

Chalcopyrite (CuFeS₂) nanocrystals provide collective quasistatic resonances in the visible where they can couple with plasmonic resonances of metal nanoparticles. Hybrid chalcopyrite - noble metal nanoparticles are introduced as catalytic nanoscale metamaterials that utilize energy and charge transfer mechanisms to generate excited charge carriers and provide chemical reactivity.

12:15 : Narrow Conducting Polymer Plasmonics via Collective Lattice Resonance

Dongqing Lin, Yulong Duan, Pravallika Bandaru, Magnus Jonsson

Linköping University (Sweden)

We improve quality factors (Q) of conducting polymer plasmonics by one order of magnitude through coupling with collective lattice resonance, and such nonlocal narrow resonance allows large extinction modulation depths during dynamic switching, which puts forward a key step in smart organic metasurfaces.

10:20 - 12:40 — Manantiales

Session 2A9

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Karin Everschor-Sitte

10:20 : **Invited talk**

Photonic Crystal Information Processing Chips

Xiaoyong Hu, Kun Liao

Peking University (China)

Several topological photonic crystal chips are realized and used to photonic information processing applications. Silicon-based optical neural network chip is fabricated to perform topological state simulation functions.

10:40 : **Invited talk**

Accelerating Topological Pumps On Integrated Photonic Chips

Wange Song

Nanjing University (China)

We demonstrated the acceleration of adiabatic evolutions by leveraging the concepts of the quantum metric, adiabatic infimum, and shortcut to adiabaticity (STA), respectively. Specifically, we achieved fast topological pumping and non-Abelian braiding in integrated photonic waveguides, significantly enhancing on-chip functionality and efficiency within high-density integrations.

11:00 : **Invited talk**

Topological Photonic Devices Based On Artificial Gauge Fields

Cuicui Lu

Beijing Institute of Technology (China)

We realize on-chip topological rainbow nanophotonic devices by constructing synthetic dimensional photonic crystal. Recently, we further realize artificial gauge fields of both magnetic field and electric field, and observe different frequencies of Landau modes are localized at different positions of the photonic crystal, so we term this phenomenon "Landau rainbow".

11:20 : **Invited talk**

Arbitrarily Configurable Nonlinear Topological Modes

Duanduan Wan, Kai Bai, Meng Xiao

Wuhan University (China)

We utilize nonlinearity to deform, reshape, and design topological mode (TM) wave functions, enabling dynamically tunable, arbitrarily shaped nonlinear topological modes controlled by external intensity. The nonlinear spectral localizer is employed to characterize the topological origin of these modes.

11:40 : **Invited talk**

Edge Bound State In The Continuum On Silicon Pillar Photonic Crystal

Rodrigo Sato, Christian Vinther Bertelsen, Maxim Nikitin, Elena Lopez Aymerich, Radu Malreanu, Winnie Edith Svendsen, Andrei V. Lavrinenko, Osamu Takayama

DTU-Technical University of Denmark (Denmark)

We report the first observation of bound states in the continuum mode supported at the edge of truncated photonic crystal where the terminating row of silicon pillars has different diameter from the rest of photonic

crystal. Additionally we demonstrate the tuning of resonance by depositing nanometer thick alumina film.

12:00 : Invited talk

All-optical control and detection of broken time-reversal symmetry and topological nonlinear optics
Giancarlo Soavi

Friedrich Schiller University Jena (Germany)

I will discuss our recent experimental and theoretical efforts in the field of all-optical control and detection of broken time-reversal symmetry and topological nonlinear optics.

12:20 : Invited talk

DNA Origami Self-Assembled Diamond Lattice Photonic Crystals

Xin Yin¹, Gregor Posnjak¹, Paul Butler², Oliver Bienek², Mihir Dass², Seungwoo Lee³, Ian Sharp², Tim Liedl¹

¹LMU Munich (Germany), ²TUM Munich (Germany), ³Korea University (Korea)

We present a DNA-origami-assembled diamond lattice photonic crystal with 170 nm periodicity. Silicification and TiO₂ coating yield mechanically robust, high-index structures supporting UV-range photonic bandgaps. Optical measurements and simulations confirm tunable bandgap behavior. This bottom-up approach offers a scalable route toward programmable 3D photonic metamaterials with subwavelength precision.

10:20 - 12:40 — Veselago

Session 2A10

Symposium VI: Advanced Techniques for Computational Electromagnetics

Organized by: Maha Ben Rhouma

Chaired by: Yongmin Liu

10:20 : Invited talk

Multiphysics Topology Optimization For Optimal Photon-electron Interaction In Geometrically Tailored Quantum-well Environments

Rasmus Christiansen, Ole Sigmund

Technical University of Denmark (Denmark)

We present a multi-physics-based Topology-Optimization framework for maximizing photon-electron interaction by co-location of an electronic and an optical state, solely through tailoring of the environment geometry. Hereby, we seek to achieve electron confinement without the need for embedding quantum dots of different materials, enabling simpler, scalable fabrication.

10:40 : Invited talk

Metasurfaces With Integrated Mems Structures As Tunable Elements For Spoof Surface Plasmon Polaritons

Lars Franke, Steffen Klingel, Marco Rahm

RPTU Kaiserslautern-Landau (Germany)

By proper design, we tailor the dispersion of spoof surface plasmon polaritons on metasurfaces in a wide frequency range to implement on-chip networks with tunable properties, as e.g. tunable filters and beam steering leaky wave antennas. The practical implementation relies on the integration of MEMS into the metasurface unit cells.

11:00 : Invited talk

Gstcs: A Connection To Exact Spherical Multipoles

Hossein Allahverdizadeh, Karim Achouri

EPFL (Switzerland)

Metasurfaces, as subwavelength structures, control both local and nonlocal electromagnetic properties. Conventional methods like GSTC focus on far-field calculations and often overlook near-field effects. Here, we

use multipolar decomposition to link near-field properties with far-field scattering, enabling oblique incidence analysis and generalization to various background materials, including layered substrates.

11:20 : Invited talk

Free-electron Optical Nonlinearities In Heavily Doped Semiconductors: From Fundamentals To Integrated Photonics

Gonzalo Alvarez-Perez¹, Huatian Hu¹, Michele Ortolani², Cristian Ciraci¹

¹Italian Institute of Technology (Italy), ²Consiglio Nazionale delle Ricerche (Italy)

Heavily doped semiconductors have emerged as an enabling platform for mid-infrared photonics, leveraging free electrons to achieve strong and tunable nonlocal-nonlinear light-matter interactions. In this talk, we will discuss recent theoretical and experimental studies on third harmonic generation and Kerr nonlinearity in heavily doped semiconductors, in which hydrodynamic contributions dominate.

11:40 : Invited talk

Tunable Plasmonic Metasurfaces With Epsilon-near-zero Semiconductors: The Case For A Quantum Carrier Model

Masoud Shahbaninezhad, Lora Ramunno, Pierre Berini

University of Ottawa (Canada)

We model MOS capacitors using the drift-diffusion, density-gradient and Schrödinger-Poisson theories, connecting carrier distributions to permittivity distributions via the Drude model, then to electrodynamic computations to determine the optical performance of devices. This comprehensive approach enables accurate predictions of the voltage-gated performance of tunable plasmonic metasurfaces and high-speed electroabsorption modulators.

12:00 : Invited talk

An FFT-accelerated PML-BIE Method For 3d Acoustic Scattering Problems In Layered Media

Hangya Wang, Wangtao Lu

Zhejiang University (China)

For a 3D acoustic scattering problem in a two-layer medium with an axisymmetric interface, we use PML to truncate the unbounded domain, PML transformed Green's functions to derive boundary integral equations, and design FFT-accelerated high-accuracy quadrature rules. Numerical examples demonstrate the effectiveness of the PML-based BIE solver.

12:20 : Invited talk

Physics Informed Bayesian Optimization For Efficient Solution Of Inverse Problems In Nanophotonics

Ivan Sekulic, Philipp-Immanuel Schneider, Martin Hammerschmidt, Sven Burger

JCMwave GmbH (Germany)

We introduce physics-informed multi-channel Bayesian optimization for inverse design problems in nanophotonics and nanometrology. By learning vector-valued physical properties of numerically simulated systems, from which the final cost is constructed, our approach achieves faster convergence compared to other optimization methods, enhancing efficiency in solving inverse problems across engineering and physics.

10:20 - 12:35 — Maxwell

Session 2A11

Optical antennas and metasurfaces: fundamentals and applications of enhanced light-matter interactions

Organized by: Guillermo Acuna, Peter Zijlstra and Hiroshi Sugimoto

Chaired by: Guillermo Acuna and Hiroshi Sugimoto

10:20 : Invited talk

Mechanically Tunable Optical Responses In Silicon Nanospheres Square Lattice Array Metasurface

Fabricated Via Bottom-up Process**Yongan Hu, Patrick Probst, Mojtaba Karimi Habil, Hiroshi Sugimoto, Minoru Fujii***Kobe University (Japan)*

We fabricate a 2-dimensional (2D) square lattice array of silicon nanospheres on a polydimethylsiloxane (PDMS) substrate from a colloidal suspension of silicon nanospheres by a bottom-up process, and demonstrate the reflectance modulation via switching on and off the lattice Kerker effect by uniaxial strain.

10:40 : Invited talk**Dna Origami-based Rhodium Dimers As A New Type Of Uv-plasmonic Nanoantennas****Karol Kolataj, Nicco Corduri, Guillermo Acuna***University of Fribourg (Switzerland)*

The DNA origami technique has been extensively used to arrange plasmonic nanoparticles for various photonic applications. Here, we present a new type of such nanoantennas based on UV-active rhodium nanocubes, which can be used for label-free fluorescence or resonance-SERS measurements of biologically important molecules, such as proteins and DNA.

11:00 : Invited talk**Cooperative electron-vibron interactions in Surface-Enhanced Raman Scattering (SERS)****Miguel A. Martínez García, Diego Martín-Cano***Universidad Autónoma de Madrid (Spain)*

We identify cooperative electron-vibron interactions between near-resonant and non-resonant electronic levels in SERS. Using an open-system quantum model, we demonstrate how Raman interference leads to large modifications in SERS peak intensities. This mechanism generates enhanced nonclassical photon correlations, reshaping conventional assessments of optomechanical contributions in SERS spectra and quantum observables.

11:20 : Fluorescence Color-routing And Steering With A Single Dielectric Nanoparticle**Maria Sanz-Paz¹, Nicole Siegel², Guillermo Serrera³, Javier Gonzalez-Colsa³, Fangjia Zhu², Hiroshi Sugimoto⁴, Pablo Albella³, Guillermo Acuna²**¹University of Fribourg (Switzerland), ²Université de Fribourg (Switzerland), ³University of Cantabria (Spain),⁴Kobe University (Japan)

Nanoscale photon sources exhibit a dipole-like emission pattern, limiting their incorporation into on-chip devices. Nanoantennas can control their radiation pattern, but often involve lossy plasmonic nanoparticles. Here, we show that a single dielectric nanoparticle can direct the emitted light by a nearby nanoemitter, allowing for geometrical and spectral light routing.

11:35 : Fabrication of Plasmonic Lattices through Optical Printing**Abril Julieta Pereyra¹, María Cristina Mina Villarreal¹, Alejandro Manjavacas², Juan Jose Alvarez-Serrano², Fernando Daniel Stefani³, Julian Gargiulo¹, Ianina Lucila Violi¹**¹Universidad Nacional de San Martín (UNSAM) (Argentina), ²Instituto de Química Física Blas Cabrera (IQF)-CSIC (Spain), ³Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) (Argentina)

Metal nanoparticle arrays support lattice plasmon resonances with enhanced optical and photothermal responses. In this work, we fabricate square grids of 100 nm colloidal Au NPs with tunable parameters through optical printing and explore how lattice spacing and size affect resonance properties, also comparing experimental results with simulations.

11:50 : Chiral Sensing With Degenerate Quasi-bound States In The Continuum**Diana Shakirova¹, Adrià Canós Valero¹, Andrey Bogdanov², Thomas Weiss¹**¹University of Graz (Austria), ²Harbin Engineering University (China)

Dielectric nanoresonators have proven to be efficient platforms for chiral sensing due to high-quality-factor resonant states that increase chiral light-matter interaction and boost circular dichroism. We theoretically show that a proper combination of such resonant states significantly increases the chiroptical response to a level that should be measurable in experiments.

12:05 : Full-stokes Polarimetric Microscopy Using Cross-grating Wavefront Microscopy (polar-cgm)**Baptiste Marthy¹, Khosro Z. Kamali², Mikael Käll², Guillaume Baffou¹**¹Institut Fresnel / CNRS (France), ²Chalmers University of Technology (Sweden)

We associate a 4-polarization camera with a 4-wave diffraction grating to achieve single-shot imaging of the vectorial electromagnetic field associated to nanostructures at the sample plane of an optical microscope. We illustrate the technique on lithographic and colloidal nanoparticles and metasurfaces.

12:20 : **High-refractive-index And Flexible Sic Nanoantenna Stickers**

Shunsuke Murai, Hiroya Maruyama, Joshua Tse, Hongjie Gao, Katsuhisa Tanaka

Kyoto University (Japan)

We fabricated a periodic SiC nanoparticle array embedded in a flexible polymer. Photoluminescence enhancement was demonstrated by placing it on the top of phosphor (YAG:Ce³⁺) plate. the SiC sticker outperforms the TiO₂ nanoantenna sticker with identical design.

10:20 - 12:35 — Fresnel

Session 2A12

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Kotaro Kajikawa

10:20 : **Invited talk**

Boosting the magnetic response of a composite nanostructure in the near-visible region with a Fano resonance

Maximilian Grimmer, Monika Fleischer

University of Tübingen (Germany)

We investigate the optical properties of a plasmonic nanostructure, focusing on its magnetic response. Using the geometry of a composite split-ring resonator, it is possible to create a magnetic response at wavelengths close to the visible regime, which can be increased by modifying the geometry and enabling a Fano resonance.

10:40 : **Invited talk**

Photonics And Ai For Next-generation Smart Applications

Luigi Di Lauro¹, A Aadhi¹, Imtiaz Alamgir¹, Pavel Dmitriev¹, Bennet Fischer², Celine Mazoukh¹, Nicolas Perron¹, Evgeny Viktorov³, Anton Kovalev³, Armaghan Eshaghi⁴, Mario Chemnitz², Piotr Roztocki⁵, Shervin Vakili¹, Brent Little⁶, Sai Chu⁷, David Moss⁸, Roberto Morandotti¹

¹INRS-EMT (Canada), ²Leibniz Institute of Photonic Technology (Germany), ³ITMO University (Russia), ⁴Huawei Technologies Canada (Canada), ⁵Ki3 Photonics (Canada), ⁶QXP Technology Inc. (China), ⁷City University of Hong Kong (Hong Kong), ⁸Swinburne University of Technology (Australia)

We demonstrate an all-optical reservoir computing device with a nonlinear amplifying loop mirror for high-speed ML tasks and optimization algorithms for microcomb design. These advancements enhance AI, telecommunications, and smart photonic optimization.

11:00 : **Invited talk**

Extracting Resonances In Nanophotonic Systems From Light Scattering Simulations

Felix Binkowski¹, Fridtjof Betz¹, Lin Zschiedrich², Sven Burger¹, Martin Hammerschmidt²

¹Zuse Institute Berlin (Germany), ²JCMwave GmbH (Germany)

In this contribution, we present a rigorous method for calculating resonance modes from scattering solutions of nanophotonic systems. We demonstrate its application in computing resonant states in periodic nanostructures such as metasurfaces, nanostructured waveguides, and other photonic systems.

11:20 : **Invited talk**

Negative Refraction Of Light Using Atoms Instead Of Metamaterials

L. Ruks¹, K. E. Ballantine², Janne Ruostekoski²

¹NTT Corporation (Japan), ²Lancaster University (United Kingdom)

Negative refraction has driven the development of metamaterials. However, due to material characteristics, the applications of this phenomenon, such as perfect lensing, have been constrained. Here, we demonstrate negative refraction of light in an atomic array without the use of artificial metamaterials, employing essentially exact simulations of light propagation.

11:40 : Invited talk

Non-hermitian Skin Effect In Lossy Anisotropic Nanophotonic Systems

Yuto Moritake, Nozomi Ogawa, Issei Takeda, Masaya Notomi

Institute of Science Tokyo (Japan)

We experimentally demonstrated a non-Hermitian (NH) point gap in complex frequency space using NH photonic crystals. Furthermore, we propose unique light transport and the generation of orbital angular momentum enabled by the NH skin effect in nanophotonic systems.

12:00 : Invited talk

Spin-Orbit Coupling And Tunable Lasing In Liquid-Crystal-based Photonic 1d Crystals

Jacek Szczytko¹, Marcin Muszyński¹, Pavel Kokhanchik², Przemysław Oliwa¹, Piotr Kapuscinski¹, Daniil Bobylev², Eva Oton³, Rafal Mazur³, Przemysław Morawiak³, Wiktor Piecek³, Przemysław Kula³, Witold Bardyszewski¹, Barbara Piętka¹, Dmitry Solnyshkov², Guillaume Malpuech²

¹University of Warsaw (Poland), ²Université Clermont Auvergne (France), ³Military University of Technology (Poland)

We created a tunable one-dimensional photonic crystal with strong polarization dependence by embedding a uniform lying helix (ULH) structure in a planar optical microcavity. The voltage-controlled orientation of liquid crystal molecules modifies the photonic band gaps and induces spin-orbit coupling. Additionally, doping with dyes enables tunable polarized lasing.

12:20 : Metamaterial Grating Distributed Feedback Laser Spatial Coupled-mode Modelling

Henri Benisty¹, Yaoyao Liang², Abderrahim Ramdane², Anatole Lupu²

¹Institut d'Optique Graduate School (France), ²C2N-Université Paris-Saclay (France)

A metamaterial grating based on arrays of cut-wires interacts with a laser ridge to provide resonant distributed feedback. We describe the device operation by a four-modes coupled-mode model. With proper parameters, it reproduces well the electromagnetically-induced-transparency type feature of the spectrum.

Lunch

12:30 - 14:00

14:00 - 15:00 — Torremolinos

Session 2A13

Conference Tutorial

14:00 : Tutorial

Nonlocal metasurfaces

Andrea Alu

City University of New York (USA)

The use of engineered nonlocal responses in metasurfaces has been recently unveiled as a paradigm for extreme wave control, enabling rational control over space, time, frequency and momentum of the incoming signals, as well as analog-based image processing and computing. Several recent demonstrations of metasurfaces performing edge-detection and image-processing using engineered spatial nonlocality have shown a path towards ultrafast, efficient, massively parallel analog image processing based on passive devices, which holds the promise for being extended towards general analog computing platforms. Space-time nonlocal metasurfaces performing the space- and time-derivatives of the incoming signal were also envisioned by tailoring their frequency and momentum dispersion. In this tutorial, I will discuss the basics of nonlocality engineering in

metasurfaces and their various implementations and opportunities for this field of research, showcasing compact meta-structures with reconfigurable properties that can perform mathematical operations, solve compact mathematical problems and address the issues of reprogrammability and cascaded responses. I will discuss how these findings may open exciting opportunities for applications in imaging, automotive vehicles, sensing and computing, and serve as a pre-processing tool for simplifying complex computing architectures.

15:00 - 16:00 — Torremolinos

Session 2A14

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Kai Chang

15:00 : **Invited talk**

Holotomography In Optics And X-ray: Advancing The Study Of Metamaterials

Yongkeun Park

KAIST/PHYSICS (Korea)

Holotomography reconstructs 3D refractive index distributions of unlabeled samples with high resolution. This talk covers advancements in visible-light and X-ray techniques, machine learning integration, and dielectric tensor tomography, emphasizing applications in cell biology and industrial fields like semiconductors and display technologies.

15:20 : **Invited talk**

Quasi-babinet Principle In Dielectric Resonators And Mie Voids

Masoud Hamidi¹, Kirill Koshelev², S. Gladyshev¹, A. C. Valero¹, M. Hentschel³, H. Giessen³, Y. Kivshar², Thomas Weiss¹

¹*University of Graz (Austria)*, ²*Australian National University (Australia)*, ³*University of Stuttgart (Germany)*

We establish a quasi-Babinet principle for dielectric systems, linking dielectric Mie voids and their complementary structures. Among its various implications, this principle notably connects their resonant properties, and our work establishes simple design rules for constructing dielectric resonators with complex functionalities from their complementary counterparts.

15:40 : **Invited talk**

Towards Photonic Orbitronics: Exploiting The Orbital Angular Momentum Of Light

Max Weber, Julian Schulz, Ian Heil, Christina Jörg, Georg von Freymann

RPTU University Kaiserslautern-Landau (Germany)

We report on first experimental steps towards realizing the orbital Hall effect in coupled photonic waveguide architectures fabricated using direct laser writing. Due to the symmetry properties of the underlying lattice, light with orbital angular momentum of opposite handedness propagates into opposite directions.

14:00 - 15:55 — Alamos

Session 2A15

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jerome Plain, Alexander Govorov, Davy Gerard and Pedro Hernandez Martinez

Chaired by: Davy Gerard

14:00 : Invited talk**Sensing Mechanical Resonances Of Living Human Cells Using Nanomechanical Resonators**

Jose Jaime Ruz, Verónica Puerto-Belda, Carmen Millá, Álvaro Cano, Marina Lopez Yubero, Sergio García, Priscila Kosaka, Montserrat Calleja, Javier Tamayo

IMN-CNM/CSIC (Spain)

A mechanical resonance is a very specific way of energy absorption. The question of whether human living cells exhibit mechanical resonances has remained unresolved for more than 70 years. In this work, we have finally proved the existence of these resonances exploring the frequency response of a nanomechanical resonator.

14:20 : Invited talk**Directional Light Scattering In Mie-resonant Si Particles With Ultra-thin Plasmonic Shells**

Emmanuel Idowu¹, Kevin O'Connor², Jonathan Veinot², Sabrina Lacomme¹, Julien Proust³, Jérôme Plain⁴, Xiaoyan Li⁵, Mathieu Kociak⁵, Alexandre Baron¹, Virginie Ponsinet¹, Lucien Roach⁶, Peter Wiecha⁷, Glenna Drisko¹

¹ Université de Bordeaux (France), ² University of Alberta (Canada), ³ University of Technology of Troyes (France), ⁴ University Technology of Troyes (France), ⁵ Université Paris-Saclay (France), ⁶ CNRS-ENS de Lyon (France), ⁷ Université de Toulouse (France)

We present the synthesis of Si@Au core-shell particles as candidate directional scatterers. Characterized using electron energy-loss spectroscopy mapping and single-particle scatter spectroscopy. These were supported by T-matrix simulations and Mie theory. We show that to significantly improve forward scattering intensity, continuous plasmonic shells of ~12 nm thickness are needed.

14:40 : Invited talk**Chiral Silicon Meta Biosensors**

Dominic J.P. Koyrotysaltis-McQuire¹, Rahul Kumar¹, Tamas Javorfi², Giuliano Siligardi², Adiran Lapthorn¹, Nikolaj Gadegaard¹, Malcolm Kadodwala¹

¹ University of Glasgow (United Kingdom), ² Diamond Light Source Ltd. (United Kingdom)

We introduce a chirally sensitive spectroscopic phenomenon using "metadiastereomersbiomolecule-nanostructure complexes with distinct birefringent properties. This approach, with sensitivity nine orders of magnitude greater than traditional methods, enables femtomole-level detection and offers exceptional potential for biosensing applications with minimized off-target interference and enhanced.

15:00 : Invited talk**Chiral Photogrowth On Plasmonic Nanostructures Under Circularly Polarized Light**

Lucas Vazquez Besteiro

CINBIO - Universidade de Vigo (Spain)

With adequate conditions, achiral plasmonic structures under circularly polarized light can develop chiral shapes by photocatalytically imprinting on them the reduced symmetry of the local fields. Experimental realizations of this strategy can exploit different energy-transfer mechanisms. We will discuss the fundamentals of such light-to-matter chirality transfer and recent experimental demonstrations.

15:20 : Angularly Resolved Optical Response of Organic Molecules in Single and Collective Plasmonic Gold Nanosphere ystems

Felix Schneider¹, Daniel Schäfer², Sebastian Schlücker², Alfred J. Meixner¹, Dai Zhang¹

¹ Eberhard-Karls-Universität Tübingen (Germany), ² University of Duisburg-Essen (Germany)

Plasmon-based nanosphere systems are used for surface enhanced Raman scattering (SERS) of organic molecules. Angular excitation effects are investigated by varying the electric field distribution and incidence angle of the excitation radiation. We excite different plasmonic coupled or collective resonances to analyze the spatial emission behavior in the k-space.

15:35 : Invited talk**Controlled Self-assembly Of Polymer-grafted Nanoparticles Toward Hyperuniform Materials**

Kyoungweon Park, Derek Huang, Kenya Hazell, Anesia Auguste, Andrew Gillman, Rich Vaia, Larry Drummy

AFRL (USA)

Hyperuniform materials combine local disorder with long-range uniformity, enabling control over wave pro-

pagation. Here we developed a synthetic protocol for highly concentrated, monodispersed gold nanoparticles with tunable size and shape. Using bimodal size distributions, we fabricated thin films of polymer-grafted AuNP assemblies, achieving macroscale packing and statistically verified hyperuniformity.

14:00 - 15:50 — Playamar

Session 2A16

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Konstantin Bliokh

14:00 : **Invited talk**

Plasmonic Nanocrystals For Hot Electron Generation And Chiral Photochemistry

Alexander Govorov

Ohio University (USA)

Plasmonic nanostructures with hot spots exhibit significantly amplified optical and energy-related effects, including the hot-electron generation via plasmonic hot spots for photochemistry and photodetection, chiro-optical plasmonic phenomena for sensing chiral biomolecules and asymmetric photochemistry, and more.

14:20 : **Invited talk**

What Is And What Is Not A Good Measure For Enhanced Chiroptical Response?

Thomas Weiss

University of Graz (Austria)

Enhancing chiral light-matter interaction by nanophotonic resonators has attracted a lot of interest in recent years. However, various theories and measures exist to understand and quantify this enhancement. We are going to compare these approaches and discuss their advantages and disadvantages.

14:40 : **Invited talk**

Listening To Nanostructures' Absorption And Chirality: Widely Tunable Photo-acoustic Spectroscopy

**Emilija Petronijevic, Claudia Skubisz, Grigore Leahu, Concita Sibilis, Roberto Li Voti, Alessandro Be-
lardini**

Sapienza University of Rome (Italy)

Photo-acoustic spectroscopy (PAS) is a low-cost, scattering-free and non-destructive method of measuring material absorption. Here, we enrich PAS with many degrees of freedom: laser wavelength, polarization, direction, focus, and the possibility of spatial and frequency mapping. We show its potential in characterizing both commercial and specially designed nanostructures.

15:00 : **Keynote talk**

Rethinking Linking – Topology In Magnetism, And Plasmonics

**Maria Azhar, Ross Knapman, Philipp Gessler, Alexander Neuhaus, Pascal Dreher, Frank Meyer zu
Heringdorf, Karin Everschor-Sitte**

University of Duisburg-Essen (Germany)

Topology in physics explores robust, fault-tolerant states of matter aiming at practical applications. Similar topological structures arise in magnetism, optics, and plasmonics despite differing physics. A challenge is understanding them when traditional mathematical topological frameworks are not necessarily applicable. Linking and geometry offer intuitive ways to describe these complex textures.

15:30 : **Invited talk**

Attosecond Magnetism: Ultrafast Control Of Magnetic Phases And Novel Probes

Ofer Neufeld

Technion Israel Institute of Technology (Israel)

Magnetism can be coherently controlled by light via mechanisms that allow transfer of spin and orbital moments from electric fields to matter at varying timescales, down to femtoseconds. I will present our recent works towards controlling magnetism at even faster attosecond timescales, and developing novel ultrafast spectroscopies for detecting it.

14:00 - 16:00 — Bajondillo

Session 2A17

Symposium III: Advanced passive and active metasurfaces and zero-index materials

Organized by: Howard Lee, Pin-Chieh Wu and Wen-Hui (Sophia) Cheng

Chaired by: Andrea Alu and Sophia Cheng

14:00 : **Keynote talk**

Active Metastructures – Tailoring Space-Time and Breaking Reciprocity

Harry Atwater

California Institute of Technology (USA)

In this talk, I will discuss approaches to spatiotemporal wavefront control in active metastructures that can modify energy and momentum states of light, break reciprocity via space-time modulation, and break Kirchhoff's radiation law via action of external or internal magnetic fields.

14:30 : **Invited talk**

Ultra-Sensitive Infrared Gas Molecular Measurement Using Three-Dimensional Broadband Metasurface Absorber

Takuo Tanaka

RIKEN (Japan)

A broadband metasurface absorber featuring three-dimensional metal double-cylinder structures was fabricated and applied to an ultra-sensitive infrared spectroscopic gas measurement technique. Owing to its strong and broadband resonant absorption, the signal-to-background ratio has been improved, enabling the measurement of IR spectroscopic signals from different gas molecules.

14:50 : **Invited talk**

Confinement-Induced Nonlocality, Topological Darkness, And Goos-Hänchen Effect Enhancement In Transdimensional Plasmonic Film Systems

Igor Bondarev¹, Svend-Age Biehs²

¹*North Carolina Central University (USA)*, ²*Carl von Ossietzky Universität (Germany)*

We classify topologically protected singularities for the reflection coefficient of transdimensional plasmonic films. Originating from their nonlocal electromagnetic response due to vertical electron confinement, these singularities lead to lateral (angular) Goos-Hänchen shifts on the millimeter (milliradian) scale in the visible range, greatly exceeding those reported previously for artificially designed metasurfaces.

15:10 : **Invited talk**

Accelerating The Design Of Photonic Metamaterials With Artificial Intelligence

Yongmin Liu

Northeastern University (USA)

I will discuss how to accelerate the design of novel metamaterials by deep learning. Different from the conventional approaches, deep learning can produce fast and accurate designs without the need of case-by-case and time-consuming numerical calculations, helping to push the function capacity of metamaterials towards their physical limits.

15:30 : **Keynote talk**

Functional "MetaOptical Fibers for Advanced Imaging and Endoscopy

Ho Wai (Howard) Lee, Andrew Palmer, Yucheng Jin, Jin Yan, Beyonce Hu, Harvey Lin, Stuart Love, David Dang, M. Father, L. Liu, A. Teoh
University of California, Irvine (USA)

In this talk, I will review the various material platforms (metallic, dielectric, and compound structures) and geometric platforms which have been utilized in “meta”-fiber devices to date. I will present our recent development of “Meta”-optical fiber, an advanced optical fiber integrated with emerging metasurface concepts. I will present the development of ultrathin optical metalens which is cascaded on the facet of optical fiber that enables advanced optical functions via wavefront shaping such as light focusing.

14:00 - 16:00 — Carihuela

Session 2A18

Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and Noé Jiménez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

14:00 : **Invited talk**

Band Structure Engineering In Artificial Phononic Trans-polyamynoborane With First And Second-nearest Neighbors

Rafael Méndez-Sánchez¹, Yonatan Betancur-Ocampo¹, Bryan Manjarrez-Montañez¹, Angel M. Martínez-Argüello²

¹Universidad Nacional Autónoma de México (Mexico), ²Benemérita Universidad Autónoma de Puebla (Mexico)

An artificial phononic molecule that emulates the electronic properties of trans-polyaminoborane with second-nearest-neighbor hoppings is studied. The numerical band structures obtained with COMSOL Multiphysics agree with tight-binding calculations of the κ -deformed Dirac equation. Topologically protected states are obtained in a 1D finite chain.

14:20 : **Invited talk**

Realizations Of Acoustic And Elastic Meta-structures To Reduce Noise And Vibration

Wonju Jeon

KAIST (Korea)

We present three meta-structures with audiovisual demonstrations aiming at real-world applications. The first is an ultra-light soundproofing meta-panel to insulate broadband noise from electric vehicles. The second is a meta-liner to insulate noise in ducts while allowing flow. The third is a modified acoustic black hole to suppress structural vibrations.

14:40 : **Invited talk**

Conditions For Weak Scattering In Flexural Waves

Mario Lázaro¹, Vicent Romero-García², Luis M. García-Raffi²

¹Universitat Politècnica València (Spain), ²Universitat Politècnica de València (Spain)

This work examines wave propagation in continuous media with weakly coupled scatterers. We rigorously analyze the quantification of weak scattering and the applicability of the Born approximation to elastic waves. Eigenvalues of the scattering matrix are evaluated, and the spectral radius is selected as a representative parameter of scattering behavior.

15:00 : **Invited talk**

Locally Resonant Mosaic Meta-plate

Nan Gao¹, Vicente Romero-García¹, Jean-Philippe Groby², Ping Sheng³

¹Polytechnic University of Valencia (Spain), ²Le Mans University (France), ³The Hong Kong University of Science and Technology (Hong Kong)

This work proposes and realizes a mosaic plate system with a zero-frequency bandgap extending from 0+ up to 6800 Hz, while maintaining translational degrees of freedom. Simulation and experimental results confirm significant vibration cancellation (50-6800 Hz) and notable sound insulation advantages over a homogeneous plate with the same mass density.

15:20 : Invited talk

Towards A Generalized Theory For Aeroacoustic Metacontinua

Umberto Iemma, Giada Colombo

Università degli Studi Roma Tre (Italy)

Acoustic metamaterials enable unconventional wave manipulation but lose efficiency in a moving medium, if designed for static conditions. This work encloses the past decade's progress toward a generalized theory for acoustic metacontinua modelling, incorporating convective effects and integrating spacetime differential geometry into enhanced formulations of existing methodologies for aeroacoustic analysis.

15:40 : Invited talk

Nonlinear and Optomechanical Applications Harnessing Silicon Nanostructures

P. Nuño Ruano, J. Zhang, D. González-Andrade, H. E. B. Ferhart, T. T. D. Dinh, D. Medina-Quiroz, S. Edmond, P. Cheben, D. Marris-Morini, E. Cassan, L. Vivien, N. D. Lanzillotti-Kimura, Carlos Alonso Ramos

Université Paris-Saclay (France)

Subwavelength silicon nanostructures provide unprecedented flexibility in the control of optomechanical effects. Here, we review our recent results on the use of nanostructures for the optimization of Brillouin interactions in suspended and non-suspended optomechanical cavities.

14:00 - 16:00 — Montemar

Session 2A19

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Jacek Szczytko

14:00 : Invited talk

Chern insulators: nonlinearity and switching

Justin Cole

University of Colorado (USA)

Most results on Chern insulators are based on linear theories. Here nonlinear Chern insulator models and the states they support are examined. Solitons and traveling waves are investigated. A secondary agenda examines switching within Chern insulator models. Namely, mechanisms for controlling the flow of light are to be discussed.

14:20 : Invited talk

Electric field induced second order nonlinearity in amorphous As₂S₃, SiO_x and SiN_x

Laurids Wardenberg¹, Krishna Koundinya Upadhyayula¹, Georg von Freymann², Vadim Talalaev¹, Michael Hanke³, Andre Kühling¹, Joerg Schilling¹

¹Martin-Luther-University Halle-Wittenberg (Germany), ²RPTU Kaiserslautern-Landau (Germany), ³Paul-Drude-Institut für Festkörperelektronik (Germany)

Applying an electric field to As₂S₃, and silicon rich SiO_x and SiN_x leads to the formation of a field dependent quasi-c(2) and field induced second harmonic generation in transmission. Both PECVD-grown SiO_x and SiN_x also exhibit a field free c(2) leading to enhanced SHG by a waveguide surface grating.

14:40 : Invited talk

Anisotropic Nonlinearities In Crystalline Gold And How To Exploit Them

Sergejs Boroviks, Olivier Martin

École Polytechnique Fédérale de Lausanne (EPFL) (Switzerland)

We demonstrate a monocrystalline plasmonic metasurface which takes advantage of the anisotropic second-harmonic generation from 111-type gold surface. Furthermore, we provide a comprehensive description of this anisotropic nonlinearity that is rooted in the microscopic symmetries of the crystal, and validate experimental results with numerical simulations, which show excellent agreement.

15:00 : Invited talk

High-Temperature Superfluorescence In Perovskites

Kenan Gundogdu

NC State University (USA)

In this presentation, I will introduce the superradiance mechanism that leads quantum coherence in lead-halide perovskites and its implications for designing new materials that exhibit macroscopic quantum coherence at high temperatures.

15:20 : Invited talk

Transition Metal Dichalcogenide Lateral Heterostructure-based Excitonic Platform For Photonics And Optoelectronics

Hassan Lamsaadi¹, Aurélien Cuche¹, Gonzague Agez¹, Ioannis Paradisanos², Dorian Beret¹, Laurent Lombez¹, Pierre Renucci¹, Delphine Lagarde¹, Xavier Marie¹, Ziyang Gan³, Antony George³, Kenji Watanabe⁴, Takashi Taniguchi⁴, Andrey Turchanin³, Nicolas Combe¹, Bernhard Urbaszek⁵, Jean-Marie Poumirol¹, Vincent Paillard¹

¹University of Toulouse (France), ²Foundation for Research and Technology-Hellas (Greece), ³Friedrich Schiller University Jena (Germany), ⁴National Institute for Materials Science (Japan), ⁵Technische Universität Darmstadt (Germany)

Lateral heterostructures of different Transition Metal Dichalcogenide monolayers provide new architectures leading to a wide range of novel photonic and optoelectronic applications. In recent studies, we have shown that such lateral heterostructures can be used to filter, focus, collimate, or trap neutral excitons, giving a base for excitonic devices.

15:40 : Invited talk

Suspended AlGaAs Integrated Nonlinear Photonics

Changzheng Sun, Yuqian Zhang, Bing Xiong, Jian Wang, Zhibiao Hao, Lai Wang, Yanjun Han, Hongtao Li, Lin Gan, Yi Luo

Tsinghua University (China)

We present our recent work on nonlinear optics in suspended AlGaAs waveguides/micresonators, including fabrication of high-Q suspended AlGaAs microring resonators, microcomb generation in near and mid-infrared regime, and octave-spanning supercontinuum generation.

14:00 - 14:45 — Litoral

Session 2A20

Metamaterials: novel trends and applications

Organized by: Tatjana Gric

Chaired by: Tatjana Gric

14:00 : Geometric Approach Based On Optimal Toric Packings For Photonic Crystals And Metamaterials Design.

Alexander Itin

TUHH (Germany)

We introduce new classes of nanostructures (optimal toric packings of particles and their Voronoi tessellations) having remarkable properties when used in design of photonic, plasmonic, or phononic crystals. They provide

a connection between the classic mathematical problem of optimal packings on tori and several solid-state physics problems.

14:15 : **Bound-state-in-the-continuum Dielectric Bowtie Metasurfaces For Strongly Enhanced Light-matter Interaction**

Sergei Lepeshov, Nikolaj Balslev Hougs, Søren Stobbe

Technical University of Denmark (Denmark)

Dielectric bowtie cavities allow confining light well below the diffraction limit without absorption and therefore enable greatly enhanced light-matter interactions. Here we present theoretical results showing that this enhancement may be harnessed in metasurfaces that support bound states in the continuum laterally confined to dielectric bowties.

14:30 : **Plasmonic Multilayers Metamaterials Combining Nitrides, Oxynitrides And Transparent Conductors With Novel, Broad And Tunable Properties**

Cristina Mancarella¹, Claudia Pernilla Hallqvist¹, Simone Bossetti¹, Ludovica Tovaglieri¹, Gianluigi Baiardi¹, Alessio Lamperti², Demosthenes Koutsogeorgis³, Nikolaos Kalfagiannis³, Vincenzo Caligiuri⁴, Antonio De Luca⁴, Andrea Li Bassi¹

¹Politecnico di Milano (Italy), ²CNR-IMM (Italy), ³Nottingham Trent University (United Kingdom), ⁴Università della Calabria (Italy)

Plasmonic effects enhance light-matter interactions for advanced metamaterials with tunable properties and broad spectral responses. Noble metals limit modulation beyond the visible range. This work develops novel meta-structures using alternative plasmonic materials (transparent conductors, nitrides, oxynitrides) to achieve customizable plasmonic properties from visible to infrared for extreme light control.

14:45 - 15:45 — Litoral

Session 2A21

Metamaterial-Based Devices

Chaired by: Antonio Ambrosio

14:45 : **Side-coupled Fabry-perot Based On Multi-slot Subwavelength Grating Metamaterials For Sensing Applications**

Seyedhadi Badri, Artem S. Vorobev, Liam O'Faolain

Munster Technological University (Ireland)

We present a side-coupled Fabry-Perot sensor with multi-slot subwavelength grating (SWG) metamaterials. The broadband photonic bandgap of the SWG mirrors enhances versatility by enabling operation across a wide spectral range, improving robustness for diverse sensing applications. The fabricated device achieved a sensitivity of 520 nm/RIU using NaCl solutions.

15:00 : **Skin-Interfaced Metasurface Sensor For Advanced Noninvasive Physiological Monitoring**

Torjus Steffensen, Arthur Georg Serville Torvund, Vegar Stubberud, Nils Kristian Skjærvold, Martin Steinert, Angelos Xomalis

Norwegian University of Science and Technology (Norway)

Physiological monitoring is constrained by wires, batteries and skin contact for signal readout, introducing discomfort. Here we propose a laser-free all-optical methodology for heartbeat monitoring using a wearable and stretchable metasurface. Monitoring color contrast caused from blood flow under the patient's skin, we record heartbeat with smartphone camera in real-time.

15:15 : **Transfer Learning For The Design Of A Composite Metasurface Unit Cell In The Ka-band**

Alexander Wolff, Lukas Mueller, Steffen Klingel, Marco Rahm

RPTU Kaiserslautern-Landau (Germany)

Training data is a sparse resource when designing neural networks to describe the scattering parameters of metamaterials based on their geometry. Using transfer learning, we have reduced the necessary training data

for a neural surrogate model of a tunable composite metasurface unit cell by more than an order of magnitude.

15:30 : **On-chip Refractive Index Sensors In 200 Mm Wafer Silicon Technology**

Sebastian Reiter¹, Akant Sengül¹, Christian Mai², Carlos Alvarado Chavarin², Christian Wenger², Inga Anita Fischer¹

¹BTU Cottbus-Senftenberg (Germany), ²IHP - Leibniz Institut (Germany)

We present electrooptical characterization results for Ge photodetectors with TiN nanohole arrays as miniaturized sensors for the detection of refractive index changes. Fabrication was carried out in CMOS compatible 200 mm wafer Si technology, which leverages the platform for cost-effective sensors as well as integration with signal evaluation circuits.

14:00 - 16:00 — Manantiales

Session 2A22

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Muriel Botey

14:00 : **Invited talk**

Visualization Of Thermal Extraction Process Achieved By Metamaterial Absorber

Wakana Kubo

Tokyo University of Agriculture and Technology (Japan)

We visualized how a metamaterial absorber extracts heat from surrounding objects. After a certain period of heating, we observed that the temperature of the Cu plate placed on the metamaterial substrate attached to the thermoelectric device decreased faster than that of the Cu plate placed on the control substrate.

14:20 : **Invited talk**

Twisted Moiré Metasurfaces With Emissive Gap Layers Enabling Giant And Tunable Chiral Emission

Zijie Jiang, Zhao Sun, Zhuofei Gan, Wen-Di Li

The University of Hong Kong (Hong Kong)

We present twisted moiré chiral metasurfaces with tunable chiral emission using cost-effective and large-area fabrication combining nanoimprint and interference lithography, achieving luminescence dissymmetry factor of -1.21. Chirality is tuned via twist angles and gaps, validated by reciprocity-based simulations. Compatibility with quantum dots and perovskites enables versatile chiral light sources.

14:40 : **Invited talk**

Modulation And Amplification Of Waves By Metasurfaces

Ilya Shadrivov

Australian National University (Australia)

In this presentation I will overview our approaches to creating tunable metasurfaces for controlling amplitude, phase and polarization of electromagnetic waves. I will further discuss the parametric processes that allow amplification and up-conversion of electromagnetic waves.

15:00 : **Invited talk**

The General Boundary Conditions For All Interfaces, Including Arbitrary Moving Metasurfaces And Instantaneous Changes In Constitutive Relations.

Jonathan Gratus¹, Simon Horsely², Martin McCall³

¹Lancaster University (United Kingdom), ²Exeter University (United Kingdom), ³Imperial College (United Kingdom)

We present the most general boundary conditions, which satisfy basic physical constraints: linearity, causality and local to the boundary. Using relativity they are valid for all motions of the interface, including arbitrary moving metasurfaces and superluminal motion. We discuss the nature of causality for boundaries.

15:20 : Invited talk

Harnessing The Power Of Mid-infrared Metasurfaces For Ultrafast And High-efficiency All-optical Modulation

The Linh Pham¹, Amirmostafa Amirjani¹, Kacper Pilarczyk¹, Nils Deßmann², Thanh Tung Nguyen³, Ewald Janssens¹

¹KU Leuven (Belgium), ²Radboud University (The Netherlands), ³Vietnam Academy of Science and Technology (Vietnam)

In this study, we propose a comprehensive platform to harness the localized surface plasmon resonance of metasurfaces for achieving ultrafast all-optical modulation via carrier multiplication in the silicon substrate, demonstrated with time-resolved pump-probe experiments. This finding paves the way for high-speed optical modulation using low-photon energy light sources.

15:40 : Invited talk

Far-field Petahertz Sampling Of Plasmonic Fields

Kai-Fu Wong¹, Weiwei Li², Z. Wang², V. Wanie¹, E. Mansson¹, D. Hoeing³, J. Blöchl², T. Nubbemeyer², A. Azzeer⁴, A. Trabattin¹, Holger Lange², Francesca Calegari², Matthias F. Kling²

¹CFEL (Germany), ²Max Planck Institute of Quantum Optics (Germany), ³The Hamburg Centre for Ultrafast Imaging (Germany), ⁴King-Saud University (Saudi Arabia)

We demonstrate the realtime observation of linear plasmonic fields by optical field sampling. Our findings also demonstrate the ability to manipulate the spectral properties of ultrashort laser pulses by plasmonic samples.

14:00 - 16:00 — Veselago

Session 2A23

Symposium VI: Advanced Techniques for Computational Electromagnetics

Organized by: Maha Ben Rhouma

Chaired by: Riccardo Messina

14:00 : Invited talk

Adiabatic Time Modulations Vs. Photonic Time Interfaces

Mariya Antyufeyeva, Victor Pacheco-Peña

Newcastle University (United Kingdom)

We develop an in-depth theoretical study on the potential properties of temporal adiabatic modulations of the refractive index of the medium where a wave travels. The results are compared with the field distribution produced by photonic time interfaces demonstrating the potential to mimic time refracted signals.

14:20 : Invited talk

Inverse Design Of Large And Complex Metaoptics Systems

Bryan Stone¹, Evan Heller², Li-Ce Hu³, Rob Scarmozzino², Mayank Bahl², Ziwei Zhu², Maryvonne Chalony⁴, Yijun Ding², Chenglin Xu²

¹Synopsys, Inc (USA), ²Synopsys, Inc. (USA), ³Synopsys, Inc. (Taiwan), ⁴Synopsys, Inc. (France)

The fully automated inverse design tools developed at Synopsys can be used for large and complex metaoptics systems, such as hybrid metalens systems, to reduce physical size and specify complex metasurfaces to achieve high performance. Minimal design experience is required because of pre-built knowledge in the design tools.

14:40 : Invited talk

Recent Progress In The Design And Simulation Of Large-scale Metalenses

Jens Niegemann¹, Dan-Nha Huynh², Han-Hsiang (Michael) Cheng³, Thibault Leportier¹, Dylan McGuire¹

¹Ansyes Canada Ltd. (Canada), ²Ansyes Germany GmbH (Germany), ³Ansyes Japan K.K. (Japan)

This presentation discusses recent advances in the design and simulation of large-scale metalenses. We will present a complete simulation workflow from the design of individual meta-atoms to the simulation of

complete optical systems. Future directions for research and potential industrial applications are highlighted.

15:00 : Invited talk

Inferring Structure From Fundamental Limits

Sean Molesky¹, Pengning Chao², Alessio Amaolo³, Alejandro W. Rodriguez³

¹*Polytechnique Montreal (Canada)*, ²*MIT (USA)*, ³*Princeton University (USA)*

We show that the fields calculated during the computation of limits via Lagrange duality can be used to improve the performance of inverse design.

15:20 : Invited talk

Study Of The Radiative Properties Of Quasi-bound States In The Continuum In Dimer Gratings Using The Quasi-normal Mode Method

Emmanuel Centeno¹, Victor Kalt², Rafik Smalli¹, Antoine Moreau¹

¹*Insitut Pascal (France)*, ²*Université de Lyon (France)*

We study the radiating properties of dimer grating supporting quasi-bound states in the continuum (QBICs) with a novel approach based on the quasi-normal mode method. This approach allows an accurate calculation of the Purcell factor, light extraction and radiative enhancement coefficients for a unique quantum emitter.

15:40 : Invited talk

Quantum Effects And Ultrafast Thermoelectric Phenomena In Nanoplasmonics

P. André Gonçalves

University of Southern Denmark (Denmark)

Plasmonic nanostructures can exhibit significant quantum-mechanical effects and intricate photothermal phenomena. We present methods to unveil quantum effects in nanoplasmonics and harness thermoelectric effects to generate ultrafast electric fields, leveraging them to probe the dynamical optical and thermal processes governing the nanoscale response of material nanostructures.

14:00 - 16:15 — Maxwell

Session 2A24

Quantum Light Emitters and Photonic Heterogeneous Integration

Organized by: Han Htoon, Huan Zhao and Libai Huang

Chaired by: Libai Huang

14:00 : Invited talk

Quantum Light In A Moiré Heterostructure

Mauro Brotons-Gisbert

Heriot-Watt University (United Kingdom)

The electronic interaction of two different atomic sheets stacked together with a relative twist leads to a spatially periodic potential-energy landscape: the moiré superlattice. Here we will present magneto-optical spectroscopy of MoSe₂/WSe₂ heterobilayer devices with a small relative twist. We will discuss moiré-trapped inter-layer excitons, which can emit quantum light.

14:20 : Enhanced Quantum Emission Via Epsilon Near Zero Materials

Sven Stengel¹, Abhishek Solanki², Hamza Ather², Pei-Gang Chen², Jae Ik Choi², Brandon M. Triplett², Mustafa Ozlu², Kyu Ri Choi², Alexander Senichev², Wallace Jaffray¹, Alexei S. Lagoutchev², Marcello Ferrera¹, Alexandra Boltasseva², Vladimir M. Shalaev²

¹*Heriot-Watt University (United Kingdom)*, ²*Purdue University (USA)*

Near-infrared quantum emitters have huge potentials in quantum technologies, especially for integrated photonics. By coupling PbS/CdS quantum dots to a CMOS-compatible epsilon-near-zero index substrate, we show improved emission directionality, increased saturation intensity and a 30-fold lifetime reduction, leading the way to advanced quantum optics applications.

14:35 : Invited talk**Atomically Thin Near Infrared Quantum Light Emitters****Han Htoon***Los Alamos National Laboratory (USA)*

This talk will highlight our recent efforts on the development of three 2D material-based quantum light emitters capable of operating in near-infrared spectral regime.

14:55 : Invited talk**Strained Two-dimensional Semiconductors Toward Straintronics****Jin Myung Kim, Soyeong Kwon, SungWoo Nam***University of California (USA)*

We report strain-induced exciton transport in monolayer WSe₂ across microns at room temperature via steady-state pump-probe measurement. Wrinkle architecture enabled optically-resolvable local strain (2.4 %) and energy gradient (49 meV/ μm) to WSe₂. We observed strain gradient induced flux of high-energy excitons transported to the nearest energy minima with high transport efficiency.

15:15 : Invited talk**Fundamental Limits Of Boron-vacancy Spin Dynamics In Hexagonal Boron Nitride**

Benjamin Lawrie¹, Yueh-Chun Wu¹, Abhishek Solanki², Ian Gallagher¹, Hamza Ather², Aravindh Shankar², Priyo Adhikary², Owen Matthiessen², Xingyu Gao², Demid Sychev², Alexei Lagoutchev², Tongcang Li², Yong Chen², Vladimir Shalaev², Pramey Upadhyaya², Huan Zhao¹, Ivan Vlassiuk¹

¹*Oak Ridge National Laboratory (USA)*, ²*Purdue University (USA)*

We probe the spin-relaxation dynamics of boron-vacancy spin defects in hBN and show that T₁ is strongly sensitive to the applied magnetic field, especially at low temperatures. Moreover, we explore the effect of the boron vacancy formation on the fundamental limits of T₁ and T₂ in these 2D spin defects.

15:35 : Invited talk**Diamond Color Center For In-memory Computing****Xiaodong Yan***University of Arizona (USA)*

This presentation will discuss our recently work on the diamond color center and elucidate our efforts to interpret and harness the unique emission property, which lead to novel IMC functionalities.

15:55 : Invited talk**Increased Formation Of Silicon-vacancies In Diamond By Sub-bandgap Light Irradiation During Annealing****Coleman Cariker¹, Yifan Yao², Andre Schleife², Michael Titze¹**¹*Sandia National Laboratories (USA)*, ²*University of Illinois Urbana-Champaign (USA)*

This study investigates the brightness enhancement of silicon-vacancy (SiV) centers in diamond through UV irradiation during post-implantation annealing. Results show a 15 % increase in photoluminescence brightness, attributed to improved SiV formation due to reduced divacancy density, suggesting potential for optimized manufacturing of single defect sites for quantum applications.

14:00 - 16:00 — Fresnel**Session 2A25****Symposium II: New Trends in Nanophotonics and Advanced Materials**

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Rasmus Christiansen

14:00 : Invited talk**Steering Plasmonic Optical Losses Using Alkali Metals**

Yuhan Yang, Jie Liang, Lin Zhou

Nanjing University (China)

Plasmonic losses are regarded as one of the most crucial issues for nanophotonics and integrated optics. In this talk, the authors will present the recent advancements on a variety of material/meta-structure strategies on steering the optical losses based on alkali metals, from the fundamental optical properties to the potential applications.

14:20 : Invited talk

Second-order Coherence Of Bose-einstein Condensation In Plasmonic Lattices

Evgeny Mamonov, Sioneh Eyvazi, Lukas Freter, Päivi Törmä

Aalto University School of Science (Finland)

Plasmonic lattices accompanied with active media are versatile platform for many applications such as lasing or Bose-Einstein condensation (BEC). Here we present our studies of second-order coherence of BEC in plasmonic lattices. We analyze the behavior of $g(2)(t=0)$ function in the three stages of emission: lasing, incomplete thermalization and condensation.

14:40 : Invited talk

Self-hybridized Plasmonic Excitations And Hot Electron Generation In Aluminum Nanorods

J. Martin¹, O. Avalos-Ovando², T. Simon¹, G. Arditi³, F. Lamaze¹, J. Proust¹, L. Tizei³, M. Kociak³, A. Govorov², O. Stéphan³, Davy Gerard¹

¹Université de Technologie de Troyes (France), ²Ohio University (USA), ³Université Paris-Saclay (France)

We evidence a phenomenon of self-hybridization of the resonances sustained by aluminum nanorods, owing to the strong coupling of the localized plasmonic resonances with interband transitions occurring within the metal. Anomalously high rates of hot electron generation are associated with these hybridized states.

15:00 : Invited talk

Enhancing Thermoplasmonic Sensing Via Plasmonic Nanoplatfoms

Andreea Campu, Simion Astilean, Monica Focsan

Babes-Bolyai University (Romania)

Thermoplasmonic detection is an emerging application within the rapidly expanding and promising field of thermoplasmonics. While the heat generated by gold nanoparticles has been utilized in biomedical applications such as photothermal therapy, the impact of nanoscale photothermal processes remains a topic of ongoing discussion.

15:20 : Invited talk

Fluorescence-based Chiral Sensing With Silicon Metasurfaces

Tom Siermans¹, Artemijs Krimovs², Robert Pal², Alberto Curto¹

¹Ghent University (Belgium), ²Durham University (United Kingdom)

Chiral molecules with opposite handedness can have strongly different biological functionalities. Identifying chirality is, however, limited by low sensitivity, restricting detection to high concentrations and large volumes. We propose a silicon nanophotonics-based sensing technique to enhance the sensitivity of chiral molecular detection.

15:40 : Invited talk

Large-area Nanohelices As Chiral Metasurface For Engineering Optical Chirality

Thu H. H. Le¹, Hisako Sato², Takuo Tanaka³

¹National Institute of Advanced Industrial Science and Technology (AIST) (Japan), ²Ehime University (Japan),

³RIKEN Center for Advanced Photonics (Japan)

This study presents a wafer-scale, self-assembly fabrication method of metallic helices by engineering the residual stresses and gradient strains in thin films to induce spontaneous folding. The fabricated nanohelices of sub-micrometer radii exhibit strong chiroptical responses in the infrared regime, enabling practical applications in chiroptical spectroscopies and chiral chemistry.

Coffee Break
Session 2P2
Poster session IV
16:00 - 16:40

P1: Investigation of Structural and Optical Properties of Tungsten Doped VO₂-Au Plasmonic Switchable Material

Shraddha Shukla, Urvashi Solanki, Abhishek Prasad, P. Mandal

UPES (India)

We have developed tungsten doped VO₂-Au switchable material with needle-like morphology through hydrothermal synthesis and post growth thermal annealing method. Structural studies confirm the grown samples are mixture of various polymorphs of VO₂ (VO₂ (M), VO₂ (B) and VO₂ (R)) which is further supported by vibrational studies using Raman spectroscopy.

P2: Plasmon-enhanced Vibrational Circular Dichroism In Plasmonic Nanostructures Incorporating Chiral Drugs

Raju Adhikary¹, Matteo Venturi¹, Giovanna Salvitti¹, Ambaresh Sahoo¹, Carino Ferrante², Paola Benassi¹, Francesco Di Stasio³, Andrea Toma³, Hatice Altug⁴, Massimiliano Aschi¹, Andrea Marini¹

¹University of L'Aquila (Italy), ²CNR-SPIN (Italy), ³Istituto Italiano di Tecnologia (Italy), ⁴EPFL (Switzerland)

We investigate the chiroptical response of plasmonic nanostructures based on Aluminum-doped zinc oxide (AZO) and a layer of pharmaceutical chiral drug solutions. We systematically study the localized surface plasmon resonances (LSPRs) to enhance the vibrational circular dichroism (VCD) of the chiral drug solution to develop innovative chiroptical sensing techniques.

P3: Water-based Cylindrical Metamaterials With Radial Anisotropy For Electric Field Enhancement And Suppression

Julia Brandt, Hagen Renner, Dominik Langer, Manfred Eich, Alexander Koelpin, Alexander Petrov

Hamburg University of Technology (Germany)

In this paper, we study how a cylindrical shell made from a radially anisotropic material can modify the electric field inside an isotropic core, either by enhancing or suppressing it. We present a water-air metamaterial that enhances electric fields by 10 dB across a broad frequency range.

P4: Metamaterial Two-Sphere Newton's Cradle

Simon Pope¹, Oliver Wright²

¹University of Sheffield (United Kingdom), ²Hokkaido University (Japan)

We show that the collision dynamics of two pendulum-suspended mass-in-mass resonators, essentially a two sphere ("meta-atom") Newton's cradle can be described using effective parameters. These effective parameters can assume non-conventional values compared to their conventional counterparts. This work paves the way for the development of new collision-based metamaterial structures.

P5: Influence Of The Plasmonic Lattice Kerker Effect On Second-harmonic Generation

Sergejs Boroviks, Benjamin Syriam Garcia, Olivier Martin

École Polytechnique Fédérale de Lausanne (EPFL) (Switzerland)

We study the Kerker effect associated with the excitation of multipolar surface lattice resonance and its influence on nonlinear optical response. Observing that appearance of the Kerker effect is associated the strong absorption, we show that it diminishes second-harmonic generation despite strong near-field enhancement.

P6: Single-shot Optical Imaging Of Plasmonic Nanoparticles: Orientation, Polarization Anisotropy, Aspect Ratio

Petr Bouchal¹, P. Dvorak¹, Martin Hrtoň¹, Katarína Rovenská¹, Vlastimil Křápek¹, Radim Chmelík¹, Tomáš Šikola¹, Zdeněk Bouchal²

¹Brno University of Technology (Czech Republic), ²Palacky University (Czech Republic)

We demonstrate single-shot wide-field optical imaging of plasmonic nanoparticles visualizing their orientation and aspect ratio, in conventional far-field methods hidden below the diffraction limit. The capability of

the method is demonstrated in the time-resolved imaging of the electrophoretic deposition process or the Brownian motion imaging using plasmonic nanorods.

P7: Optical Biosensor For Rapid Detection Of Medical Biomarkers Based On Bound States In The Continuum

Magdalena Zadura¹, Weronika Glowadzka¹, Karolina Bogdanowicz¹, Piotr Polak¹, Joanna Jankowska-Śliwińska¹, Kamil Kosiel¹, Krzysztof Piskorski¹, Marek Ekielski¹, Tomasz Czystanowski², Anna Szerling¹

¹Lukasiewicz - IMIF (Poland), ²Lodz University of Technology (Poland)

We present an optical biosensor for detecting the S protein of COVID-19. Based on a low-refractive-index contrast subwavelength grating, we employ Fano resonance for high-sensitivity detection. The platform, fabricated using E-beam lithography and plasma etching, can be adapted for various biomarkers, including cancer-related proteins and pathogens.

P8: Submicron Periodic Structures In Metal Oxide Thin Film Via Laser Ablation And Thermal Oxidation

Julianija Nikitina¹, Simonas Indrišius², Tomas Tolenis¹, Mindaugas Andrulevičius¹, Lukas Ramalis¹, Lina Grinevičiūtė¹

¹Center For Physical Sciences and Technology (Lithuania), ²Kaunas University of Technology (Lithuania)

Direct laser interference patterning of metal layer followed by thermal oxidation for the fabrication of fully inorganic transparent submicron periodic structures, avoiding complexities of direct patterning of dielectric materials.

P9: Angle Independent Enhancing And Diminishing Metasurface With Susceptibility-driven Inverse Design

Sandeep Yadav Golla, Jian Cao, Sarah Salhi, Paula Nuño Ruano, Carlso Alonso-Ramos, Daniele Melati
Université Paris-Saclay (France)

This study presents metasurfaces for angle independent enhancement and diminution, designed and fabricated using analytical target phases derived from susceptibilities via generalized sheet transition conditions. Electric field and far-field simulated results demonstrate precise doubling/halving of angular patterns even at extreme angles, enabling applications in beam shaping and steering.

P10: Computing Metalens Array For Programmable Quantum Algorithms And Complex-to-complex Discrete Fourier Transform

Randy Stefan Tanuwijaya, So Lap, Wai Chun Wong, Tailin An, Wing Yim Tam, Jensen Li

The Hong Kong University of Science and Technology (Hong Kong)

Photonic computing offers a promising platform for accelerating highly parallel tasks, including neural networks. We present a computing metalens array scheme for programmable quantum algorithms and complex-to-complex DFT. The scheme incorporates error correction through multi-focal point focusing and phase reconstruction. Experimental results demonstrate accuracy with random inputs amplitude and phase.

P11: Fabrication Of Bound States In The Continuum Laser Cavity Compatible With Standard Semiconductor Technology

Karolina Bogdanowicz¹, Laura Stanco¹, Weronika Glowadzka¹, Tomasz Fas², Jan Suffczynski², Marek Ekielski¹, Jan Muszalski¹, Tomasz Czystanowski¹, Anna Szerling¹

¹Lodz University of Technology (Poland), ²University of Warsaw (Poland)

The work demonstrates fabrication of the laser cavity with broken symmetry based on bound states in the continuum (BICs). A fabrication process for a 1D dielectric grating was developed to realize a newly designed cavity, achieving a mechanically stable laser, manufactured using standard semiconductor technology.

P12: Silicon Nanoparticle Arrays for Studies on Colloidal WS₂ Nanosheets

Melanie Sommer, Markus Fröhlich, Lukas Lang, P. Christian Simo, Jannika Lauth, Monika Fleischer
University of Tübingen (Germany)

Silicon nanoantennas have gathered a lot of interest in recent years because of their ability to manipulate light on the nanoscale with simultaneous excellent CMOS compatibility. Here we investigate their properties aiming to enhance the photoluminescence of colloidal WS₂ nanosheets, fabricated by a wet-chemical synthesis.

P13: A Surface Integral Equation With Bianisotropic Impedance Boundary Conditions For Simulation Of Acoustic Metasurfaces

Junze Shao¹, Rui Chen², Hakan Bagci¹

¹KAUST (Saudi Arabia), ²Nanjing University of Science and Technology (China)

A surface integral equation with bianisotropic impedance boundary conditions is formulated and numerically solved using a Nystrom method for simulation of acoustic metasurfaces. An acoustic splitter is simulated using the proposed method. Simulation results agree very well with analytic results demonstrating the method's validity and accuracy.

P14: Incoherent Digital Holography Using Multilayer Metasurfaces For Zeroth-order-light-free Recording

Teruyoshi Nobukawa, Ryo Higashida, Koki Imamura, Yasutaka Maeda, Kei Hagiwara

Japan Broadcasting Corporation (Japan)

We propose and experimentally demonstrate an incoherent digital holography (IDH) system using multilayer metasurfaces. Unlike conventional IDH systems using a geometric-phase metalens, which suffer from noise caused by the zeroth-order light of the metalens, our proposed system exhibits exceptional robustness to such noise owing to its multilayer geometry.

P15: Circularly Polarized Photoluminescence In Tm₂/Tm₂S₂ Heterostructures

María Teresa López Carrasco¹, Daniel Vaquero Monte¹, Maxen Natanael Colin Ganesh Cosset-Chéneau¹, Cao Van Phuoc², Jeong Jong-Ryul², Marcos H.D. Guimarães¹

¹Zernike Institute of Advance Materials (The Netherlands), ²Chungnam National University (Korea)

Next-generation communication technologies require miniaturization and more energy-efficient devices. Two-dimensional materials provide a promising platform for advancing atomic-scale applications. Here, we demonstrate control of circularly polarized photoluminescence in a WS₂ monolayer placed on thulium iron garnet substrate under linearly polarized excitation by switching the magnetization direction.

P16: Spatio-spectral Fission Through Time-varying Layers

Wallace Jaffray¹, Sven Stengel¹, Fabio Biancalana¹, Colton Fruhling², Mustafa Ozlu², Michael Scalora³, Alexandra Boltasseva², Vladimir Shalae², Marcello Ferrera¹

¹Heriot-Watt University (United Kingdom), ²Purdue University (USA), ³Redstone Arsenal Aviation and Missile Center (USA)

Transparent conducting oxides are highly-doped semiconductors exhibiting remarkable nonlinear optical properties in the near-infrared spectrum—a feature previously overlooked despite their long-standing application in photovoltaics and touchscreens. Here we report the spatio-spectral fission of an ultra-fast pulse trespassing a thin film of aluminium zinc oxide with a non-stationary refractive index.

P17: Development Of A New Reconfigurable Nanophotonic Platform Based On Spin Modulation

Lucas Mascaro-Burguera¹, Jorge Parra¹, Ramon Torres-Cavanillas², Teresa Mengual¹, Luis Manuel Mañez-Espina¹, Pablo Sanchis¹, Ana Díaz-Rubio¹, Elena Pinilla-Cienfuegos¹

¹Universitat Politècnica de Valencia (Spain), ²Universitat de Valencia (Spain)

Reconfigurable integrated photonic devices rely on phase-change materials for their ability to transition between states with distinct optical properties under external stimuli. In this work, we present a novel reconfigurable photonic switch that operates at room temperature, utilizing integrated spin crossover nanoparticles to enable efficient, reversible switching with enhanced performance.

P18: Canalized Light Creates Directional And Switchable Surface Structures In Vanadium Dioxide

Daniel Kazenwadel, Noel Neathery, Peter Baum

University of Konstanz (Germany)

We create self-organized, re-writable, laser-induced periodic surface structures in single-crystalline vanadium dioxide. We discover anisotropic features from canalized surface plasmon polaritons that can only propagate along one crystal axis. All nanostructures remain mostly single-crystalline and preserve the material's sharp metal-to-insulator transition, enabling femtosecond switching by temperature or light.

P19: Enhanced Chiral Sensing In Epsilon-near-zero metamaterials

Ashis Paul¹, Matteo Venturi¹, Raju Adhikary¹, Leone di Mauro Villari¹, Giovanna Salvitti¹, Carino Ferrante², Davide Tedeschi¹, Francesco Di Stasio³, Andrea Toma³, Hatice Altug⁴, Andrea Marini¹

¹University of L'Aquila (Italy), ²CNR-SPIN (Italy), ³Istituto Italiano di Tecnologia (Italy), ⁴Ecole polytechnique fédérale de Lausanne (EPFL) (Switzerland)

We report enhanced optical activity in the epsilon-near-zero regime in a chiral metamaterial composed of metallic nanospheres randomly dispersed in a chiral drug solution. Our results are relevant for developing innovative devices capable of detecting the chirality of low-volume samples with applications in nanomedicine and pharmaceuticals.

P20: Discrete Multilevel Metasurfaces For Absorbers And Antireflective Layers

Mihai Kusko, Cristian Kusko

IMT Bucharest (Romania)

We numerically investigate dielectric nonresonant metasurfaces consisting in periodic arrays of blocks with different sizes and heights placed one on the top of the other. By adjusting the features of the blocks one can find enhanced functionalities of these metasurfaces such as absorbers or antireflecting layers.

P21: Emitting Properties Of A-si:c:h- Coated 2d-opaline Photonic Crystals

Sergey Pavlov¹, Mikhail Bochkarev², Sergey Dyakov³, Valery Golubev¹, Sergey Grudinkin¹, Mikhail Limonov², Alexander Pevtsov¹

¹Ioffe Institute (Russia), ²ITMO University (Russia), ³Skolkovo Institute of Science and Technology (Russia)

Two-dimensional photonic crystals are fabricated from opal slabs coated with an a-Si:C:H emitting layer. The optical response of the emitting 2D PhC's near Γ -point of the Brillouin zone have been studied. A significant increase in the luminescence intensity in the visible spectral range has been demonstrated in the synthesized structures.

P22: Physics of Low-loss Phase Change Material (Sb₂Se₃) Enabled Nanophotonic Metasurface

Priya Deoli, Otto Muskens, Ioannis Zeimpekis, Kai Sun

University Of Southampton (United Kingdom)

This research aims to develop an active, continuously reconfigurable metasurface by integrating a low-loss chalcogenide phase-change material, Antimony Selenide (Sb₂Se₃), with a Silicon dielectric metasurface. The objective is to create a metasurface that can modulate various aspects of light, including amplitude modulation, comprehensive 2π phase control and dynamic optical switching.

P23: Topology Optimization Of Blazed Metasurfaces For High-efficiency Spectrographs

Simon Ans¹, Frédéric Zamkotsian², Guillaume Demésy³, Quentin Tanguy⁴, Roland Salut⁴, Andrei Mursa⁴, Nicolas Passilly⁴

¹CNRS - LAM - Fresnel (France), ²CNRS - LAM (France), ³CNRS - Fresnel (France), ⁴CNRS - FEMTO-ST (France)

By benchmarking two Topology Optimization (TO) strategies, a metasurface grating is presented, developed using a 3D Finite Element model based on open-source softwares. It exhibits nearly 60 % of average diffraction efficiency on the -1st diffraction order in reflection 400 and 1500 nm.

P24: Anapole Response With Polarization-independent Properties Of A Trimer-based dielectric Metasurface

Andrey Evlyukhin¹, Vladimir Tuz²

¹Leibniz University Hannover (Germany), ²Jilin University (Ukraine)

Features of anapole state occurrence in a dielectric metasurface formed by trimer-based clusters (meta-atoms) have been revealed. Manifestation of anapole has been found in near-field distribution and wave transmission and reflection properties by a trimer-based metasurface.

P25: Spin Valley Topological Photonics

Ekta -, Brijesh Kumar, Abhishek Kumar, Anshuman Kumar

IIT BOMBAY (India)

This research focuses on the design and fabrication of topological photonic crystals (TPCs) using Electron Beam Lithography (EBL). Through Fourier imaging and COMSOL simulations, the study investigates the topologically protected waveguiding properties, highlighting the robustness of TPCs to defects and their potential for efficient, reliable optical applications.

P26: Modeling Microstructured Optical Fibers Using Boundary Element Method

Marc Amour Ayela¹, Jean-René Poirier¹, Frederic Surre², Han Cheng Seat¹

¹Université de Toulouse (France), ²University of Glasgow (United Kingdom)

We use the boundary element method to analyze the propagation modes and distribution of the electromagnetic field in microstructured optical fibers. We focus on the proportion of the field located in an outer corona surrounding the air holes, a key region for fiber optic sensor engineering.

P27: Electromagnetically Induced Transparency And Lasing Without Inversion In Chiral Molecules
Somasree Pal¹, Ambaresh Sahoo¹, Raju Adhikary¹, Matteo Venturi¹, Giovanna Salvitti¹, Carino Ferrante², Davide Tedeschi¹, Paola Benassi³, Massimiliano Aschi¹, Andrea Marini¹

¹University Of L'Aquila (Italy), ²CNR SPIN (Italy), ³University Of L'Aquila, CNR SPIN (Italy)

We study how molecular chirality influences electromagnetically induced transparency and lasing without inversion, revealing key chiroptical effects and quantum coherence phenomena. These insights are essential for advancing spectroscopic techniques, improving the detection and characterization of chiral molecules, and enhancing applications in quantum optics and molecular spectroscopy.

P28: A Simplified Approach To 3d Spherical Cloaking Using Shell Based Dielectric Metamaterials
Guan Wen Chen, Jing-Hao Huang, He-Jun Ren, Tsung-Yu Huang

Ming Chi University of Technology (Taiwan)

We propose a 3D spherical reciprocal invisibility cloak using shell-based dielectric metamaterials, minimizing scattering and ensuring effective concealment. The cloak operates from 2.8 to 4.33 GHz with 1.63 GHz bandwidth, offering simpler design, broader bandwidth, and improved fabrication feasibility for transformation optics applications.

P29: Neural Network Surrogate For Monte Carlo Prediction Of Radiative Properties In Nanoparticle-embedded Layers

Fahime Seyedheydari, Kevin Conley, Simo Särkkä

Aalto University (Finland)

This paper presents a data-driven neural network-based surrogate model to reduce the computational cost of Monte Carlo simulations for radiative transfer in scattering media. The model integrates neural networks with Mie theory to predict optical properties efficiently. The results suggest a strong ability to predict unseen data.

P30: Efficient Lookup Table Computation For The Design Of Metalenses Leveraging Propagation Phase

Andrea Locatelli, Marco Gandolfi, Davide Rocco, Olga Sergaeva, Costantino De Angelis

University of Brescia (Italy)

We introduce an efficient technique to accelerate the computation of lookup tables for the design of metalenses leveraging propagation phase. Our approach determines the phase imposed by each meta-atom through an analysis of the modal properties of a uniform waveguide array cross section.

16:40 - 19:00 — Torremolinos

Session 2A26

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Takashige Omatsu

16:40 : Keynote talk

A Large Language Model Agent for Autonomous Inverse Metamaterial Design

Willie Padilla, D. Lu, J. M. Malof

Duke University (USA)

An agentic framework consists of large language models coordinating the completion of complex tasks and have recently shown novel results. We propose and demonstrate an agentic system capable of the inverse design of a material which achieves a desired spectra. The future of this rapidly growing field is discussed.

17:10 : Keynote talk**Non-Normality, Pseudospectra and Exponential Sensitivity****Konstantinos Makris***University of Crete (Greece)*

In the context of non-Hermitian photonics, we present recent results regarding non-normal optical waveguides. We investigate photonic lattices with gain/loss, as well as, asymmetric couplings and study their spectral and dynamical response based on pseudospectra theory. The recent notions of exponential sensitivity, and power eigenchannels will be also discussed.

17:40 : Invited talk**Nonlocal metasurfaces and thin film devices for all-optical image processing and phase contrast imaging****Ann Roberts***The University of Melbourne (Australia)*

Metasurfaces and tailored thin film devices can manipulate images and extract information from optical fields in the object plane, leading to a significant reduction in size compared to other optical approaches. Here recent progress in extending and utilizing the range of information obtainable using these devices will be presented.

18:00 : Invited talk**Plasmonic Sensing On Nanofibers For In Vivo Protein Measurement In The Brain****Jean-Francois Masson, M. H. Jodaylami***Université de Montréal (Canada)*

The optical properties of nanofibers show a combination of resonator modes and lensing effect that enhances plasmonic enhancement. This presentation will detail these optical effects and show the application of nanofibers for monitoring proteins in brain tissue using surface-enhanced Raman scattering and its translation to in vivo measurement.

18:20 : Invited talk**Metasurface with gap and collective surface plasmon modes****Anatoliy Pinchuk¹, Yeshchenko Oleg²**¹University of Colorado (USA), ²Taras Shevchenko National University of Kyiv (Ukraine)

A tunable metasurface, constructed from a monolayer of gold nanoparticles on a glass substrate positioned in close proximity to a thin aluminum film, was studied both numerically and experimentally. Three distinct peaks, dependent on angle and polarization, were observed in the metasurface's extinction spectra.

18:40 : Invited talk**Broadband Third Harmonic Generation Through Strong Coupling Between All-dielectric Metasurfaces And Epsilon-near-zero Materials****Hui-Hsin Hsiao***National Taiwan University (Taiwan)*

A hybrid metasurface, consisting of amorphous silicon nanocubes with a drilled hole on an ultrathin indium tin oxide film, is designed to explore the coupling among Mie resonance, quasi-bound states in the continuum, and the bulk-plasma mode, as well as their impact on third-harmonic generation.

16:40 - 18:40 — Alamos**Session 2A27****Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy**

Organized by: Jerome Plain, Alexander Govorov, Davy Gerard and Pedro Hernandez Martinez

Chaired by: Dongling Ma and Alexander Govorov

16:40 : Invited talk

Chiro-optical Microscopy Of Plasmonic Materials And Chiral Near-field Interaction With Molecules And Materials

Hiromi Okamoto, Shun Hashiyada, Hyo-Yong Ahn, Junsuke Yamanishi

Institute for Molecular Science (Japan)

We demonstrate here microscopic and nanoscopic imaging of chiral optical fields with far-field CD microscopy, near-field polarimetry, and chiro-photoinduced force microscopy for plasmonic materials, and near-field chiral plasmon-matter interaction phenomena.

17:00 : Invited talk

Chiral Photochemical Amplification In Mesoporous Plasmonic Shurikens Demonstrating Asymmetric Catalysis

Olga Guselnikova¹, Pavel Postnikov², Markus Valtiner³, Jonathan P. Hill¹, Joel Henzie¹, Daniel T. Payne¹, Martin Kartau⁴, Iliyana Samardzhieva⁴, George Lefroy Brookes⁴, Malcolm Kadodwala⁴, Alexander O. Govorov⁵, Affar S. Karimullah⁴, Yusuke Yamauchi⁶

¹TU Wien (Austria), ²Tomsk Polytechnic University (Russia), ³Vienna University of Technology (Austria), ⁴University of Glasgow (United Kingdom), ⁵Ohio University (USA), ⁶Nagoya University (Japan)

We demonstrate enantioselective photocleavage exceeding circularly polarized light using chiral plasmonic shurikens with mesoporous gold. Optimized chiral near-fields enhance interactions for spectroscopy and catalysis, achieving 2-3 times higher R/S-metalaxyl photolysis rates and >25 % enantiomeric excess, marking the first proof of chiral plasmonic catalysis via superchiral fields.

17:20 : Invited talk

From Symmetry to Chirality: Near-Field Optical Activity in Achiral Gold Nanoparticles

Minyu Chen¹, Thinhinane Aoudjit¹, Baozhong Deng², Yuqing Zhao³, Ali Issa³, Sylvie Marguet⁴, Davy Gerard³, Lucas Vázquez Besteiro⁵, Safi Jradi³, Bin Wei², Alexander Govorov⁶, Tao Xu², Renaud Bachelot¹

¹Université de Technologie de Troyes (France), ²Shanghai University (China), ³University of Technology of Troyes (France), ⁴Université Paris Saclay (France), ⁵University of Vigo (Spain), ⁶Ohio University (USA)

Chirality is essential in light-matter interactions, traditionally studied in chiral structures with chiral light. This work demonstrates that C_{3v}-symmetric achiral gold nanotriangles exhibit chiral near-field distributions under linearly polarized light, arising from anisotropic plasmonic responses. Using near-field-assisted two-photon polymerization, we visualize and structurally manifest these effects, exploring their wavelength dependence.

17:40 : Invited talk

Photocatalytic hydrogen evolution with plasmonic and photonic nanomaterials

Alberto Naldoni

University of Turin (Italy)

Plasmonic and photonic nanomaterials have emerged as promising platforms for transducing solar into chemical energy. In this contribution, I will present our research on hydrogen evolution driven by plasmonic and photonic photocatalysts. These catalysts leverage heat, hot electrons, or nanoscale coupling effects to drive chemical reactions relevant to energy applications.

18:00 : Invited talk

Plasmonic Materials for Healthcare and Solar Energy Harvesting Applications

Fang Xie

Imperial College London (United Kingdom)

Novel plasmonic nanostructures developed in our group can serve as powerful fluorescence enhancers and boost solar energy harvesting. In this talk, I will present plasmonic materials for healthcare applications using Metal-Enhanced Fluorescence. Additionally, the role of plasmonic nanoparticles in enhancing photoelectrochemical water splitting will be discussed.

18:20 : Invited talk

Pancake Meta-photonics: Stacking Layers To Prepare Quasi-3d Metasurfaces

Shunsuke Murai

Kyoto University (Japan)

A general approach to prepare 3D metasurfaces by stacking metasurface layers will be proposed. Bilayer metasurfaces prepared by nanoantenna stickers on another nanoantenna are exhibited as preliminary examples.

16:40 - 19:00 — Playamar

Session 2A28

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Maria Kafesaki

16:40 : **Invited talk****Two-color Laser Driven Novel Phenomena In Solids: Detection Of Symmetries And Control Of Photo-current****Masahiro Sato, Minoru Kanega, Mina Udon***Chiba University (Japan)*

We theoretically explore novel nonlinear responses of materials to two-color lasers, mixed waves of two different lasers. We show that (a) two-color-laser driven harmonic generation is useful to detect symmetries in quantum magnets and (b) the photocurrent in graphene can be controlled by tuning the laser intensity, ellipticity, and phase.

17:00 : **Invited talk****Uv-plasmonics For Surface-enhanced Spectroscopies****Bjoern Reinhard***Boston University (USA)*

Aluminum (Al) nanostructures provide tunable plasmon resonances in the UV, which makes Al nanostructures interesting antennas for applications in surface-enhanced chiroptical spectroscopies. In this presentation scalable fabrication strategies for Al nanoparticles are investigated and the wavelength-dependent circular dichroism signal of Al nanostructures embedded in a chiral molecular film is examined.

17:20 : **Invited talk****Helicity-dependent Optical Control Of The Magnetization Emerging From The Zeeman Energy****Amir Capua***The Hebrew University of Jerusalem (Israel)*

Typically, the magnetic component of the optical radiation is neglected when considering light-matter interactions. Here, we show that by simply accounting for the Zeeman energy of the magnetic component of the EM radiation, an optically induced torque emerges, influencing the magnetization state.

17:40 : **Invited talk****Observation Of Large Nonreciprocal Propagation Constants In Zero-index Magneto-optical Meta-waveguides****Yucong Yang¹, Yueyang Liu², Yang Li², Lei Bi¹**¹*University of Electronic Science and Technology of China (China)*, ²*Tsinghua University (China)*

We report observation of giant nonreciprocal phase shift (NRPS) and nonreciprocal loss (NRL) effects in magneto-optical(MO) zero-index metawaveguides (MZIMs). One order of magnitude enhancement of NRPS and NRL in MZIMs is observed at both microwave and optical frequencies, which agree well with both effective medium and photonic band theories.

18:00 : **Invited talk****Extreme Light Manipulation: Hyperbolic Plasmon Polaritons And Subcycle Orbitalangular Momentum Control****Antonio Ambrosio***Istituto Italiano di Tecnologia (Italy)*

This research explores two extreme light manipulation phenomena: hyperbolic plasmon polaritons in van der Waals materials and ultrafast modulations with subcycle control of orbital angular momentum. By confining light beyond the diffraction limit and dynamically modulating its properties on femtosecond timescales, we enable new frontiers in nanophotonics.

18:20 : Invited talk**Emergent Chirality, Antiskyrmions And Bloch Skyrmions In Ferroelectrics****Jiri Hlinka***Czech Academy of Science (Czech Republic)*

The talk is summarizing symmetry aspects of magnetic and structural skyrmion defects and phases in ferroelectric crystals and relationships to the species of macroscopic chiral symmetry breaking.

18:40 : Invited talk**Ultrafast Tacos****J. Terentjevas, P. Vindel-Zandbergen, L. Rego, F. Morales, A. Ordóñez, O. Smirnova, David Ayuso***Imperial College London (United Kingdom)*

We bring together the advantages of terahertz and optical spectroscopies to introduce TACOS (Terahertz-Assisted Chiro-Optical Spectroscopy), a novel approach for ultrafast and highly efficient imaging of molecular chirality. TACOS relies on driving nonlinear electronic dynamics with terahertz and few-cycle optical pulses, but it does not require optical carrier-envelope phase stability.

16:40 - 18:55 — Bajondillo**Session 2A29****Symposium III: Advanced passive and active metasurfaces**

Organized by: Howard Lee, Pin-Chieh Wu and Wen-Hui (Sophia) Cheng

Chaired by: Howard Lee and Pin-Chieh Wu

16:40 : Invited talk**Active And Dynamic Optical Phase Gradient Metasurfaces Enabled By Resonant Nanophotonics And Electro-Optic Materials****David Barton¹, Sahil Dagli², Sina Abedini Dereshgi¹, Jennifer Dionne³**¹Northwestern University (USA), ²Stanford University (USA), ³USA (USA)

Tunable subwavelength metasurfaces will enable low energy consumption and compact computing, communications, and sensing devices. Towards this, we will discuss our work leveraging electro-optics and high quality factor nanoantennas to demonstrate high efficiency phase gradient modulators operating at GHz speeds.

17:00 : Invited talk**Dynamic Ir Beam Steering And Switching With Active Metasurfaces****Min Seok Jang***KAIST (Korea)*

This presentation reports our recent works on dynamic infrared beam steering and switching based on active metasurfaces. Full 2π phase-only transmission modulation, single-gate beam switching, and thermal emission steering will be discussed.

17:20 : Invited talk**Towards Tunable Metamaterial-based Torque Sensing****Michael Töfferl, Alexander Schossmann, Maximilian Saiko, Peter Banzer, Alexander Bergmann***Graz University of Technology (Austria)*

We show the potential application of tunable metamaterials in torque sensing systems. Our concept comprises broad-side coupled split-ring resonators as passive sensor components and state-of-the-art millimeter wave transceiver for read-out. We provide a proof-of-concept demonstration for torque measurements on a fixed shaft.

17:40 : Invited talk**Electrochemically Active Mid-ir Metasurfaces Based On Conjugated Polymers****Po-Chun Hsu**

University of Chicago (USA)

Electrochemistry can introduce substantial optical property change reversibly and efficiently, making it a promising tool for active metasurfaces. This talk will discuss our recent progress in co-designing hierarchical structures, charge transport properties, and optical cavities of conjugated polymers for mid-IR active metasurface with high performance and functionality.

18:00 : Invited talk

Nonlocal Metalens For Far-field Label-free Super-resolution Imaging

Bohan Zhang, Yuanmu Yang

Tsinghua University (China)

We introduce an alternative approach to far-field, label-free super-resolution imaging that surpasses the diffraction limit by breaking the fundamental shift-invariance assumption of conventional imaging systems.

18:20 : Invited talk

Highly Confined, Low-Loss Infrared Phonon Polaritons In Perovskite Oxide Membranes

Yin Liu

North Carolina State University (USA)

Phonon polaritons (PhPs) enable light confinement and field enhancement, which are essential for various photonic and thermal applications. Here we demonstrate infrared low-loss, highly confined, thickness-tunable PhPs within transferable free-standing SrTiO₃ membranes synthesized through a scalable approach, achieving high propagation merits comparable to the record values from the vdW materials.

18:40 : Addressing The Challenge Of Phase-only Dynamic Modulation Of Transmissive Metasurfaces

Juyoung Kim¹, Ruzan Sokhoyan², Harry Atwater², Min Seok Jang¹

¹Korea Advanced Institute of Science and Technology (Korea), ²California Institute of Technology (USA)

Dynamic phase-only modulation in transmissive metasurfaces is instrumental to on-chip photonic applications, but has been elusive due to the zero-transmission dip in two-port, single-resonance systems. We show that by introducing diffraction ports this issue is circumvented, and demonstrate a proof-of-concept metasurface with around 300° phase modulation with almost constant amplitude.

16:40 - 19:10 — Carihuela

Session 2A30

Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and Noé Jiménez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

16:40 : Invited talk

Acoustic And Mechanical Features Of Polymer Colloidal Crystals – Brillouin Spectroscopy Studies

Bartłomiej Graczykowski

Adam Mickiewicz University Poznan (Poland)

Colloidal crystals (CCs) of polymer nanoparticles exhibit tunable acoustic and mechanical properties but are often brittle. Using Brillouin light scattering, we study GHz sound filtering and elasticity mapping in 2D and 3D CCs. We also demonstrate a supercritical fluid-based cold soldering method to enhance CCs robustness while preserving periodicity.

17:00 : Invited talk

Locally Resonant Elastic Metagratings: Theory, Experiment, And Applications

Liyun Cao¹, Y. -F. Wang¹, B. Assouar², Y. -S. Wang¹

¹Tianjin University (China), ²Université de Lorraine (China)

This report introduces the concept of Locally Resonant Elastic Metagrating (LREM), a new paradigm for effi-

cient, compact, and lightweight wave manipulation in elastic wave systems. By combining elastic impedance modulation and hybridization of evanescent waves, LREM overcomes size limitations and challenges posed by vibration modes in traditional metastructures.

17:20 : Keynote talk

Keynote Talk of Marco Miniaci

Marco Miniaci

Université de Lille (France)

TBA.

17:50 : Invited talk

Applications Of Mechanical Metamaterials In Microsystems: Challenges And Perspectives

Valentina Zega

Politecnico di Milano (Italy)

Mechanical metamaterials, thanks to their exceptional properties, are entering the world of microsystems as valid solutions for the increasing request of better performances at reduced power-consumption, footprint and costs. Here, an overview of the main results achieved on the topic are reported together with the main challenges and perspectives.

18:10 : Invited talk

A Non-diffracting Resonant Angular Filter

Tristan Lawrie¹, Gregor Tanner¹, Gregory Chaplain²

¹*University of Nottingham (United Kingdom)*, ²*Exeter University (United Kingdom)*

We conceptualise and numerically simulate a resonant metamaterial interface incorporating non-local, or beyond nearest neighbour, coupling that acts as a discrete angular filter. It can be designed to yield perfect transmission at customizable angles of incidence, without diffraction, allowing for tailored transmission in arbitrarily narrow wavenumber windows.

18:30 : Invited talk

Developing Active Acoustic Metamaterials Using Magneto-rheological Fluids

Richard Watson

University of Warwick (United Kingdom)

Active acoustic metamaterials are being developed through incorporation of magneto-rheological fluids to allow control of fluid/ metamaterial structure interactions and provide active control of metamaterial systems. Investigation of Magneto-rheological fluids, non-magnetic phononic crystals and their acoustic properties has been undertaken with locally manufactured magnetic field generation systems.

18:50 : Invited talk

Luneburg Lens for Surface Water Waves

S. M. Kuznetsova¹, V. F. dal Poggetto¹, M. Mazzotti¹, M. Onorato², V. Pagneux³, M. Miniaci¹

¹*Université de Lille (France)*, ²*Università degli Studi di Torino (Italy)*, ³*Université du Mans (France)*

Focusing of surface water waves is investigated using an analog of a Luneburg lens constructed by submerged pillars. Efficient focusing is observed on a wide range of frequencies. The results may find application in the ocean-human interaction, such as coastal protection.

16:40 - 18:20 — Montemar

Session 2A31

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: David Grosso

16:40 : Invited talk

Precision Fabrication Of Nanoscopic Europium Emitters utilizing Electron Beam Lithography

Marijn Rikers¹, Ayesheh Bashiri¹, Ángela Barreda², Michael Steinert¹, Duk-Yong Choi³, Thomas Pertsch¹, Isabelle Staude¹

¹Friederich-Schiller-University Jena (Germany), ²University Carlos III of Madrid (Spain), ³Australian National University (Australia)

A new method for fabricating fluorescent nanostructures with defined magnetic dipolar transitions is presented. Electron beam lithography exposes a negative tone resist embedded with Europium complexes, achieving emitter diameters as small as 80 nm, which facilitates investigations of magnetic local density of optical states in nanophotonics.

17:00 : Invited talk

Controlled Electrophoretic Deposition Of Nanoparticle Films And Their Applications In Light Emitting Diodes

Ning Liu, Anthony Mullen, Lin Lyu, Yongliang Zhang, Nandita Biswas, Kevin M. Ryan

University of Limerick (Ireland)

Electrophoretic deposition provides a feasible route to form closely packed, crack-free nanoparticle thin films as the emissive layer in a LED device. Herein, we present a method to monitor the film growth in real time and obtain information on film thickness and morphology without resorting to advanced microscopy techniques.

17:20 : Invited talk

Ultrafast Manipulation Of Collective Modes Via Chiral Fermions In A Charge Density Wave Weyl Semimetal

L. Cheng, Z. X. Wei, Y. G. Yao, Jingbo Qi

University of Electronic Science and Technology of China (China)

In Weyl semimetal (TaSe₄)₂I, excitation of femtosecond optical pulses induces terahertz emission in the CDW state, arising from contributions of ultrafast photocurrent and various collective modes. Due to topologically non-trivial linear bands, we discover that properties of the collective modes at low temperatures can be manipulated with an ultrafast manner.

17:40 : Invited talk

Heterostructured Photonic Media For Phz Optoelectronics Applications

Václav Hanus, Beatrix Fehér, Peter Dombi

HUN-REN Wigner Research Centre for Physics (Hungary)

We demonstrate an optical chip with which one can induce the transient metallization of dielectrics with pJ-level femtosecond laser pulses in micron-sized gaps between electrodes. Because of the ultrafast and reversible nature of the current generation process, our device paves the way toward PHz optoelectronics applications.

18:00 : Invited talk

Modifying Perovskite Solar Cell Architecture To Limit The Effective Radiative Recombination To Enhance The Open Circuit Voltage

Martina D'Andrea, R. Runjun, F. Bernal-Texca, Jordi Martorell

ICFO (Spain)

We provide experimental evidence that an effective radiative recombination of complete perovskite cells can be larger than 10 % of the total direct recombination. The design and fabrication of nano-structures which are effective in limiting radiative recombination and raising the open circuit voltage without significantly altering sunlight absorption will be discussed.

16:40 - 18:35 — Litoral

Session 2A32

Chiral fields and ultrafast chiral spectroscopy

Organized by: Jamal Berakdar

Chaired by: Jamal Berakdar

16:40 : **Invited talk****Utilization Of Strong Chiro-optical Field Near Chiral And Achiral Plasmonic Nanostructure: Chiral Emission And Photofabrication****Hyo-Yong Ahn, Junsuke Yamanishi, Hiromi Okamoto***Institute for Molecular Science (Japan)*

We developed methods to utilize the chiro-optical field of plasmonic nanostructures. Chiral emission with high luminescence dissymmetry was generated from the chiral nanoparticle, and chiral structures were photofabricated by using the chiro-optical interaction of achiral nanoparticle with circularly polarized light.

17:00 : **Invited talk****Chiral Stark shift - tweezing molecules in enantiofashion****Robert M Jones¹, Nicola Mayer¹, Serguei Patchkovskii², Emilio Pisanty¹, Margarita Khokhlova¹**¹King's College London (United Kingdom), ²Max Born Institute (Germany)

We present an experimentally realisable scheme for all-electric dipole trapping of chiral molecules in an enantioselective fashion. Our theory shows that light with chirality structured in time induces a chiral Stark shift resulting in trapping of the chosen enantiomer in the laser beam, while the other enantiomer is shaken away.

17:20 : **Invited talk****Knotted topologies in the polarization state of bichromatic light****Emilio Pisanty***King's College London (United Kingdom)*

I will present recent work on the fundamental polarization singularities available to polychromatic light. The presence of multiple colours, coherent with each other, allows light to have higher-order internal symmetries, which permits new topologies, and new conserved quantities, as well as novel optical singularities.

17:40 : **Invited talk****Deep Learning and Nano-optics: Designing nanoscale polaritonic effects in twisted chiral multilayers of vdW materials****L.F. Álvarez-Tomillo***University of Oviedo (Spain)*

This talk builds on recent advances in hyperbolic nanooptics, introducing a neural-network-based approach to design phonon polariton propagation in twisted multilayers. We achieve on-demand control—including canalization and bi-canalization—in previously unexplored frequency ranges, demonstrating a powerful strategy for tailoring light–matter interactions at the nanoscale.

18:00 : **Invited talk****Chiral Far-field Signature Of Single Achiral Gold Nano-antennas****Annika Mildner¹, Andreas Horrer², Patrizia Weiss¹, Simon Dickreuter¹, Christian Simo¹, Davy Gérard³, Dieter P. Kern¹, Monika Fleischer¹**¹University of Tübingen (Germany), ²University of Technology of Troyes (Germany), ³University of Technology of Troyes (France)

Optical chirality is most commonly associated with geometrically chiral nanostructures. By spectrally analyzing single planar achiral nanostructures with two dipolar plasmonic resonances, it can be shown that the polarization state of the emitted light is determined by chiral near-fields, leading to a chiroptical far-field response.

18:20 : **Enantiosensitive Exceptional Points For Exceptional Detection Of Molecular Chirality****Nicola Mayer¹, Alexander Löhr², Nimrod Moiseyev³, Misha Ivanov², Olga Smirnova²**

¹ King's College London (United Kingdom), ² Max-Born-Institut (Germany), ³ Technion-Israel Institute of Technology (Israel)

We introduce the concept of enantiosensitive exceptional points - non-Hermitian degeneracies whose position in parameter space is sensitive to the handedness of an open system. We apply the concept for the development of novel highly sensitive and robust methods to detect molecular chirality, from single molecules to racemic mixtures.

16:40 - 18:55 — Manantiales

Session 2A33

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Andrey Evlyukhin

16:40 : **Invited talk**

Tailored Resonant Metasurfaces for Enhanced Third-order Nonlinear Optics

Hailun Xie, Lili Gui, Kun Xu

Beijing University of Posts and Telecommunications (China)

We demonstrate two tailored resonant metasurfaces for enhancing third-order nonlinear optics, namely, a surface lattice resonance aluminum metasurface for wavelength-tunable Q-switched fiber laser, and a quasi-bound state in the continuum amorphous silicon metasurface to amplify two-photon absorption effect.

17:00 : **Invited talk**

Conducting Polymer-cellulose Devices For Tunable Infrared And Thz Optics

Chaoyang Kuang, Shangzhi Chen, M. P. Jonsson

Linköping University (Sweden)

Conducting polymers possess excellent reversible tunability for optical and electrical properties, enabling their various applications ranging from organic (opto)electronics to nanophotonics. In this talk, I will present our latest studies on conducting polymer devices for terahertz and infrared photonic applications.

17:20 : **Invited talk**

Ab Initio Simulation Of Nonlinear Optical Response In Periodic Semiconducting Nanostructures

Mitsuharu Uemoto

Kobe University (Japan)

First-principles electron dynamics simulation has become a practical approach to describing light-matter interactions, including linear and nonlinear optical phenomena. We use a multiscale method that combines electron dynamics simulation with electromagnetics to predict harmonic generation enhancement in an all-dielectric, periodically structured nanostructure array and analyze the influence on geometric parameters.

17:40 : **Invited talk**

Characteristics Of Optical Chiral Fields Around Nanostructures Revealed By Scanning Near-field Optical Microscopy

Kohei Imura

Waseda University (Japan)

Optical chiral density is amplified near the gold and dielectric nanostructures. We investigate the optical chiral field near the nanostructure by using apertured near-field optical microscope and reveal that the unique spatial characteristics of the optical chiral field are induced depending on the elementary mode excited.

18:00 : **Invited talk**

Enhanced Photo-Excitation Of Spin-Forbidden Gray Exciton In 2d Materials By Using Spin-Orbit-Coupled Vector Vortex Beams

Shun-Jen Cheng

National Yang Ming Chiao Tung University (Taiwan)

We present a comprehensive theoretical investigation, implemented on the first-principles base, of the light-matter interaction between excitons in WSe₂ monolayers and vector vortex beams. Through the optical spin-orbit interaction, vector vortex beams are shown to enable the photo-generation of gray excitons, a type of spin-forbidden dark exciton.

18:20 : Invited talk

Nonlinear Photonics In Low-index Time-varying Systems

Marcello Ferrera, Wallace Jaffray, Sven Stengel

Heriot-Watt University (United Kingdom)

Over the past decade, transparent conductive oxides (TCOs) have attracted interest due to their electro-optical properties. Operating near their cross-over wavelength, these materials have emerged as the most nonlinear solid-state platform for all-optical integrated devices. These systems closely approximate ideal time-varying systems, with potential applications extending into the quantum domain.

18:40 : Metrology Of Singular Metasurfaces

Yanel Tahmi¹, Matthieu Ansquer², Pierre-Marie Coulon¹, Sébastien Chenot¹, Virginie Brandli¹, Benoit Wattellier², Patrice Genevet³, Samira Khadir¹

¹University Côte d'Azur (France), ²Phasics (France), ³Colorado School of Mines (USA)

This study employs quadriwave lateral shearing interferometry (QLSI) to characterize singular metasurfaces generating optical vortex beams. By analyzing effective refractive index (ERI) and Pancharatnam-Berry (PB) phase metasurfaces, we demonstrate QLSI's accuracy in detecting phase errors, non-integer topological charges, and complex multi-vortex configurations, offering robust phase metrology for advanced photonic applications.

16:40 - 18:45 — Veselago

Session 2A34

Symposium VI: Advanced Techniques for Computational Electromagnetics

Organized by: Maha Ben Rhouma

Chaired by: Maha Ben Rhouma

16:40 : Invited talk

Advances In Topology Optimization For Nanophotonics

Antonio Calà Lesina

Leibniz University Hannover (Germany)

Inverse design methods based on topology optimization can uncover nanophotonic structures in 3D with free-form shapes beyond human intuition, and optical functionalities not obtainable with conventional design methods. This talk highlights the recent achievements of my team in topology optimization for nanophotonics and integrated optics.

17:00 : Invited talk

Silicon-based metasurface polarizer supporting quasi-bound states in the continuum

Maria Antonietta Vincenti¹, Sonia Freddi², Alfonso Nardi³, Agostino Di Francescantonio³, Johann Osmond⁴, Attilio Zilli³, Michele Gherardi³, Domenico de Ceglia⁵, Michele Celebrano³, Marco Finazzi³, Monica Bollani⁵

¹University of Brescia (Italy), ²Institute of Photonics and Nanotechnology (IFN) - CNR (Italy), ³Milano Politecnico (Italy), ⁴ICFO-Institut de Ciències Fotoniques (Spain), ⁵Istituto di Fotonica e Nanotecnologie (IFN) del CNR (Italy)

The study reports the theoretical and experimental demonstration of an ultra-compact dielectric metasurface that leverages the topological features of symmetry protected quasi-bound states in the continuum supported by a silicon-based nanostructure. The dual-mode operating regime allows you to select the transmitted

polarization without modifying the device orientation.

17:20 : Invited talk

The Technology And Commercialization Strategy Of Next-generation Computational Electrodynamics

Zongfu Yu, Shanhui Fan, Jianming Jin

Flexcompute Inc. (USA)

We'll explore the future of electromagnetic solvers in the era of cloud computing, GPUs, and AI. How these advancements enable unprecedented speed and efficiency in tackling complex engineering challenges, unlocking new possibilities for faster, more accurate, and more scalable simulations in photonics and RF engineering.

17:40 : Keynote talk

Computational Models Of Light Management In Photovoltaics And Leds

Vivian Ferry

University of Minnesota (USA)

This talk will discuss the computational models for light management strategies in photovoltaics, including systems that integrate luminescent solar concentrators in greenhouses and reduce the temperature of outdoor panels.

18:10 : Invited talk

Nanophotonic Design for Augmented Reality Displays: Opportunities and Challenges

Christina Spaegle

Meta (USA)

This talk explores the opportunities and challenges of computational design for nanophotonic components in Augmented Reality (AR) devices. It discusses the stringent requirements for AR displays, the potential of nanophotonics, and the complexities introduced by factors like unwanted artifacts and fabrication constraints in achieving high-performance AR displays.

18:30 : Hybrid Silicon Metamaterial Combining Microstructured Siliconsurface With Silicon / Silicon Dioxide Multilayer As A Selectiveemitter For Thermophotovoltaic Applications

Karam Choukri, Maha Ben Rhouma, Armande Hervé, Elodie Richalot-Taisne, Elyes Nefzaoui

Lab.ESYCOM Gustave Eiffel University (France)

We propose a broadband selective emitter combining a microstructured doped silicon surface with a Si/SiO₂ multilayer for thermophotovoltaic applications. This structure enhances the infrared above bandgap emissivity while suppressing below bandgap emissivity over a broad spectral range. The structure composition and properties are optimized using a Particle Swarm Optimization algorithm.

16:40 - 19:00 — Maxwell

Session 2A35

Quantum Light Emitters and Photonic Heterogeneous Integration

Organized by: Han Htoon, Huan Zhao and Libai Huang

Chaired by: Michael Titze

16:40 : Invited talk

Thin Film Materials and Device Platforms for Quantum Photonics and Sensing Applications

Yong P. Chen

Purdue University (USA)

We will present our recent work developing and characterizing various thin film materials and device platforms for quantum photonics and sensing applications based on 1) spin defect centers in h-BN and 2) exciton/Rydbergs in transition metal dichalcogenides (TMDCs) and synthetic Cu₂O films/foils.

17:00 : Invited talk**Lattice Symmetry Guided Spin Dynamics In Supramolecular Assemblies****Xuedan Ma***Rice University (USA)*

We study photodynamics in supramolecular structures and reveal the important role played by lattice symmetry in exciton spin states. These findings have important implications for engineering soft materials towards efficient energy conversion and photocatalytic applications.

17:20 : Invited talk**Nanoscale Magnetic Field Imaging Based On Nv Center In Diamond: Instruments And Applications****Pengfei Wang***University of Science of Technology of China (China)*

Based on the solid-state spin sensors in diamond, we have developed scanning nitrogen-vacancy probe microscope for magnetic measurement with a spatial resolution up to 10 nm. We have carried out dark matter detection, in situ single cell magnetic resonance imaging, and harmonic spin wave generations in vortex-like spin texture.

17:40 : Invited talk**Cavity Quantum Electrodynamics With Single Photon Emitters In 2d Crystals****Carlos Antón Solanas***Universidad Autónoma de Madrid (Spain)*

Weak light-matter coupling conditions allow to generate bright single photon emission from solid-state sources. In this talk we will present results on quantum dots in monolayers of WSe₂ (and defects in hexagonal Boron Nitride) that are coupled to a tunable Fabry-Pérot microcavity, rendering a bright single photon emission.

18:00 : Invited talk**Spatial resolution enhancement by quantum entanglement****Zhe He***Shandong Institute of Advanced Technology (China)*

Quantum imaging surpasses the classical limit of spatial resolution without the need for labeling by measuring the second-order correlation functions of entangled photons. Here, we discuss the mechanism and methods of resolution enhancement by using a type-I BBO quantum source.

18:20 : Invited talk**Towards top-down integrated quantum photonics based on color centers in hBN****Aymeric Delteil***CNRS - UVSQ (France)*

We present the quantum optical properties and controlled integration of single-photon sources created in the 2D material hBN by local irradiation with an electron beam. This technique yields high-quality color centers with reproducible emission wavelength in the visible range, enabling scalable integration into monolithic devices for applications in quantum technologies.

18:40 : Invited talk**A Colloidal Quantum Dot On A Hybrid Nanoantenna As An Ultrafast And Efficient Single Structured Photon Source For Room Temperature High Dimensional Quantum Communications****Ronen Rapaport***The Hebrew University of Jerusalem (Israel)*

We demonstrate ultrabright, highly directional single photon sources operating at room temperature, utilizing a colloidal quantum dot positioned on a hybrid nanoantenna device, that produces structured photons. We then demonstrate two high-dimensional quantum key distribution protocols, by encoding and decoding qudits on different degrees of freedom of these structured photons.

16:40 - 18:40 — Fresnel

Session 2A36

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Miguel Beruete

16:40 : **Invited talk****Recent Progress In Metasurface Fluorescence Biosensors: Expansion Of The Targets To Next-generation Nucleic Acid Biomarkers****Masanobu Iwanaga***National Institute for Materials Science (NIMS) (Japan)*

Metasurface fluorescence (FL) biosensors are a powerful biosensing tool that has been applicable for diverse biomolecules across DNA and antigen/antibody, exhibiting outstanding biosensing performance. We address a recent progress in the metasurface FL biosensors-extremely high sensitivity detection of next-generation biomarker of microRNA.

17:00 : **Invited talk****Direct Determination Of Carrier Parameters In Plasmonic Indium Tin Oxide Nanocrystals Exploiting Magnetoplasmonic Modulation****Alessio Gabbani¹, Elisa Della Latta², Xiaoyan Li³, Andrea Scarperi², Francesca Martini², Francesco Biccari¹, Mathieu Kociak³, Marco Geppi⁴, Silvia Borsacchi⁵, Francesco Pineider⁴**¹ *University of Florence (Italy)*, ² *Universita di Pisa (Italy)*, ³ *Université Paris-Saclay (France)*, ⁴ *University of Pisa (Italy)*, ⁵ *CNR-ICCOM (Italy)*

Tin-doped indium oxide nanocrystals are promising candidates for optoelectronics and active plasmonics in the NIR. Here, an integrated approach was developed involving magneto-optics and single particle spectroscopy to directly determine experimentally the carrier parameters as a function of tin doping, which is challenging in such small nanosystems.

17:20 : **Invited talk****Chiral Metasurface Photodetectors For Circular-polarization-selective Phase Contrast Imaging****Ahmet Erturan, Jianing Liu, Maliheh Azimi Roueini, Nicolas Malamug, Lei Tian, Roberto Paiella***Boston University (USA)*

We report metasurface photodetectors that can selectively measure the local phase gradient of only one circular polarization component of any incident wave, in a single shot and with standard imaging optics. Pixel arrays of these devices may enable new functionalities for applications in chemical sensing, biomedical microscopy, and machine vision.

17:40 : **Invited talk****Miniaturized Microfluidic Plasmonic Chip For Enhanced Biosensing****Andreea Campu, Daria Stoia, Dana Maniu, Simion Astilean, Marc Lamy de la Chapelle, Monica Focsan***Babes Bolyai University (Romania)*

Acute myocardial infarction is one of the most severe cardiovascular diseases. As a result, considerable efforts are being made to develop biosensing technologies that can efficiently detect cardiac troponin biomarkers. Therefore, we developed a microfluidic plasmonic chip for fast and real-time detection of the cardiac troponin I biomarker.

18:00 : **Invited talk****Near-Infrared Photodetector Enhancement via Plasmonic Diffraction****Soh Uenoyama***Hamamatsu Photonics K.K. (Japan)*

Near-infrared photodetectors have gained attention due to their attractive applications. However, the photo-absorption efficiency of Si-based photodetectors is relatively weak. In this talk, we demonstrate a plasmonic-diffraction approach that increases the effective photo-absorption length, resulting in a 2.0 $\times$ enhancement in photocurrent at a specific wavelength and polarization.

18:20 : Invited talk

Active Conducting Polymer Plasmonics and Metasurfaces

Magnus Jonsson

Linköping University (Sweden)

We recently introduced conducting polymers as a new type of active plasmonic materials, enabling redox-tunable metasurfaces. I will present the background to this emerging area and discuss challenges and recent advances, including exploration of different polymers, narrowing of resonances through nonlocal coupling, and new possibilities based on hyperbolic polymers.

Thursday 24th July, 2025

08:30 - 09:40 — Torremolinos

Session 3A1

Plenary Session III

Chaired by: Ortwin Hess

08:30 : **Plenary talk**

Routes for Integrated Photonics and Meta-Optics in Quantum Technologies and Precision Experiments

Stefanie Kroker, M. Gaedtke, S. Häfner, L. Shelling Neto, S. Sauer, M. Schittenhelm, A. Sorokina, N. Wagner

TU Braunschweig (Germany)

Integrated photonics and meta-optics enable compact, precise light control, advancing optical metrology in applications like atomic clocks and gravitational wave detectors. This work explores nanophotonic devices for precision experiments and atom chips, focusing on light-matter interactions and the impact of material properties on performance and precision.

09:05 : **Plenary talk**

Applications Of Highly Nonlinear Epsilon-near-zero Materials In Photonics

Robert Boyd

University of Ottawa (Canada)

Optical materials display extremely large nonlinear response in a spectral band around their plasma frequency. This presentation reviews the origin of this behavior and provides examples of such materials and of applications enabled by this response.

Coffee Break

Session 3P1

Poster session V

9:40 - 10:20

P1: Impact Of Disorder On The Radiative Efficiency Of Bound States In The Continuum In Dimer Gratings

Victor Kalt¹, Emmanuel Centeno², Rafik Smaali², Antoine Moreau²

¹ *Université Jean Monnet (France)*, ² *Université Clermont Auvergne (France)*

A dimer grating is engineered to increase the light emission of a dipole source in the normal direction through the transformation of a bound state in the continuum (BIC) into a quasi-BIC (QBIC). We study the effect of controlled and structural disorder on the structure.

P2: Programmable Sound Wave Transmission By Active Acoustic Meta-layers

Shoubao Dai, Hao Gao, Yegao Qu

Shanghai Jiao Tong University (China)

We have developed a programmable acoustic meta-layer that can precisely control sound waves transmission while meeting ventilation requirements. The acoustic meta-layer can realize non-reciprocal transmission and frequency conversion. Further, various functions such as tunable anomalous refraction, wave focusing and self-bending beam can be realized by adjusting the phase distribution.

P3: A Metamaterial Coherent Detector for mmWave Operation

Natalie Rozman¹, O. Khatib², W. J. Padilla²

¹Leidos Inc. (USA), ²Duke University (USA)

A coherent detector, that is both sensitive to phase and amplitude, has yet to be established at high frequencies. To address this gap, we experimentally demonstrate a frequency, phase, and power-sensitive metamaterial coherent detector (MCD) for operation at millimeter (mmW) wavelengths.

P4: Resonant Optical Metasurfaces for Eye-Tracking Applications

Vittorio Bonino¹, Filippo Coviello¹, Pietro Baldin², Alberto Sivera², Rafael Bellei de Carvalho², Paolo Biagioni², Giuseppe Della Valle², Giovanni Isella², Roman Sordan², Gianluca Valentini², Giulio Cerullo², Anna Cesaratto¹, Tommaso Ongarello¹, Jacopo Stefano Pelli Cresi¹

¹EssilorLuxottica (Italy), ²Politecnico di Milano (Italy)

We propose an optical coupler to enhance signal detection in smart eyewear eye-tracking systems. Supporting surface lattice resonances, the metasurface is tuned to near-infrared wavelengths via geometric control of dielectric meta-atoms. Fabricated using electron-beam lithography, it achieves >80 % visible transparency while enhancing infrared scattering at the lens.

P5: Mass Production of Metasurfaces Using BaTiO₃ Nanoparticle-Embedded Resin (nano-PER)

Seungyeon Lee, Chanwoong Park, Hansang Sung, Heon Lee

Korea University (Korea)

In this study, we fabricated a high-performance meta-hologram using BaTiO₃ nanoparticle-embedded resin (nano-PER) via nanoimprint lithography. BaTiO₃ offers a high refractive index, low extinction coefficient, and ferroelectric properties. By uniformly dispersing these nanoparticles in nano-PER, we developed an optimized resin and mass-produced meta-holograms.

P6: Cost-effective And Mass Production Of Meta-hologram Using Photolithography And Nanoimprint Lithography

Chanwoong Park, Seungyeon Lee, Hansang Sung, Jaein Park, Heon Lee

Korea University (Korea)

This study introduces a cost-effective, scalable manufacturing technique for metasurfaces using ArF scanner and nanoimprint lithography. The process allows high-throughput production with an 8-inch master stamp. A demonstration meta-hologram using TiO₂ nanoparticle-embedded resin achieved optical efficiencies of 44.8 %, 32.3 %, and 22.9 % at different visible wavelengths.

P7: Fourier Modal Method For Calculating Two-dimensional Periodic Photonic Crystals With Chiral Inclusions

Iliia Smagin, Sergey Dyakov

Skolkovo Institute of Science and Technology (Russia)

To calculate the optical properties of two-dimensionally periodic photonic crystal slabs having inclusions with non-zero macroscopic coefficients of chirality, an enhanced version of the Fourier Modal Method which employs mathematically accurate Fourier transform rules for material equations with coefficients of chirality, expressed as arbitrary 3-by-3 tensors, has been developed.

P8: Thermal Radiation Forces On Nanostructures With Reduced Symmetry

Juan R. Deop-Ruano, Alejandro Manjavacas

Instituto de Quimica-Fisica (IQF-CSIC) (Spain)

The fluctuations of the electromagnetic field produce a drag force on nanostructures moving with respect to a thermal radiation bath. We show that nanostructures with the appropriate symmetry properties are subject to a lateral force that significantly modifies their trajectory and a propulsion force that opposes the drag.

P9: Mechanically Machinable, Printable Photonic Materials

Jong G. Ok, Minwook Kim, Kwangjun Kim

Seoul National University of Science and Technology (Korea)

We demonstrate recently developed approaches for creating photonic structures and materials by mechanical machining and printing methods. The printable nanophotonic structures fabricable by imprinting and printing of metallic ink, the mechanically inscribed microtrenches with solution-processable metallic wires embedded therein, and the direct machining of metallic microgratings will be mainly presented.

P10: Cryogenic Bistable Current-voltage Dependence In A Silicon Pn-junction Formed By Wafer-bonding**Sung Hoon Cho¹, Petr Moroshkin², Damir Kulzhanov², Jimmy Xu², Ki Tae Nam¹**¹Seoul National University (Korea), ²Brown University (USA)

We report a novel bistable current-voltage behavior observed in a Si pn-junction formed by direct wafer bonding at cryogenic temperatures below 30K. The phenomenon, driven by a 6nm SiO₂ barrier layer at the interface, reveals negative differential resistance and suggests potential applications in high-performance and quantum devices.

P11: Strong Coupling Of Chiral Light With Chiral Matter: A Macroscopic Study**Natalia Salakhova, S. A. Dyakov, I. A. Smagin, I. M. Fradkin, N. A. Gippius***Skolkovo Institute of Science and Technology (Russia)*

We studied the strong coupling of chiral light with chiral material by incorporating the Lorentz pole into macroscopic chirality parameter: dielectric permittivity, magnetic permeability, and chirality coefficient. Our study demonstrates significantly distinct behaviors between the material's enantiomers, offering a promising approach for their detection and selective differentiation.

P12: Polarization-multiplexed Vectorial Oam Holography Based On Dielectric Metasurfaces**Joonkyo Jung, Hyeonhee Kim, Jonghwa Shin***KAIST (Korea)*

We propose novel metasurface holograms, where multiple vectorial holographic images can be encrypted into the polarization state and orbital angular momentum (OAM) of incident light. By expanding the multiplexing capability, we anticipate that our approach can find various applications such as optical information storage, secure encryption, and optical communications.

P13: Design And Fabrication Of Parity-time Symmetric Optical Waveguides For Unidirectional Propagation Of Light**Indre Meskelaite, Kestutis Staliunas, Darius Gailevicius***Vilnius University (Lithuania)*

A parity-time symmetric optical waveguide enabling unidirectional propagation of light is proposed. Its numerical investigation via the finite-difference time-domain method and experimental realization by means of femtosecond direct laser writing is presented. A possible application of such a device is foreseen in optical neural networks.

P14: Plasmonic Gold Nano-dendrites For Efficient Co2 Reduction: Tailored Architectures And Enhanced Multi-electron Pathways**Anjalie Edirisooriya, Ning Lyu, Zelio Fusco, Fiona Beck***Australian National University (Australia)*

A scalable plasmonic gold nano-dendrite catalyst enhances multiple electron transfer and carbon-carbon (C-C) coupling in CO₂ reduction reactions (CO₂RR). The dendritic morphology allows tuning of plasmonic resonance energies to optimize reaction efficiency, demonstrating a promising approach for enhancing product selectivity towards valuable C₂⁺ products in CO₂ conversion.

P15: Basic Performance Test Results Of A 3d Underwater Acoustic Metalens Using A Sensor Positioning Device In A Water Tank**Sea-Moon Kim¹, Beomseok Oh², Yeon-Seong Choo¹, Jeong-Bin Jang¹, Dongwoo Lee², Junsuk Rho², Sung-Hoon Byun¹**¹Korea Research Institute of Ships and Ocean Engineering (Korea), ²Postech (Korea)

An underwater sensor positioning device was developed to control the hydrophone's location and the azimuth angle of tested metamaterial. Recently, a 3D underwater acoustic metalens was designed and fabricated using a 3D metal printing process. Basic performance tests with the positioning device in a tank showed a high focusing performance.

P16: Complex Continuation Exceptional Point And Its Role In Eigenvalue Knots For Open Boundary Lattices**Yuancheng Zhao, Kun Ding***Fudan University (China)*

Non-Bloch EPs are not merely straightforward generalizations of Bloch EPs. We define complex continuation EPs (CCEPs) and non-Bloch Fermi arcs (NBFAs) connecting CCEPs, clarify the distinction between non-Bloch EPs and CCEPs, and show that CCEPs and NBFAs in OBC knots mirror Bloch EPs and non-Hermitian Fermi arcs in PBC knots.

P17: Polarization-dependent Anapole States In Elliptical Nanodisks For Nonlinear And Filtering Applications

Mikko Kjellberg, Hanna Kylhammar, Anand Srinivasan

KTH Royal Institute of Technology (Sweden)

We demonstrate anapole states in vertically stacked Si nanodisks by leveraging the high refractive index contrast between Si and SiO₂, simplifying fabrication. By extending this to elliptical disks, we achieve polarization-dependent dual-wavelength anapole excitation. This platform offers strong field enhancements, enabling advanced nonlinear optical applications and wavelength filtering.

P18: Interplay Of Two Structures Of Nano-modulated Thin Films

Lucciano Antonio Letelier Carreño¹, Julianija Nikitina², Lina Grineviciute², Kestutis Staliunas³

¹FTMC - Laser Technology Department (Lithuania), ²FTMC (Lithuania), ³ICREA (Spain)

In this work, we demonstrate that combining two closely spaced resonances can create extremely narrow high-pass bands in transmission, with a theoretically tunable passband width that can approach zero in wavelength-angle space.

P19: Quasi Three Dimensional Gold Plasmonic Metasurfaces For Enhanced Harmonic generation And Light Conversion To Uv

Shroddha Mukhopadhyay¹, Ana Conde-Rubio², Agustín Mihi², Jose Trull¹, Maria Antonietta Vincenti³, Michael Scalora⁴, Crina Cojocaru¹

¹Universitat Politècnica de Catalunya (Spain), ²ICMAB - CSIC (Spain), ³University of Brescia (Italy), ⁴US Army CCDC (USA)

We report a combined experimental-theoretical investigation on nanoscale light-matter interaction in quasi-3D photonic crystals of gold. Using ultrafast optical pulses we produce strongly localized surface plasmon resonances in the metal-dielectric interface, to enhance nonlinear frequency conversion from visible/NIR to ultraviolet ranges.

P20: Numerical Investigation Of Transverse-mode Theory For Strongly Coupled Periodic All-dielectric Metasurfaces

Pooja Uday Naik, Massimiliano Guasoni

University of Southampton (United Kingdom)

Transverse mode behaviour has been investigated by modelling strongly coupled periodic nanoantenna array. Our study, unlike the Mie theory and look-up table approach-where individual nanoantenna modes and their interference are studied-considers the effect of coupling strength on the supermode of the array, offering new insights into light-matter interaction.

P21: Silver Nanocubes Decorated Silicon Nanostructures Used As 3d Active SERS Platforms For Detection Of Microplastics

Adina Boldeiu, Pericle Varasteanu, Oana Brancoveanu, Gabriel Craciun, Razvan Pascu, Andrei Avram, Cosmin Romanitan, Iuliana Mihalache, Mihaela Kusko

IMT Bucharest (Romania)

In this work, 3D hybrid architectures on silicon substrate have been fabricated and employed to detect plastic particles using surface-enhanced Raman spectroscopy (SERS). The novel SERS platforms were obtained by embedding silver nanocubes synthesized using an eco-friendly route in two types of silicon nanostructures substrates, Si nanotrees and nanopillars, respectively.

P22: Modelling, Fabrication And Characterization Of Tunable Plasmonic Substrates For Designer Ultra-thin Optical Filters

Arka Jyoti Roy, Sai Rama Krishna Malladi, Shourya Dutta Gupta

IIT Hyderabad (India)

This study demonstrates the thermally tunable shape dependent plasmonic substrates coated with gold nano bipyramids for ultra-thin optical filters. We perform correlative microscopy, including in-situ TEM and in-situ

optical spectroscopy with an integrated heating platform, to track the real-time changes in the optical response due to the shape change.

P23: Ring Distributed Metamaterial With Phase Cancellation For Rcs Reduction

Oscar Fernandez¹, Rodrigo Gonzalez¹, Alvaro Gomez¹, Ismael Barba²

¹Universidad de Cantabria (Spain), ²Universidad de Valladolid (Spain)

In this communication a phase cancellation metasurface is presented. The novelty of the proposed design resides on the combination of structures based on the same unit cells but with slight modifications. This metasurface is designed to reduced monostatic RCS but also improve the diffuse scattering taking advantage of secondary lobes.

P24: On-chip Angle-scanning Scattering Microscopy With All-dielectric Metasurfaces And Surface-emitting Lasers

Khosro Zangeneh Kamali, Oliver Olsson, Erik Strandberg, Hana Jungová, Mikael Käll

Chalmers University of Technology (Sweden)

Here, we propose a miniaturized imaging system based on integrating scattered light spatial frequencies under angled illumination. We employ spatially arranged vertical-cavity surface-emitting lasers to configure the azimuthal beam rotation. This, integrated with silicon and gallium arsenide metasurfaces, facilitates fast biological specimens imaging beyond the classical diffraction limit.

P25: Multicolor Scintillators Coupled With Physics-aware Postprocessing Allows Energy-resolved X-ray Imaging Of Medical Contrast Agents

Seokhwan Min¹, Seou Choi², Simo Pajovic², Sachin Vaidya², Nicholas Rivera³, Shanhui Fan⁴, Marin Soljacic², Charles Roques-Carmes²

¹Korea Advanced Institute of Science and Technology (Korea), ²Massachusetts Institute of Technology (USA),

³Harvard University (USA), ⁴Stanford University (USA)

We present an end-to-end reconstruction framework that combines a three-layer multicolor scintillator with a physics-aware postprocessing algorithm to allow energy-resolved X-ray imaging. Using this framework, we demonstrate the simultaneous identification of iodine and gadolinium-based contrast agents from body tissues through simulations of a computational phantom.

P26: Cosine Beams For Near-field Space Division Multiple Access In 6g Communications And Beyond

Sotiris Droulias, Giorgos Stratidakis, Angeliki Alexiou

University of Piraeus (Greece)

In this work, we propose the family of cosine beams that satisfy the orthogonality condition, offering a multitude of communication modes for multiple access in the near-field. We introduce the concept of near-field space division multiple access (NF-SDMA) to enable spatial multiplexing and capacity improvements for 6G near-field wireless connectivity.

P27: Orienting Fluorophores For Highly Efficient Plasmonic Nanoantennas

Karol Kolataj, Aleksandra Adamczyk, Guillermo Acuna

University of Fribourg (Switzerland)

Here, we use the DNA origami technique to assemble an optical antenna and position a single fluorophore at the antenna gap with controlled, parallel and perpendicular orientation. We study the coupling for both conditions revealing a 5-fold higher fluorescence intensity when the emitter is aligned with the antenna's main axis.

P28: An ultrasonic metamaterial based on Lieb lattice structures

Anusha Rehman¹, David A. Hutchins¹, Peter J. Thomas¹, Rudolph Römer¹, Katarzyna Sopińska¹, Jisun Im¹, Phillip Sheffield¹, Stefano Laureti²

¹University of Warwick (United Kingdom), ²University of Calabria (Italy)

This work proposes a polymer based acoustic metamaterial based on Lieb lattices, supporting energy localization at specific ultrasonic frequencies. The structure's tuneable bandgap and topologically-protected flat band are demonstrated through simulations and experimental verification, leading to possible future applications in ultrasonic medical imaging, sensing, and acoustic manipulation.

10:20 - 12:25 — Torremolinos

Session 3A2

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Alexander Cerjan

10:20 : **Keynote talk****AI-Driven Photonics: From Metaphotonics to Silicon Photonics Integration****Seokho Yun***Samsung Advanced Institute of Technology (Korea)*

As we enter the AI era, photonics is evolving beyond boundaries. This keynote explores advances in metaphotonics and silicon photonics—enabling next-generation image sensors, LiDAR, micro-LED displays, and optical interconnects. Their convergence opens new pathways to compact, power-efficient, and high-performance devices that elevate the capabilities of future optical systems.

10:50 : **Invited talk****Development Of A Silicon Nitride Platform For Next Photonic Integrated circuits****Brahim Ahammou¹, Narges Dalvand², Boris Le Drogoff¹, Youssef Ouldhnini¹, Abir Radi¹, Majid Taghavi Dehaghani¹, Kulbir Kaur Ghuman¹, Joëlle Margot³, Michael Ménard², Mohamed Chaker¹**¹*INRS-EMT (Canada)*, ²*ETS (Canada)*, ³*Université de Montréal, (Canada)*

As an ideal platform for photonic integrated circuits, silicon nitride material is explored. In particular, we investigate residual stress and cracking limits in SiNx films through experimental and computational approaches, as well as plasma-based SiNx nanopatterning.

11:10 : **Invited talk****Subwavelength Metamaterials For High-performance Power And Modal Control In Silicon Photonics****Raquel Fernández de Cabo¹, Alejandro Sánchez-Sánchez², Yijun Yang³, Daniele Melati³, Carlos Alonso-Ramos³, Pavel Cheben⁴, Aitor V. Velasco⁵, David González-Andrade²**¹*Institute of Photonic Sciences (Spain)*, ²*Universidad de Málaga (Spain)*, ³*Université Paris-Saclay (France)*, ⁴*National Research Council Canada (Canada)*, ⁵*Consejo Superior de Investigaciones Científicas (Spain)*

Subwavelength metamaterials have significantly driven silicon photonic integrated circuits since their inception in 2006. In this invited talk, we will provide an overview of our latest findings, with particular emphasis on the development of high-performance building blocks engineered for highly-efficient modal manipulation and power distribution.

11:30 : **Invited talk****Integrated Photonic Platforms For Nonlinear Light Generation In The Ultraviolet And Visible Regions****Natale Pruiti, Elissa McKay, Eugenio Di Gaetano, Cosmin Suci, Daniel Kelly, Stuart May, Marc Sorel***University of Glasgow (United Kingdom)*

We report on integrated photonic platforms for visible-range nonlinear optics using alumina, silicon nitride, and lithium niobate waveguides. Efficient supercontinuum generation and nonlinear wavelength conversion are demonstrated in ultra-low-loss, dispersion-engineered waveguides fabricated via multi-pass lithography and heterogeneous material integration.

11:50 : **Invited talk****Monolithic Integration For Silicon Photonics****Frederic Gardes¹, Ilias Skandalos¹, Xingshi Yu¹, Afroz Shoa¹, Qianbin Luo¹, Thalia Dominguez Bucio¹, Ipsita Chakraborty¹, Michele Paparella¹, Ioannis Zeimpekis¹, Huiyun Liu², Alwyn Seeds²**¹*University of Southampton (United Kingdom)*, ²*University College London (United Kingdom)*

We report recent advancements in silicon nitride monolithic integration schemes, highlighting progress in integrated broadband nonlinear structures, non-volatile photonic memories, and precise device trimming techniques. These developments underscore significant strides in the field, paving the way for enhanced photonic device functionality and integration.

12:10 : Modeling Electromagnetic Wave Interactions With Ferroelectric Vortex Lattices In The Sub-thz Regime**Marvin Degen¹, Ramaz Khomeriki², Vakhtang Jandieri¹, Jan T. Svejda¹, Pingjuan L. Werner³, Douglas H. Werner³, Jamal Berakdar⁴, Daniel Erni¹**¹University of Duisburg-Essen (Germany), ²Tbilisi State University (Georgia), ³The Pennsylvania State University (USA), ⁴Martin-Luther-University Halle-Wittenberg (Germany)

A frequency response in the sub-THz regime of strained ferroelectric materials forming chiral polar ferroelectric vortex-antivortex lattices (FVL) in a meta-stable state has been observed experimentally. In this contribution, we discuss the physics of the interactions in the sub-THz regime and aim at a corresponding numerical full-wave model.

10:20 - 12:35 — Alamos**Session 3A3****Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy**

Organized by: Jerome Plain, Alexander Govorov, Davy Gerard and Pedro Hernandez Martinez

Chaired by: Eva Yazmin Santiago and Lucas Vazquez Besteiro

10:20 : Invited talk**(Photo-)catalytic Activity Of Sub-5nm Gold Nanoparticles Limited By Coulomb Repulsion****Monalisa Garai, Thomas A. Klar***Johannes Kepler University Linz (Austria)*

Gold nanoparticles can serve as (photo-)catalytic agents promoting reductions. Frequently, it is assumed that the smaller the particles, the better they serve as catalysts. However, when storage of electrons takes place between the oxidative and reductive half-reactions, Coulomb blockade hampers the activity for nanoparticles with diameters ≤ 4 nm.

10:40 : Invited talk**Dna Origami Self-assembled Optical Antennas For Single-photon Chiral Emission****Fangjia Zhu¹, Maximilian Lengauer², Maria Sanz-Paz¹, Karol Kolataj¹, Sophie Brasselet², Guillermo Acuna¹**¹University of Fribourg (Switzerland), ²Aix Marseille University (France)

We demonstrate the achievement of chiral single-photon sources by a DNA templated trimer antenna with C_{2v} symmetry group, excited by an asymmetrically positioned achiral emitter without vector beam excitation. In this 2D configuration without inherent structural chirality, the antenna still exhibits chiral emission with a high degree of circular polarization.

11:00 : Invited talk**Experimental Femtosecond Pulse Trains For Time-modulation Metamaterials In The Terahertz Spectral Band****William Wardley, C. M. Hooper, I. R. Hooper, S. A. R. Horsley, E. Hendry***University of Exeter (United Kingdom)*

Time-modulated metamaterials are investigated using femtosecond pulses for modulation of THz absorption in graphene-based materials. To do this, we describe a new multi-cavity optic which generates pulse-trains from a single femtosecond pulse. We demonstrate the use of this tool for temporal diffraction experiments, including temporal double-slit experiments and constant-amplitude pulse-trains.

11:20 : Invited talk**Attomolar Sensing Of Cancer Markers Using A Novel Plasmonic Nanocomposite Thin Film For Early Stage Disease Diagnosis****Manon Gireau¹, Fusheng Du², Joelle Youssef¹, Georges Humbert¹, Shuwen Zeng², Corinne Champeaux¹,**

Frédéric Dumas-Bouchiat¹¹ Université de Limoges (France), ² Université de Troyes (France)

A plasmonic device with a complex design has been developed. The nanocomposite, consisting of an ultra-thin aluminum oxide matrix with tiny embedded silver nanoparticles and a gold film, is fabricated in a single reactor using dual laser ablation. It enables sub-attomolar cancer markers detection, offering promise for early disease diagnosis.

11:40 : Invited talk**Organic Optoelectronic Devices And Biofunctionalized Nanoplasmonic Gratings: Integration Into Miniaturized Optical Biosensors****Margherita Bolognesi, Mario Prosa, Stefano Toffanin***ISMN-CNR (Italy)*

We present the design approaches, characterization and demonstration of miniaturized optical biosensors relying on the combination of: i) miniaturized and monolithically integrated organic light-emitting diodes or transistors, and organic photodiodes as the optical transduction elements, ii) antibody-based immunoassays as recognition elements, iii) nanoplasmonic gratings for surface plasmon resonance (SPR) sensing.

12:00 : Invited talk**DNA Sensing With Whispering Gallery Mode Microlasers****Soraya Caixeiro¹, Robert Dörrenhaus², Anna Popczyk¹, Marcel Schubert¹, Stephanie Kath-Schorr², Malte C. Gather¹**¹ University of Bath (United Kingdom), ² Institute of Organic Chemistry (Germany)

We present a DNA-functionalized whispering gallery mode microlaser for DNA hybridization detection via spectral shifts. Gold nanoparticles enhance sensitivity without secondary labelling, and we introduce a hairpin-based system as a dual-purpose sensor and controlled release mechanism for potential drug delivery. This novel platform advances sequence-specific detection and in vivo applications.

12:20 : N-Heterocyclic Carbene As Robust And Conductive Linkages To Couple Gold Nanoparticles and Conductive Polymers**Ningwei Sun, Franziska Lissel***Leibniz Institute of Polymer Research Dresden (Germany)*

N-heterocyclic carbene (NHC) anchors enable electron delocalization over the gold/conductive polymer (CP) interface, resulting in an improved conductivity. Here we developed a new class of real hybrid nanocomposites using NHC to coupling AuNPs and CPs, including small Au NP@NHC-CP by bottom-up methods and large Au NP@NHC-CP by top-down methods.

10:20 - 12:40 — Playamar**Session 3A4****Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures**

Organized by: Eugene Kamenetskii

Chaired by: Eugene Kamenetskii

10:20 : Invited talk**Tailoring Broadband Large Chiral Response In All-dielectric Twisted L-shape Metamaterial Platforms****Ufuk Kilic¹, Eva Schubert¹, Christos Argyropoulos², Mathias Schubert¹**¹ University of Nebraska Lincoln (USA), ² The Pennsylvania State University (USA)

This study presents the fabrication of all-dielectric silicon-based twisted L-shape metamaterials using a two-step electron-beam glancing angle deposition approach. Systematic chiroptical characterization and optimization are performed through Mueller matrix generalized spectroscopic ellipsometry and finite element modeling, demonstrating tunable, broadband chirality response with potential applications in chiral-chemistry,

quantum optics, and nanophotonics.

10:40 : Invited talk

Spin-charge Dynamics Of Topological Magnetic Textures In Kondo-lattice Magnets

Masahito Mochizuki

Waseda University (Japan)

Kondo-lattice models describe spin-charge coupled magnets with localized spins and itinerant electrons coupled via exchange interactions. Spin-charge dynamics of topological magnetism in these models are investigated using large-scale spin-dynamics simulations. We will discuss magnetic topology switching and nontrivial spin-wave excitations in skyrmion crystals and hedgehog lattices under microwave irradiation.

11:00 : Invited talk

Microwave-modulated optomagnet as a tunable nanosource of spin-waves

Vage Karakhanyan¹, Miguel Suarez¹, Marina Raschetti¹, Thierry Grosjean¹, Anna Duvakina², Mingran Xu², Axel Deenen², Andrea Mucchietto², Dirk Grundler²

¹*Institute FEMTO-ST (CNRS) (France), ²Ecole Polytechnique Federale de Lausanne (EPFL) (Switzerland)*

We demonstrate tunable excitation of spin waves using nanoscale a modulated optomagnet. The optomagnet is a plasmonic nanoantenna coupled to a modulated CW infrared laser source. We demonstrate the conversion of different sinusoidal microwave signals into monochromatic spin waves belonging to different allowed magnon bands in the GHz frequency regime.

11:20 : Invited talk

Optical Force Nanoscopy Of Circular Dichroism In Photoinduced Force Microscopy

Junsuke Yamanishi, H.-Y. Ahn, H. Okamoto

Institute for Molecular Science (Japan)

We conducted imaging of nanoscale local chiro-optical effects utilizing photoinduced force microscopy, a force imaging technique. This study successfully achieved enantio-selective chiro-optical force nanoscopy of individual nanostructures.

11:40 : Invited talk

Inverse Design of Chiral Structures for Giant Helical Dichroism

Munseong Bae¹, Chia-Chun Pan², Hongtao Wang³, Jaesung Lim¹, Ranjith Unnithan², Joel Yang³, Sejeong Kim², Haejun Chung¹

¹*Hanyang University (Korea), ²University of Melbourne (Australia), ³Singapore University of Technology and Design (Singapore)*

This work uses an inverse design framework to optimize a chiral nanostructure for maximal helical dichroism (HD), achieving 107 % HD at 800 nm for orbital angular momentum beams. This approach significantly enhances differential absorption of the OAM beams with opposite signs of topological charges.

12:00 : Invited talk

Enantioselective Molecular Sensing By Chiral Gold Helicoid Nanoparticles

Jeong Hyun Han, Ki Tae Nam

Seoul National University (Korea)

Colloidally synthesized chiral plasmonic gold nanoparticles, helicoids, offer enhanced and non-vanishing chiral light-matter interaction and thereby great potential for ultrasensitive enantioselective molecular sensing. We demonstrate experimental realization and relevant theory of spectroscopic molecular chirality detection based on circular dichroism and SERS from systematically integrated helicoids platform.

12:20 : Invited talk

Can The Spinterface Model Explain All Different CISS Related Effects?

Amos Sharoni¹, S. Alwan², Yonatan Dubi²

¹*Bar Ilan University (Israel), ²Ben Gurion University of the Negev (Israel)*

The CISS effect, where chiral materials cause magnetic like behavior has different manifestations, including in transport, photoelectric, magnetic switching, and others. But can these effects be understood from one underlying theory? We show our spinterface model explains many of the effects. However, there is still work to be done.

10:20 - 12:35 — Bajondillo**Session 3A5****Symposium III: Advanced passive and active metasurfaces and zero-index materials**

Organized by: Howard Lee, Pin-Chieh Wu and Wen-Hui (Sophia) Cheng

Chaired by: Pin-Chieh Wu and Giulia Tagliabue

10:20 : Invited talk**Metasurface For Multi-Functional Edge Imaging And Quantitative Phase Imaging****Zhaowei Liu***University of California (USA)*

Metasurfaces have been proved to be a promising approach for various optical imaging techniques with advanced functionalities. In this talk, I will summarize some of our recent progresses in the field and showcasing quantitative phase imaging and edge detection imaging using metasurfaces.

10:40 : Invited talk**Room-temperature, Tunable Lasing From Quasi-2d Perovskites Integrated With Plasmonic Lattices****Yu-Jung Lu***National Taiwan University (Taiwan)*

We presented a stable, wavelength-tunable, room-temperature single-mode laser based on quasi-2D perovskites coupled with a waveguide-hybridized surface lattice resonance mode composed of aluminum nanoparticle arrays.

11:00 : Invited talk**Liquid-Metal-Based Reconfigurable Metasurfaces For Display And Sensing Applications****Peter Qiang Liu***State University of New York at Buffalo (USA)*

The flexibility, conformability and transformability of room-temperature gallium-based liquid metals are unique advantages over widely used solid metals. In this talk, I will discuss our recent explorations into using such liquid metals to realize dynamically reconfigurable metasurfaces for different spectral regions and various applications, such as display and molecular sensing.

11:20 : Invited talk**Metasurface-Based Optical Elements For Biomedical Applications****S. Vyas, C. H. Chu, J. A. Yeh, Yuan Luo***National Taiwan University (Taiwan)*

Metasurfaces are vital for creating flat optical components with tailored functionalities. By manipulating light properties such as amplitude, phase, and polarization, metasurface-based optical elements enhance biomedical imaging system' performance. This work explores recent advancements in our laboratory applying metasurface optical components in biomedical instruments.

11:40 : Invited talk**Nonlinear Optics Driven By Out-of-equilibrium Electron Dynamics In Epsilon-near-zero Media****Matteo Silvestri¹, Ambaresh Sahoo¹, Luca Assogna¹, Matteo Venturi¹, Raju Adhikary¹, Paola Benassi¹, Carino Ferrante², Davide Tedeschi¹, Alessandro Ciattoni², Andrea Marini¹**¹ *University of L'Aquila (Italy)*, ² *CNR-SPIN (Italy)*

We theoretically model nonlinear optical effects produced by collision-driven electron dynamics in epsilon-near-zero heterogeneous nanostructures. We explore the potential of several setups based on poor metals for the development of compact extreme ultraviolet radiation sources and for integrated spectroscopy schemes.

12:00 : Invited talk**Terahertz Modulators Enabled By Vanadium Dioxide: From Materials Optimization To Devices****Xi Wang**

University of Delaware (USA)

This talk focuses on optimizing the deposition techniques to produce high-quality, large-area vanadium dioxide (VO₂) thin films with precisely controlled phase transitions. Additionally, it introduces novel metasurface design concepts that may improve the scalability, performance, and tunability for various applications of VO₂-based terahertz (THz) devices.

12:20 : Optical Charge Trap Memory Based On Graphene/zno Heterostructures For Long-term Retention And Adaptive Learning

Junhyung Kim, Seungmin Shin, Hyeongdoh Lee, Min Seok Jang, Himchan Cho

KAIST (Korea)

Graphene/ZnO optical charge trap memory exhibits long retention via charge transfer quenching and electron trapping. Photodoping analysis confirms rapid charge transfer, with a high energy barrier preventing recombination. Adaptive learning reduces pulses needed for memory restoration. ANN simulations show fast convergence, making charge trap memory promising for energy-efficient neuromorphic applications.

10:20 - 12:45 — Carihuela

Session 3A6

Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and Noé Jiménez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

10:20 : Invited talk

Maximizing the modal effective mass of metamaterial resonators through topology optimization

Vanessa Cool, Willem Jaspers, Berkay Biçer, Claus Claeys, Elke Deckers

KU Leuven (Belgium)

The lightweight nature of locally resonance-based metamaterial solutions is a key design factor. A topology optimization framework is proposed to maximize the modal effective mass (MEM) of structural resonators. A novel design achieving a MEM of 96.2 % is presented and validated through vibration attenuation evaluation for a finite metamaterial structure.

10:40 : Invited talk

When Acoustic Artificial Materials Meet Artificial Intelligence: Ai-empowered Metamaterials And Their Applications

Bin Liang, Jingjing Liu, Jing Yang, Jianchun Cheng

Nanjing University (China)

This report will focus on the novel discoveries emerging from the integration of artificial intelligence and artificial structures, and explore how this synergy has led to groundbreaking advancements in relevant application fields including such as acoustic imaging and noise reduction.

11:00 : Keynote talk

Transition waves in multistable mechanical metamaterials

Vincent Tournat

Université du Mans (LAUM) (France)

I will highlight the fundamentals and a selection of recent results on transition waves triggering, propagation, and discuss some of their potential applications. In general, these reconfiguration fronts obey nonlinear reaction-diffusion equations and show specific properties not necessarily found in other waves supported by periodic and/or nonlinear media.

11:30 : Invited talk

Hypersonic Surface Acoustic Wave In A Nanomembrane

Omid Reza Ranjbar Naeini¹, Tapani Makkonen², Oili M.E Ylivaara², Jouni Ahopelto², Clivia M Sotomayor Torres¹

¹INL - International Iberian Nanotechnology Laboratory (Portugal), ²VTT - Technical Research Centre of Finland Ltd (Finland)

Hypersonic surface acoustic wave (SAW) propagation was experimentally studied by laser Doppler vibrometry. The SAW was measured along different regions of nanocrystalline silicon devices at excitation frequencies from 2-2.3GHz. The data reveals wavelength variations, phase velocity differences and acoustic impedance mismatches which contribute to the dissipation of mechanical energy.

11:50 : Invited talk

Sound-absorbing Metasurface Using Hybrid Resonators With Embedded Necks And Micro-perforations
Hyeonbin Ryoo¹, Ki Yong Lee², Wonju Jeon²

¹Korea Institute of Machinery and Materials (Korea), ²Korea Advanced Institute of Science and Technology (Korea)

This study introduces a hybrid resonator combining Helmholtz resonators with micro-perforations to achieve perfect sound absorption with a low Q-factor. Based on a theoretical model to outline the effective impedance, an acoustic metasurface is designed to achieve the 90 %-absorption bandwidth from 380 to 790 Hz with a compact thickness ($\lambda/15$).

12:10 : Invited talk

Unlocking Large-scale Metasurface Fabrication With Electron Beam Lithography Through Algorithmic Patterning

Michael Kahl¹, Frank Nouvertné¹, Rainer Schmid², Volker Boegli¹

¹Raith GmbH (Germany), ²Raith America, INC. (USA)

Algorithmic patterning enhances electron beam lithography (EBL) by reducing data overhead, enabling large-scale metasurface fabrication and intricate photonic designs. By adding new shapes and tailored design data formats at the pattern generator level, it streamlines workflows, accelerates exposures, and expands design possibilities for next-generation photonic devices.

12:30 : Transforming room acoustics with causality-driven dual-function passive metamaterials

Eric Ballesterio¹, Yang Meng¹, Ping Sheng², Vincent Tournat¹, Vicente Romero-García³, Jean-Philippe Groby¹

¹Université du Mans (LAUM) (France), ²Hong Kong University of Science and Technology (Hong Kong),

³Universitat Politècnica de Valencia (Spain)

A dual-function passive acoustic metamaterial is proposed that effectively balances absorption and diffusion within the same structure by leveraging causality principle.

10:20 - 11:40 — Montemar

Session 3A7

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Joel Cox

10:20 : Invited talk

Dna Identification Using Surface-enhanced Raman Spectroscopy (sers) And Surface Plasmon Resonance (spr) Sensors: Identification Of Brca1 Gene Mutation Variants In Clinical Samples

Agata Kowalczyk¹, Anna Nowicka¹, Aleksandra Michalowska¹, Michal Duszczyk¹, Malgorzata Sikorska¹, Jan Weyher², Sebastian Zieba³, Artur Kowalik³, Andrzej Kudelski¹

¹University of Warsaw (Poland), ²Polish Academy of Science (Poland), ³Holy Cross Cancer Center (Poland)

Surface-enhanced Raman scattering (SERS) spectroscopy and surface plasmon resonance (SPR) are promising methods for detection of specific DNA fragments. In this contribution, we describe construction and

tests with clinical samples of SERS and SPR sensors for the identification of six the most popular in Poland variants of BRCA1 gene mutations.

10:40 : Invited talk

Spectroscopy Of Single Metal Nanoparticles For Single-molecule Biosensing

Peter Zijlstra

Eindhoven University of Technology (The Netherlands)

In this talk I will discuss two biosensing platforms that exploit plasmon-enhanced single-molecule detection. The first platform enables fluorescence-free sensing for hours, and is based on reversible nanoparticle-on-film coupling. The second platform enables the study of multivalent single-molecule interactions with microsecond temporal resolution.

11:00 : Invited talk

Optical Fiber Microstructure Devices Inscribed By Femtosecond Laser And Their Sensing Applications

Xuewen Shu

Huazhong University of Science and Technology (China)

We hereby report our recent progress in the fabrication of various in-fiber microstructures, such as interferometers and gratings, by using femtosecond laser, and then discuss their sensing applications.

11:20 : Invited talk

Nanostructured Surfaces For Enhanced Spectroscopy And Nonlinear Optics

Luca Razzari

Institut National de la Recherche Scientifique (Canada)

In this talk, I will present our results regarding the exploitation of a nanostructured metallic surface to enhance terahertz spectroscopy of monolayer WSe₂, as well as the use of dielectric metasurfaces to artificially engineer nonlinear wavelength conversion.

11:40 - 12:35 — Montemar

Session 3A8

Advanced Theoretical Methods for Nanoplasmonics and Molecular Plasmonics

Organized by: Tommaso Giovannini and Stefano Corni

Chaired by: Tommaso Giovannini

11:40 : Invited talk

Nonadiabatic Dynamics Of Plasmon-mediated Photochemistry

Yu Zhang

Los Alamos National Laboratory (USA)

Heterogeneous catalysis of adsorbates on metallic surfaces mediated by plasmons has the potential to achieve controllable reaction selectivity. However, the underlying physics of plasmon-mediated chemical transformations is very challenging to delineate. This talk will present our developments in theory and numerical methods for plasmon-mediated chemistry and the physical insights obtained.

12:00 : Invited talk

Polaritonic Index: A Computational Tool For Classifying Hybrid Light-matter Excitations In Metal-molecule Systems

Lucia Cascino¹, Roberto Messina¹, Stefano Corni², Stefania D'Agostino¹

¹University of Salento (Italy), ²University of Padova (Italy)

Polaritonic chemistry exploits light-matter interactions to control chemical reactions. This study develops the Polaritonic Index (PI), a Python tool useful to classify electronic excitations in hybrid metal-molecule systems. Tested on systems of azobenzene (single or multiple molecules) interacting with Ag clusters, PI enables to

control polariton-induced changes in photochemical processes.

12:20 : Multiscale Models Integrating Different Physical Mechanisms Of Plasmonic Photocatalysis

Lucas Vazquez Besteiro

CINBIO - Universidade de Vigo (Spain)

Designing hybrid photocatalysts requires balancing fabrication parameters to efficiently harvest light towards specific target reactions. Including plasmonic antennas enhances conversion efficiency but extends the design parameter space. Multiscale models of plasmonic photocatalysts as chemical reactors can integrate different interacting phenomena in the same framework to support solving complex design problems.

10:20 - 12:40 — Litoral

Session 3A9

Bottom-up approaches, new fabrication routes and ENSEMBLE3

Organized by: Dorota Pawlak and Virginie Ponsinet

Chaired by: Dorota Pawlak

10:20 : Invited talk

Light Scattering Of Hyperuniform-Disordered Metasurfaces

Alexander Sprafke¹, Peter Piechulla², Davy Tesch¹, Prerak Dhawan¹, Carsten Rockstuhl², Ralf Wehrspohn¹

¹Martin Luther University Halle-Wittenberg (Germany), ²Karlsruhe Institute of Technology (Germany)

We explore scattering metasurfaces employing hyperuniform disorder (HuD), a special spatial arrangement in the realm of disorder. By engineering spatial correlations in arrays of scatterers, HuD metasurfaces combine characteristics of ordered and random configurations, enabling tailored angular scattering and expanding design flexibility for photonic devices.

10:40 : Invited talk

Multi-oriented Self-assembled Hexagonal Arrays For Isotropic Plasmonic Reflectors

Gil Cardoso, Frédéric Hamouda, Vy Yam, Béatrice Dagens

Université Paris Saclay (France)

We compare optical properties of different large area self-assembled hexagonal plasmonic metasurfaces, with a correlated-disorder plasmonic metasurface fabricated by e-beam lithography. By adjusting geometric arrangements of plasmonic nanostructures and their density, we obtain metasurfaces capable of isotropically modifying the reflectivity spectrum of transparent substrates without inducing diffraction or diffusion.

11:00 : Invited talk

Tailored Photonic Bandgap In Liquid Crystalline Cellulose Ether Mesophases: Harnessing Self-assembly Kinetics And Polymer Chain Mobility

Cecile Chazot, Simona Fine, Charmaine Guo

Northwestern University (USA)

We investigate liquid crystal self-assembly kinetics and chiroptical properties in cholesteric cellulose ether mesophases. In-situ reflectivity measurements reveal the impact of polymer diffusivity and chain elasticity on photonic bandgap development. Our findings guide the design of structurally colored gels and composites with stable, angle-dependent optical properties and reversible colorimetric functions.

11:20 : Invited talk

Multifunctional Composite Materials Based On Nanoparticles-doped Blue-phase Liquid Crystals For Advanced Tunable Photonic Devices

Kamil Orzechowski¹, Chun-Ta Wang², Olga Strzeżysz³, Wiktor Lewandowski⁴, Tomasz Ryszard Woliński¹

¹Warsaw University of Technology (Poland), ²National Sun Yat-Sen University (Taiwan), ³Military University of Technology (Poland), ⁴University of Warsaw (Poland)

Our work explores the optical properties of blue-phase liquid crystals doped with gold nanoparticles. These

structures exhibit tunable optical properties, enhanced thermal stability, and significant potential for applications in electro-optical modulation, switching, tunable filters, and sensing, making them ideal for emerging photonic technologies.

11:40 : Invited talk

A Scalable Fabrication Method For High-efficiency Photocatalytic Metasurfaces

Parvaneh Mokarian-Tabari

Trinity College Dublin (Ireland)

We present a bottom-up fabrication approach for highly efficient photocatalysis using a gold-silicon metasurface, where gold nanoparticles are confined within nanopatterned porous silicon. This design enhances charge separation, prevents recombination, and increases photocatalytic activity. Our findings highlight scalable, nanostructured metasurfaces for advanced environmental and energy applications.

12:00 : Invited talk

Template-assisted Self-assembly Of Functional Metasurfaces For Advanced Photonic Applications

Sezer Seçkin, Tobias König

Leibniz-Institut für Polymerforschung Dresden e.V (Germany)

Template-assisted self-assembly (TASA) enables scalable fabrication of high-quality, defect-free nanophotonic metasurfaces by integrating pre-synthesized nanoparticles, responsive polymers, and tailored templates. This sustainable bottom-up approach combines top-down lithographic precision with self-organization, minimizing material waste and energy consumption while achieving large-area patterning for advanced sensing, energy, and spectroscopy applications.

12:20 : Invited talk

Integration of Plasmonic Metamaterials in Sensing and Photocatalytic Technologies via Scalable Fabrication Techniques

Anastasiia Zaleska

King's College London (United Kingdom)

Plasmonic metamaterials have been widely used for many application, including optical sensing and photocatalysis. Here we will discuss the fabrication techniques that were used to achieve low-cost and scalable nanosensor technology for hydrogen detection and photocatalyst system for reduction of CO₂.

10:20 - 12:30 — Manantiales

Session 3A10

Quantum Light Emitters and Photonic Heterogeneous Integration

Organized by: Han Htoon, Huan Zhao and Libai Huang

Chaired by: Han Htoon

10:20 : Invited talk

Room-temperature Quantum Emission From Interface Excitons In Mixed-dimensional Heterostructures

Nan Fang¹, Yih-Ren Chang¹, Shun Fujii¹, Daiki Yamashita¹, Mina Maruyama², Yanlin Gao², Chee Fai Fong¹, Daichi Kozawa¹, Keigo Otsuka¹, Kosuke Nagashio³, Susumu Okada², Yuichiro K. Kato¹

¹RIKEN (Japan), ²University of Tsukuba (Japan), ³The University of Tokyo (Japan)

We report on interface excitons in mixed-dimensional heterostructures consisting of two-dimensional tungsten diselenide and one-dimensional carbon nanotubes. Localization of low-energy interface excitons is indicated by extended lifetimes as well as small excitation saturation powers. Photon correlation measurements confirm antibunching at room temperature.

10:40 : Invited talk

Designer Van Der Waals Materials For Quantum Optical Emission

Shengxi Huang*Rice University (USA)*

We report new atomic engineering approaches on van der Waals materials to generate high quality single photon emitters. Our approaches include atomic substitution through plasma treatment, in-situ doping, and manipulating layer thickness and polarization. Such approaches have led to single photon emission with high purity, high brightness, and high stability.

11:00 : Invited talk**Deterministic Formation Of Single Organic Color Centers In Single-walled Carbon Nanotubes****Daichi Kozawa¹, Yuto Shiota², Yuichiro K. Kato³**¹NIMS (Japan), ²Keio University (Japan), ³RIKEN (Japan)

We develop a deterministic technique for creating single organic color centers in carbon nanotubes via in-situ photochemical reaction. By monitoring discrete photoluminescence changes, we precisely control the formation of individual color centers. Photon antibunching confirms their quantum nature, demonstrating the potential of atomically defined quantum emitters for quantum photonic devices.

11:20 : Keynote talk**Chemically Functionalized 2D Materials for Quantum Photonic Science and Technology****Mark Hersam***Northwestern University (USA)*

Chemical functionalization allows tailoring of the properties of 2D materials and the degree of coupling across heterointerfaces. In this talk, the prospects of 2D materials for quantum photonic science and technology will be discussed with a focus on how chemical functionalization can enhance quantum emission in 2D transition metal dichalcogenides.

11:50 : Invited talk**Quantum Transport And Spin-valley Control In Monolayer MoTe2 For Photonic Integration****M. A. Campbell, T. J. McSorley, J. Liu, Luis Jauregui***UC Irvine (USA)*

We demonstrate quantum transport in monolayer MoTe2 with engineered Ohmic contacts via RuCl3. High mobility and Zeeman-split oscillations reveal broken spin-valley degeneracy. Integrated with prior advances in high-quality growth and dynamic strain-tunability, our results establish monolayer MoTe2 as a promising platform for hybrid quantum photonic and light-emitting devices.

12:10 : Invited talk**From Light To Matter: Controlling Excitons For Quantum Innovation****Libai Huang***Purdue University (USA)*

In this talk, I will share our latest discoveries on how we can manipulate excitons in two-dimensional moiré superlattices. These superlattices have the potential to serve as solid-state analogues to ultracold gases for quantum simulations. We use transient photoluminescence and ultrafast reflectance microscopy to image non-equilibrium exciton phase transitions.

10:20 - 12:30 — Veselago**Session 3A11****Symposium VI: Advanced Techniques for Computational Electromagnetics**

Organized by: Maha Ben Rhouma

Chaired by: Maha Ben Rhouma

10:20 : Invited talk**Stokes Solitons And Pt-Symmetric Coupled Cavities: Two Paths To Mode-Locking Without Saturable**

Absorbers**Takasumi Tanabe, Ryo Otake, Riku Imamura, Heng Wang***Keio University (Japan)*

Through numerical analyses, we demonstrate that robust mode-locking can be achieved without the use of saturable absorbers by either exploiting stimulated Raman scattering in dispersion-engineered microresonators or by operating near exceptional points in PT-symmetric coupled cavities.

10:40 : Invited talk**Graphene-based Optoelectronics: Simulations And Design****Spyros Doukas¹, Ioannis Katsantonis², Eleftherios Lidorikis³, Anna Tasolamprou¹**¹*National and Kapodistrian University of Athens (Greece)*, ²*Foundation of Research and Technology Hellas (Greece)*, ³*University of Ioannina (Greece)*

We present a self-consistent multiphysics simulation framework for modeling the optoelectronic response of graphene-based devices in THz. The model accounts its thermodynamic response, offering valuable insights into the ultrafast processes that define graphene's behavior under strong THz fields. Two examples of ultrafast and nonlinear modulators are discussed.

11:00 : Invited talk**Predictive Modeling For Ultrafast Photothermal Effects In Nanophotonic Systems****Alessandro Alabastri***Rice University (USA)*

This work summarizes recent advances in computational methods to describe ultrafast photothermal phenomena in nanophotonic systems. We introduce predictive modeling frameworks integrating electronic dynamics and thermal diffusion, enabling optimized design and enhanced performance in applications such as photocatalysis, photothermal cancer therapy, and solar steam generation.

11:20 : Invited talk**Terahertz Parametric Detection: High Sensitivity And Applications In Nondestructive Testing****Kosuke Murate¹, Sota Mine², Kodo Kawase¹**¹*Nagoya University (Japan)*, ²*RIKEN (Japan)*

Terahertz parametric detection offers high sensitivity and, when combined with an injection-seeded terahertz parametric generator, enables measurements with a high dynamic range of 125 dB. We recently found that this technique has a relatively large incident angle tolerance. Here, we evaluate this tolerance and report on its THz scanner application.

11:40 : Invited talk**Understanding Collective Excitations In Finite-Sized Arrays Using Discrete-Dipole Approximation****Jussi Kelavuori, Ali Panahpour, Mikko Huttunen***Tampere University (Finland)*

Full-wave simulations of diffractive resonances can be accurate but slow. Semi-analytical methods based on lattice-sum calculations provide faster alternatives, with recent adaptations revealing that high-Q metasurfaces can be achieved with small arrays in slow-light environments. Furthermore, lattice-wide simulations not resorting to periodic boundary conditions offer insights into lattice's inter-particle dynamics.

12:00 : Keynote talk**Tailoring The Visual Appearance With Correlated-Disorder Metasurfaces****M. Chen¹, T. Wu¹, A. Agreda¹, M. Tréguer-Delapierre¹, K. Vynck¹, R. Pacanowski², Philippe Lalanne¹**¹*CNRS (France)*, ²*INRIA Bordeaux Sud-Ouest (France)*

We will review our current effort to model the resonance of individual resonators and collections of them with various theories, including quasinormal modes expansion and multiple scattering.

10:20 - 12:30 — Maxwell

Session 3A12

Non-Hermitian Photonics: Topological, Disordered and Quantum systems

Organized by: Konstantinos Makris and Li Ge

Chaired by: Konstantinos Makris

10:20 : **Keynote talk****Empowering Topological Photonics for OAM Manipulation****Zhigang Chen***Nankai University (China)*

In this talk, we present a few demonstrated examples of topology-driven photonic applications based on the simplest topological model. Building on these foundations, we introduce our design and implementation of more advanced photonic structures that enable robust optical vortex transport and effective manipulation of orbital angular momentum (OAM).

10:50 : **Invited talk****Light Trapping By Non-hermitian Thin Films****Lina Grineviciute¹, Ignas Lukosiunas², Julianija Nikitina¹, Indre Meskelaite², Darius Gailevicius², Kestutis Staliunas³**¹Center for Physical Sciences and Technology (Lithuania), ²Vilnius University, (Lithuania), ³ICREA (Spain)

We propose, design, fabricate, and measure non-Hermitian nano-modulated thin films, such that the in-coupling of the incident light to the waveguiding mode of the film is stronger than the outcoupling. This leads to trapping of the light in the film, and to enhanced absorption there.

11:10 : **Invited talk****Disordered Gain-loss Coupled Systems Investigated By Tracking Petermann Factors Upon Applying Continuous Gradients****Hajar Amyar, Mondher Besbes, Henri Benisty***Laboratoire Charles Fabry (France)*

We study the advent of exceptional points in 2D disordered gain-loss systems. While disorder breaks them, a real-part gradient may restore their sharpness. We track this through the Petermann factor, providing a new kind of system's "signature". We explore whether specific subsystems are also diagnosed through more direct response analysis.

11:30 : **Invited talk****Causal Structure Of Interacting Weyl Points In Acoustic Crystals****Hau Tian Teo¹, Gui-Geng Liu², Yong Ge³, Hong-yu Zou³, Wei-Chi Chiu⁴, Hongyu Chen¹, Yang Long¹, Shou-qi Yuan³, Arun Bansil⁴, Hong-xiang Sun³, Guoqing Chang¹, Baile Zhang¹**¹Nanyang Technological University (Singapore), ²Westlake University (China), ³Jiangsu University (China),⁴Northeastern University (USA)

Interactions between relativistic particles are governed by causality, represented by spacetime light cones. However, the causal relations between interacting quasiparticles remains elusive despite their conical dispersions. By dynamically driving an acoustic analogue of charge density wave, we experimentally extend the causal structure to interacting Weyl quasiparticles in three-dimensional acoustic crystals.

11:50 : **Invited talk****Intrinsic Non-Hermiticity In Photonic Floquet Topological Insulators With Genuine Temporal Modulation****Junda Wang, Haoye Qin, Zhe Zhang, Romain Fleury***EPFL (Switzerland)*

Photonic topological insulators (TIs), inspired by condensed matter TIs, exhibit intrinsic non-Hermitian properties due to the Maxwell equation's nature, particularly in Floquet TIs. This study peeks into these phenomena through a double-layered Floquet Su-Schrieffer-Heeger (SSH) model, revealing amplified and attenuated topological interface states via microwave experiments leveraging semiconductor varactors' nonlinearity.

12:10 : Invited talk**Are Lasing Zero Modes Always Topological?****M. Alizadeh¹, S. K. Ozdemir¹, A. M. Yacomotti², Ramy ElGanainy¹**¹ Saint Louis University (USA), ² Université Paris-Saclay (France)

We demonstrate that the interplay between coupling rates, dissipation, and gain saturation nonlinearity in laser arrays can significantly alter the mode structure. In particular, these effects can delocalize otherwise well-confined linear topological states, signaling a breakdown of the conventional bulk-boundary correspondence in the nonlinear lasing regime.

10:20 - 12:40 — Fresnel**Session 3A13****Symposium II: New Trends in Nanophotonics and Advanced Materials**

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Alberto G. Curto

10:20 : Invited talk**Self-illuminated Plasmonic Biosensor Enabled By Inelastic Tunnelingluminescence****Jihye Lee¹, Yina Wu², Ivan Sinev¹, Mikhail Masharin¹, Sotirios Papadopoulos³, Eduardo Dias², Lujun Wang³, Ming Lun Tseng⁴, Seunghwan Moon⁵, Jong-Souk Yeo⁵, Lukas Novotny³, Javier Garcia de Abajo², Hatice Altug¹**¹EPFL (Switzerland), ²ICFO (Spain), ³ETH Zurich (Switzerland), ⁴National Yang Ming Chiao Tung University (Taiwan), ⁵Yonsei University (Korea)

We present a self-illuminating plasmonic biosensor using quantum tunneling-driven light emission for label-free biomolecule detection. Integrating a plasmonic metasurface with a metal-insulator-metal tunnel junction removes the need for an external light source. Experiments confirm detection of nanoscale organic and biological coatings via refractive index changes, advancing compact biosensing platforms.

10:40 : Invited talk**Neural Network-optimized Multifunctional Metasurfaces For Adaptive High-frequency Wireless Communication****Miguel Beruete, Damián Rodríguez-Trujillo, Alicia E. Torres-García, Mikel Aldea, Jorge Teniente, Asier Marzo-Perez***Public University of Navarre (Spain)*

This paper introduces a novel design for passive, multifunctional metasurfaces that enable dynamic functionalities like beam steering and holographic imaging. Using neural network-driven optimization, these metasurfaces provide adaptable solutions for high-frequency wireless communication systems without the need for active components, offering a scalable, cost-effective approach for next-generation networks.

11:00 : Invited talk**Development Of Plasmonic Components For Artificial Neural Networks****Martin Aeschlimann***RPTU Kaiserslautern-Landau (Germany)*

We present a neuromorphic architecture based entirely on surface plasmon polariton interactions. A concept for a plasmonic network node (PLNN) is introduced, utilizing an optical angular momentum sorter for input encoding. Dynamic weighting is achieved through controlled excitation of plasmonic edge modes via directed optical waves.

11:20 : Invited talk**Two-dimensional Gold Flakes For Nonlinear And Low-loss Plasmonics****Alexey Krasavin¹, Chenxinyu Pan², Lufang Liu², Zhenxin Wang², Anatoly Zayats¹, Limin Tong², Pan Wang²**

¹King's College London (United Kingdom), ²Zhejiang University (China)

In this report, we will discuss exquisite optical properties of single-crystal two-dimensional gold flakes (2DGFs). The ultrathin thickness of the 2DGFs leads to the onset of quantum confinement effects, which create new pathways for gold photoluminescence and nonlinear harmonic generation, leading to their enhancement by orders of magnitude.

11:40 : Invited talk

Resonant Light Absorption Driving By Bound States In The Continuum In Hybrid metasurfaces

Andrey Evlyukhin¹, M. A. Poleva², C. Rockstuhl²

¹Leibniz University Hannover (Germany), ²Karlsruhe Institute of Technology (Germany)

We study how material-induced bianisotropy of hybrid nanostructures leads to resonant features in the optical response of both individual hybrid particles and metasurfaces composed of them. The excitation of quasi-bound states in the continuum in hybrid metasurfaces leading to spectral absorption bands is discussed.

12:00 : Invited talk

Overcoming Integration Challenges in Photonic AI Accelerators

A. Ortega-Gomez, N. Farmakidis, Håvard Hem Toftevaag, Yi Zhang, Harish Bhaskaran

University of Oxford (UK)

How can we overcome the current challenges hindering the implementation of photonic accelerators in complex AI workloads? We explore an integrated all-optical neural architecture comprising: i) a high-speed and nonlinear photonic integrator as a neuron block, ii) an ultra-low loss photonic mesh with reconfigurable interconnections.

12:20 : Invited talk

Controlling And Applying The Loss Of Electromagnetic Metasurface Based On Machine Learning

Peng Fu, Yang Guo, Changzhi Gu

Institute of Physics - CAS (China)

By integrating the non-Hermitian optical theory and machine learning methods, we promoted the design of metasurfaces from traditional experience-driven to data-driven, and from single function to multi-function collaboration. This results can be widely used in integrated photonics, sensors and detectors with high sensitivity.

10:20 - 12:30 — Bragg

Session 3A14

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Malcolm Kadodwala

10:20 : Invited talk

Past, Present And Future Of Mass Diffusion Metamaterials

Juan Manuel Restrepo Florez

University of Florida (USA)

Precise control of mass diffusion is vital in separations, reactions, and sensors. Metamaterials theory has recently advanced our understanding of mass diffusion in these systems. This talk explores how metamaterials can transform separations, outlining the current state of the art, key challenges, and promising future research directions.

10:40 : Invited talk

Very Large-Scale Integration for Fibers (VLSI-Fi): Assembling Fiber-Embedded Photonics and Optoelectronics by Melt-Shaping Multimaterial Cores

Alexander Gumennik

Indiana University Bloomington (USA)

Fiber optics interconnecting the post-Moore's law Internet is likely to embed photonics with data processing capabilities. Inspired by the VLSI design of modern microprocessors, we melt-shape multimaterial fiber cores into architectures typical of integrated circuitry to realize fiber-embedded photonics. We dubbed this fabrication approach the "VLSI for Fibers."

11:00 : Invited talk

Extreme-Ultraviolet Spatiotemporal Optical Vortices

Rodrigo Martín-Hernández¹, Guan Gui², Luis Plaja¹, Henry Kapteyn², Margaret Murnane², Miguel Ángel Porras³, Chen-Ting Liao², Carlos Hernández-García¹

¹Universidad de Salamanca (Spain), ²University of Colorado and NIST (USA), ³Universidad Politécnica de Madrid (Spain)

We demonstrate the first generation of spatiotemporal optical vortices (STOVs) in the extreme ultraviolet via high harmonic generation. This highly nonlinear process enables attosecond-scale spatiotemporal coupling, paving the way for novel probes of ultrafast light-matter interactions with structured light carrying high topological charge in space and time.

11:20 : Invited talk

Exponentially Sensitive Lattices: Pseudospectral Scalings

Ioannis Kiropelidis, Konstantinos G. Makris

IESL-FORTH (Greece)

We examine the sensitivity of non-Hermitian photonic lattices with asymmetric couplings by exploring the underlying pseudospectral scalings. We show that the extreme lattice nonnormality leads to exponentially sensitive eigenvalue spectra and power growth, suggesting a route for designing ultrasensitive systems without relying on exceptional points.

11:40 : Invited talk

Spectroscopic Proof Of The Non-thermal Reactant Activation in Plasmon-photocatalysis

Zee Hwan Kim

Seoul National University (Korea)

Recent studies on plasmon photocatalysis suggest that the hot-electrons generated by plasmon-excited nanostructures may induce non-thermal vibrational activation of metal-bound reactants. However, this postulate has not been fully validated. Here, we provide direct and quantitative evidence that such activation occurs on plasmon-excited nanostructures.

12:00 : Chiral And Non-chiral Swift Mode Conversion Through Adiabaticity Engineering

Dong Wang¹, Wen-Xi Huang², Bo Zhou¹, Wenduo Yu¹, Pei-Chao Cao¹, Yu-Gui Peng¹, Zheng-Yang Zhou³, Hongsheng Chen¹, Xue-Feng Zhu¹, Ying Li¹

¹Zhejiang University (China), ²Huazhong University of Science and Technology (China), ³Zhejiang Sci-Tech University (China)

We propose a method that dynamically engineers adiabaticity in the evolution of non-Hermitian systems to achieve arbitrary mode conversion effects. This approach addresses speed and chirality challenges in EP encircling without relying on a specific model, facilitating dynamic manipulation of nonadiabatic processes and accelerating operations with selectable mode conversion patterns.

12:15 : Tunable Nanostructured Metamaterial With Epsilon-near-zero Transition Layer

Tatjana Gric¹, Edik Rafailov²

¹Vilnius Gediminas Technical University (Lithuania), ²Aston University (United Kingdom)

Propagation of surface plasmon polaritons at the boundary of semiconductor based nanostructured metamaterial with epsilon-near-zero transition layer is investigated. The dispersive properties are altered by a dielectric function being temperature dependent allowing for sensing applications.

Lunch

12:30 - 14:00

14:00 - 15:50 — Torremolinos

Session 3A15

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Renaud Bachelot

14:00 : **Keynote talk****AI To Discover And Synthesize Sub-Terahertz Chips Beyond Human Intuition****Kaushik Sengupta***Princeton University (USA)*

Traditionally, chip-scale high-frequency system design has been in the domain of the experts. We demonstrate here for the first time how AI can not only allow design times that are orders of magnitude faster, but also unearth new sub-THz chip architectures that are beyond human intuition.

14:30 : **Invited talk****Optical Skyrmions From Metamaterials****Yijie Shen, Nilo Mata-Cervera***Nanyang Technological University (Singapore)*

Optical metamaterials and the topologies of structured light are two emerging hot topics in the photonics community. In this talk, I will perspective metamaterials for generation of diverse novel topologies of light, in particular, how recent metasurface technologies enable integrated optical skyrmion generators and the future trends.

14:50 : **Invited talk****Chirality Transfer In Silicon Nanoparticles With Chiral Molecules****Hiroshi Sugimoto¹, Hiroki Kasai¹, Kento Shintani¹, Shahin Ghamari², Frank Vollmer², Minoru Fujii¹**¹Kobe University (Japan), ²University of Exeter (United Kingdom)

Chiral molecular sensing plays a crucial role in biomedical and pharmacological applications. However, the sensitivity of existing methods is limited by the weak interaction between light and molecules. Here, we introduce a novel platform that enhances chiral light-matter interactions using Mie-resonant silicon nanospheres which can be dispersed in solution.

15:10 : **Invited talk****Tailoring The Emission And The Photodynamics Of Quantum Emitters With Simple And Optimized High-index Dielectric Nanostructures****Swaroop Palai¹, Mélodie Humbert¹, Romain Hernandez¹, Peter Wiecha¹, Jonas Muller¹, Etienne Palleau¹, Frank Fournel², Vincent Larrey², Aurélie Lecestre¹, Guilhem Larrieu¹, Christian Girard¹, Vincent Paillard¹, Laurence Ressler¹, Aurelien Cuche¹**¹Université de Toulouse (France), ²Université Grenoble Alpes (France)

Through experimental and theoretical methods, we demonstrate the controllable photodynamics of quantum emitters (NV colored centers in nanodiamonds) precisely positioned near silicon dimer nanoantennas. Then, by designing specific geometries with an evolutionary optimization algorithm, we explore enhancing the directional emission of these quantum sources numerically.

15:30 : **Invited talk****Integrating Superconductors With Silicon Photonic Circuits For High-performance Quantum Optic Applications****Jeff Young, Mohammad Khalifa, Phillip Kirwin, Joseph Salfi***University of British Columbia (Canada)*

Quantum information can be processed in the microwave or optical frequency domains, but can only be transported via optical or infrared photons. We propose and quantitatively model a novel microwave-optical quantum transducer that relies on intimate coupling of superconducting microwave and semiconducting optical cavities with an ensemble of color centers.

14:00 - 16:00 — Alamos

Session 3A16

Quantum Nanophotonics Workshop

Organized by: Ortwin Hess

Chaired by: Ortwin Hess

14:00 : **Invited talk****Polarization-entangled photon pair generation from an epsilon-near-zero metasurface****Wenhe Jia Yang, Grégoire Saerens Yang, Ülle-Linda Talts Yang, Helena Weigand Yang, Robert J. Chapman Yang, Liu Li, Rachel Grange, Yuanmu Yang***Tsinghua University (China)*

We introduce and experimentally demonstrate a nanoscale polarization-entangled photon pair source utilizing a plasmonic metasurface that is strongly coupled to an epsilon-near-zero (ENZ) material.

14:20 : **Invited talk****Lighting The Future: Advancing Quantum Nanophotonics With Forward And Inverse Designs****Lin Wu***University of Technology and Design (SUTD) (Singapore)*

This talk explores cavity quantum electrodynamics (Cavity-QED) design strategies from forward and inverse perspectives, highlighting case studies like quantum plasmonic sensing. We introduce advancements in quantum nanophotonics, combining the local density of states with deep learning to innovate and optimize design processes, offering a transformative pathway for quantum photonics.

14:40 : **Invited talk****Superresolution For Nanometer-scale Optical Imaging****Robert Boyd***University of Ottawa (Canada)*

Quantum imaging is a research area that seeks to produce "better" images using quantum methods. We review recent research in this field, especially in the context of applications in biomedicine.

15:00 : **Invited talk****Nanophotonic Interfaces For Integrated Quantum Technologies****Hamidreza Siampour***Queen's University Belfast (United Kingdom)*

In this talk, I will present my research on developing nanophotonic interfaces for integrating solid-state quantum emitters. This includes nanoscale optical positioning of single emitters in nanomaterials for efficient waveguide/cavity coupling, plasmonic enhancement of single-photon emission at the zero-phonon line, and deterministic photon-emitter interfaces in chiral nanophotonic waveguides.

15:20 : **Invited talk****Nanoscale Gap-Plasmon-Enhanced Superconducting Photon Detectors at Single-Photon Level****Yu-Jung Lu***Academia Sinica (Taiwan)*

We present a novel approach to enhance the visible-light photoresponse in NbN superconducting microwire photon detectors (SMPDs) by integrating them with gap plasmon resonators (GPRs). An impressive detection efficiency of 98 % was achieved using these plasmonic SMPDs.

15:40 : **Invited talk****Quantum Radar with Undetected Photons****Diego Dalvit***Los Alamos National Laboratory (USA)*

We propose a novel quantum sensing framework that addresses these challenges using quantum frequency combs with path identity for remote sensing of signatures ("qCOMBPASS"). The combination of one key

quantum phenomenon and two quantum resources, namely quantum induced coherence by path identity, quantum frequency combs, and two-mode squeezed light, allows for quantum remote sensing without requiring a quantum memory.

14:00 - 16:00 — Playamar

Session 3A17

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Xiangrong Wang

14:00 : **Invited talk**

Microwave-to-optical Quantum Transduction Mediated By Antiferromagnetic Magnons In Antiferromagnets

Akihiko Sekine, Ryo Murakami, Yoshiyasu Doi

Fujitsu Limited (Japan)

While earlier studies regarding the magnon-mediated quantum transduction have so far utilized ferromagnetic magnons in ferromagnets, here we formulate a theory for the microwave-to-optical quantum transduction mediated by antiferromagnetic magnons in antiferromagnets. We find that the quantum transduction can occur even in the absence of an external static magnetic field.

14:20 : **Invited talk**

Chiral Modes In Photonic Integrated Waveguides

Iago Diez, Daniel Arenas-Ortega, Josep Martínez-Romeu, Alejandro Martínez

Nanophotonics Technology Center (Spain)

A key requirement for chiral separation using integrated waveguides and chiral optical forces is the support of a guided chiral mode. We present an experimental method, based on analyzing the spectral response of Mach-Zehnder interferometers, to determine the optimal waveguide width that satisfies this requirement.

14:40 : **Keynote talk**

Vortices, Skyrmions, Möbius Strips: From Nanooptics To Ocean Waves

Konstantin Bliokh

Donostia International Physics Center (Spain)

I will present recent theoretical and experimental results on: (i) subwavelength high-intensity vortices around 'holes' in 2D wave systems: from polaritons to ocean waves, (ii) Bessel-type vortices, displacement-field skyrmions, and polarization Möbius strips in sound and water waves, and (iii) manipulation of floating particles using topologically structured water waves.

15:10 : **Keynote talk**

Empowering chiral metamaterials with gain materials

Ioannis Katsantonis, Anna Tasolamprou, Maria Kafesaki

FORTH (Greece)

We will review our recent works on chiral metamaterials involving gain materials and on chiral metamaterials combining gain and loss. Special attention will be given to parity-time symmetric chiral metamaterials and to chiral metamaterials for circularly polarized laser emission.

15:40 : **Invited talk**

Dynamics Of Softened Spin Waves In Thin Films With Perpendicular Anisotropy At Temporal Interfaces

Krzysztof Sobucki¹, Nikodem Leśniewski², Pawel Gruszecki¹

¹Adam Mickiewicz University (Poland), ²CNRS-Lab-STICC (France)

Spin wave dynamics in thin ferromagnetic films with perpendicular anisotropy and Dzyaloshinskii-Moriya interaction is studied near the phase transition between uniform and stripe-domain phases. Micromagnetic simulations show spin-wave reflection, refraction, and amplification at temporal interfaces introduced by modulating the external magnetic field, offering a novel method for spin-wave control.

14:00 - 16:00 — Bajondillo

Session 3A18

Symposium III: Advanced passive and active metasurfaces and zero-index materials

Organized by: Howard Lee, Pin-Chieh Wu and Wen-Hui (Sophia) Cheng

Chaired by: Zhaowei Liu and Sophia Cheng

14:00 : **Invited talk**

Heterogeneous High-entropy Alloy (hea) Plasmonics For Superior And Low-cost Photocatalytic Hydrogen Evolution Reaction (her)

Chun-Yen Chen, Yu-Hsuan Cheng, Alex Sam, Arya Pilakunnath, Ta-Jen Yen
NTHU (Taiwan)

A heterogeneous system has been designed in the form of gold or high-entropy alloy (HEA) nanoparticles, as well as silicon nanowires (SiNW) and molybdenum disulfide (MoS₂) nanofilms (PNP/SiNW/MoS₂), which exhibits excellent photocatalytic hydrogen evolution reactions (PC-HER) up to 477.5 mmol g⁻¹ h⁻¹.

14:20 : **Invited talk**

Far-Field Radiation And Polarization Engineering Using Luminescent Metasurfaces

Elise Bailly, Anne Nguyen, Jean-Paul Hugonin, Jean-Jacques Greffet, Benjamin Vest
Université Paris-Saclay (France)

Intrinsically incoherent luminescent emitters can be coupled to metasurfaces to establish some coherence in emission and therefore to enable structuration of the emitted field. We present here light-emitting metasurfaces designed using a Kirchhoff's law approach demonstrating a control of the polarization and of the angular radiation pattern.

14:40 : **Invited talk**

Multi-Layer Flat Optics: Challenges And Opportunities

Ahmed Dorrah
Eindhoven University of Technology (The Netherlands)

Metasurfaces have enabled advanced imaging, sensing and communications due to their CMOS compatibility, versatility, and compactness. However, challenges in diffraction efficiency, bandwidth, scalability, and limited polarization control persist. Multi-layer metasurfaces address these issues, enabling high-efficiency devices with full polarization control, achromatic response, and improved performance for many applications.

15:00 : **Invited talk**

Thermo-optical Effects In Nanoantennas And Metasurfaces

Giulia Tagliabue
EPFL (Switzerland)

The combination of photothermal and thermo-optical effects in dielectric nanoresonators open new opportunities for contactless manipulation of metasurfaces.

15:20 : **Invited talk**

Nanofocusing of the Orbital Angular Momentum Laser Beam for Nanoimaging

Zhenrong Zhang
Baylor University (USA)

In this talk, I present the development of plasmonic fiber probes for nanoscale chirality imaging. The vortex

beam carrying an orbital angular momentum (OAM) can be used to distinguish the enantiomers of the chiral molecule. I will present the design, simulation, fabrication, and characterization of plasmonic OAM probes.

15:40 : Invited talk

Nonreciprocal And Directional Control Of Infrared Emissivity In Semiconductor Enz Systems
Aaswath Raman

University of California (USA)

Controlling the spectral and directional characteristics of thermal emission is of fundamental interest for sensing and energy applications. I will introduce our recent work on controlling spectral and directional emissivity in III-V semiconductor-based photonic structures and metasurfaces, and exploiting the magneto-optic response of these architectures to break Lorentz reciprocity.

14:00 - 16:00 — Carihuela

Session 3A19

Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and Noé Jiménez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

14:00 : Invited talk

Temperonic Metamaterials: Shaping Wave-like Temperature Oscillations On The Ultrafast Time Scale.
Giulio Benetti¹, Marco Gandolfi², Riccardo Rurali³, Claudio Giannetti⁴, Francesco Banfi⁵

¹San Bortolo Hospital (Italy), ²Istituto Nazionale di Ottica - Consiglio Nazionale delle Ricerche (INO-CNR) (Italy), ³ICMAB-CSIC (Spain), ⁴Università Cattolica del Sacro Cuore (Italy), ⁵Université Claude Bernard Lyon 1 (France)

At small spatial and temporal scales, in specific materials addressed as temperonic, temperature propagates in a wave-like fashion. The talk covers a finite size temperonic crystal, a superlattice composed of alternating temperonic materials, allowing coherent control of temperature waves, similarly to the case of phononic crystal for the displacement field.

14:20 : Invited talk

Interaction Of Sloshing Water Waves With A Vertically Oscillating Plate

Magdalini Koukouraki¹, Philippe Petitjeans¹, Agnès Maurel¹, Vincent Pagneux²

¹ESPCI-Paris (France), ²Le Mans Université (France)

We theoretically investigate the interaction of a surface sloshing wave with a vertically oscillating plate inside a water tank, reporting on the stability of the surface elevation with respect to the plate oscillation amplitude and frequency. Using conformal mapping and then a Floquet stability analysis, we identify parametric amplification windows.

14:40 : Invited talk

Perfect Absorption Of Flexural Waves In Vibration Transmission Problems Via Coupled Monopolar-dipolar Resonant Scatterers

Daniele Giannini¹, Jean-Philippe Groby²

¹KU Leuven (Belgium), ²Université du Mans (LAUM) (France)

We propose a strategy to achieve perfect absorption of flexural waves in transmission problems using coupled monopolar-dipolar resonant scatterers. By enforcing vanishing transmission and reflection, we analytically derive the required scatterer impedance. A perfect absorber design, based on two cantilever beam-mass structures, is proposed and validated through full-wave simulations.

15:00 : Invited talk

Ultrafast Phononic Manipulation Of Magnetization

Carl Davies*Radboud University (The Netherlands)*

Upon driving doubly-degenerate optical phonons at resonance within a paramagnetic substrate, we demonstrate that magnetization can be created on an ultrafast timescale. Further, this transient magnetization can remotely switch magnetic ordering in an overlayer. This application of the ultrafast Barnett effect offers a potentially universal method for controlling magnetization.

15:20 : Invited talk**Controlling The Propagation Of 20 Ghz Coherent Acoustic Phonons In An Optophononic Waveguide**

Edson Rafael Cardozo de Oliveira¹, Chushuang Xiang¹, Sathyan Sandeep¹, Konstantinos Papatryfonos¹, Martina Morassi¹, Luc Le Gratiet¹, Abdelmounaim Harouri¹, Isabelle Sagnes¹, Aristide Lemaitre¹, Omar Ortiz¹, Martin Esmann², Daniel Lanzillotti-Kimura¹

¹ *Université Paris-Saclay (France)*, ² *Carl von Ossietzky Universität Oldenburg (Germany)*

We studied the propagation of ultrahigh frequency coherent acoustic phonons in a ridge waveguide based on multilayered GaAs/AlAs optophononic Fabry-Perot resonator. Additionally, by optically generating two distant phonon sources, we demonstrated the interference of the propagating coherent phonons in such system.

15:40 : Invited talk**Wave Locking In Periodically Folded Beams: Influence Of Modelling Choices On Complete Band Gap Prediction****Elisabetta Manconi, Farzad Tatar***University of Parma (Italy)*

This work presents a study on the formation of complete band gaps in periodically folded one-dimensional waveguides. The effects of modelling choices on the coupling of contradirectional Bloch waves and the formation of the first band gap are investigated. Numerical examples and a parametric analysis are provided.

14:00 - 16:00 — Montemar**Session 3A20****Advanced Theoretical Methods for Nanoplasmonics and Molecular Plasmonics**

Organized by: Tommaso Giovannini and Stefano Corni

Chaired by: Stefano Corni

14:00 : Invited talk**Emission Quenching In Plasmonics – Understanding And Countering It****Jacob Khurgin***Johns Hopkins University (USA)*

Plasmonic structures enhance light emission via the Purcell effect but often reduce efficiency due to luminescence quenching. I present a coupled-mode theory attributing quenching to nonradiative modes and showing how emitter placement and symmetry breaking can mitigate it. The model also explains why quenching is absent in plasmon-enhanced Raman scattering.

14:20 : Invited talk**Modeling Plasmonics And Molecular Plasmonics From An Atomistic Perspective****Chiara Cappelli***Scuola Normale Superiore (Italy)*

This study presents an atomistic yet classical approach coupled to a QM Hamiltonian, to predict plasmonic properties of nanostructured materials. The method enables large-scale simulations, also capturing quantum effects. Remarkably, it accurately reproduces computed reference data and experiments.

14:40 : Invited talk**Theory Of Imaging Molecules Using Light In A Scanning Tunneling Microscope**

Tomas Neuman*Institute of Physics of the Czech Academy of Sciences (Czech Republic)*

I will discuss the theoretical description and interpretation of techniques employing light in a scanning tunneling microscope. These techniques, including STM-induced electroluminescence, photocurrent generation, or tip-enhanced photoluminescence provide sub-molecular optical resolution and reveal atomic-scale molecular properties mostly related to the molecule's excited states, hardly accessible otherwise.

15:00 : Invited talk**Multiscale Modelling Insights On Plasmon-assisted Hot-carrier Injection Driving Carbon Dioxide Reduction On Rhodium Nanocubes**

Margherita Marsili¹, Giulia Dall'Osto², Mirko Vanzan³, Daniele Toffoli², Mauro Stener², Stefano Corni⁴, Emanuele Coccia²

¹ *Università di Bologna (Italy)*, ² *University of Trieste (Italy)*, ³ *University of Milan (Italy)*, ⁴ *Università di Padova (Italy)*

Using a multiscale computational approach, based on accurate electronic-structure calculations for the active site and a classical representation of the nanoparticle, we shed light on the microscopic mechanisms beyond the selective production of methane against carbon monoxide on illuminated Rh nanocubes.

15:20 : Invited talk**Active Control Of Smith-purcell Radiation Emission Using 2d Nanoribbons**

Eduardo Dias¹, Theis Rasmussen¹, Álvaro Rodríguez Echarri², Javier García de Abajo³, Joel Cox¹

¹ *SDU - University of Southern Denmark (Denmark)*, ² *Max-Born-Institut (Germany)*, ³ *ICFO - The Institute of Photonic Sciences (Spain)*

We propose a theoretical approach to actively control Smith-Purcell radiation emission using 2D (graphene/TMD) nanoribbons. By tuning doping levels via electrical gating or optothermal doping, we achieve precise control of emission directionality, enabling light focusing and steering, with implications for spectroscopy, sensing, and communication applications.

15:40 : Invited talk**Modelling hot carrier generation, relaxation and extraction in large metallic nanoparticles**

Johannes Lischner

Imperial College London (United Kingdom)

The decay of localized surface plasmons results in the generation of energetic or "hot" electrons and holes which can be harvested for applications in photovoltaics and photocatalysis. I will describe an atomistic theory of hot-carrier properties which allows the modelling of nanoparticles consisting of more than one million atoms.

14:00 - 16:00 — Litoral**Session 3A21****Bottom-up approaches, new fabrication routes and ENSEMBLE3**

Organized by: Dorota Pawlak and Virginie Ponsinet

Chaired by: Zouheir Sekkat

14:00 : Invited talk**Beyond Threshold: Geometry Matrix Modeling Of Active Plasmonic Nanoparticles**

Nicole Recalde¹, Karen Caicedo², Milena Mora¹, Ashod Aradian³, Melissa Infusino¹, Maria Antonia Iatì⁴, Rosalba Saija⁵, Onofrio Maragò⁴, Alessandro Veltri⁴

¹ *Universidad San Francisco de Quito (Ecuador)*, ² *Institute of Applied Sciences and Intelligent Systems (ISASI-CNR) (Italy)*, ³ *Université de Bordeaux (France)*, ⁴ *Institute of Chemical and Physical Processes (IPCF-CNR) (Italy)*, ⁵ *Università degli Studi di Messina (Italy)*

We introduce the Geometry Matrix formalism, a modular framework for modeling active plasmonic nanoparti-

cles in the quasi-static and Mie regimes. This approach predicts threshold gain conditions, emission spectra, and modal instabilities in gain-assisted metal nanostructures, offering a unified perspective on plasmonic nano-resonators and improving predictive modeling for plasmonic spasers.

14:20 : **Invited talk**

Numerical Modelling Of Controlled Light Amplification in Liquid Crystal Micro-structures

Jaka Zaplotnik¹, Urban Mur¹, Igor Muševič², Miha Ravnik¹

¹University of Ljubljana (Slovenia), ²Jožef Stefan Institute (Slovenia)

Self-assembled dye-doped liquid crystals, in combination with printed polymer micro-structures, can form devices that perform as micro-lasers. Here we present numerical simulations of light coupling into and between such structures, their lasing characteristics, and optical control of laser emission intensity.

14:40 : **Invited talk**

Composite Plasmonic Nanoparticles With Extraordinary Optical Properties: Nanolasing, Artificial Magnetism, And Spatial Dispersion

Ashod Aradian¹, Karen Caicedo², Ranjeet Dwivedi¹, Andres Cathey³, Nicole Recalde⁴, Melina Mora⁴, Melissa Infusino⁴, Kevin Vynck⁵, Alessandro Veltri⁴, Alexandre Baron¹

¹University of Bordeaux (France), ²Istituto di Scienze Applicate e Sistemi Intelligenti (ISASI) - CNR (Italy),

³Max Planck Institute for Plasma Physics (Germany), ⁴Universidad San Francisco de Quito (Ecuador), ⁵University Claude Bernard Lyon 1 (France)

Nanoparticles form a wide-spread class of objects with multiples applications in the field of nanophotonics and optics. I will present two examples of plasmonic nanoparticles whose composite internal structures enable extraordinary optical properties: gain-metal nanoshells allowing nanolasing, and dense plasmonic clusters displaying artificial magnetism and spatial dispersion.

15:00 : **Invited talk**

Bottom-up Design Of Isotropic Auxetic Metamaterials Via Kolmogorov-arnold Networks

Heyuan Huang

Northwestern Polytechnical University (China)

This study introduced a data-driven structural design strategy and established a mapping between design parameters and mechanical responses for classical missing rib auxetic metamaterials via Kolmogorov-Arnold Networks. The predicted mean squared error for the stress dataset was 0.81 %, only one-fourth of that achieved by multilayer perceptron models of equivalent width.

15:20 : **Invited talk**

Helicity Preserving Metasurface Mirrors For Thz Applications

J. Yan¹, I. Katsantonis¹, S. Papamakarios¹, P. Konstantakis¹, M. Loulakis¹, Th. Koschny², M. Farsari¹, M. Kafesaki¹, Stelios Tzortzakis¹

¹FORTH-IESL (Greece), ²Iowa State University (USA)

We present metasurface mirrors that achieve perfect helicity-preserving reflection for circular polarization and cross-polarized reflection for linear polarization in the THz spectrum, without the need for a back-reflector. Validated via THz time-domain spectroscopy, the designs enable advanced applications in molecular chirality sensing and broadband polarization control.

15:40 : **Invited talk**

Tailoring The Spontaneous Emission Of Magnetic Dipole Transitions With Plasmonic Multipods

Joshua Davis¹, Sébastien Bidault², Mathieu Mivelle³, Mona Tréguer-Delapierre⁴, Alexandre Baron¹

¹University of Bordeaux (France), ²ESPCI Paris (France), ³Sorbonne Université (France), ⁴Université de Bordeaux (France)

Plasmonic multipod structures with N metallic satellites on a dielectric core are designed and optimized to serve as bright, efficient and robust sources of magnetic light. Our approach based on quasi-normal modes reveals that structures with at least tetrahedral symmetry exhibit far superior behavior compared to structures with poor symmetry.

14:00 - 16:05 — Manantiales

Session 3A22

Symposium I: Hybrid Nanomaterials and Metastructures for Photonics, Sensing and Energy

Organized by: Jerome Plain, Alexander Govorov, Davy Gerard and Pedro Hernandez Martinez

Chaired by: Eva Yazmin Santiago and Lucas Vazquez Besteiro

14:00 : **Invited talk****A Platform for Single-Crystal Nanomaterials and Metasurfaces with Application in Nanophotonics, Sensing and Energy Harvesting****Sasan V. Grayli¹, Albert Adserias², Finlay MacNab², Gary Leach²**¹University of Waterloo (Canada), ²Simon Fraser University (Canada)

We describe a versatile platform for single-crystal (SC) plasmonic nanomaterials and metasurfaces. Au(100) metasurfaces provide tailored fields that produce large surface enhanced Raman scattering yields for sensing. Metasurfaces of single-crystal split ring resonators provide flat optics for polarization manipulation, and hybrid SC plasmonic alloys provide improved electrocatalysts for energy harvesting.

14:20 : **Invited talk****Photopolymerized Molecularly Imprinted Polymers for Plasmonic Sensing Platforms****A. Khitous, C. Molinaro, Olivier Soppera***Université de Haute Alsace (France)*

We present plasmonic sensors functionalized with photopolymerized molecularly imprinted polymers (MIPs) for selective detection of small molecules and enantiomers. Controlled MIP growth on metallic substrates preserves plasmonic properties and enables highly selective recognition in SPR and SERS configurations. Applications include pollutants, pharmaceuticals, and chiral analytes.

14:40 : **High-resolution And Broadband Metafiber Refraction Index Sensors****Jiyong Wang, L. Zhang, M. Qiu***Hangzhou Dianzi University (China)*

An all-fiber optical sensor with high resolution (2664 RIU-1) and broad linear range (refraction index 1.330-1.430) is realized by coupling resonances from the Fabry-Perot cavity and plasmonic metasurfaces. The whole device is integrated on the fiber tip to enable in-situ liquid monitoring.

14:55 : **Invited talk****Metasurfaces by Two-Photon Polymerization Gray Scale Lithography****Dewa Ade-Onojobi¹, Kiernan E. Arledge¹, Xitlali G. Juarez², Nazli Rasouli¹, Chase T. Ellis², Joseph G. Tischler¹**¹University of Oklahoma (USA), ²U.S. Naval Research Laboratory (USA)

Traditionally, nanostructuring is accomplished through etching of films and substrates using standard photolithography or electron beam lithography (EBL) which limit these structures to flat two-dimensions or fixed height. To overcome these challenges, we developed fabrication of gray scale masks using two-photon polymerization using a Photonic Professional GT2 Nanoscribe 3D printer.

15:15 : **Environmental Permittivity-asymmetric Bic Metasurfaces With Electrical Reconfigurability****Haiyang Hu¹, Wenzheng Lu¹, Alexander Antonov¹, Rodrigo Berté¹, Stefan A. Maier², Andreas Tittl¹**¹Ludwig-Maximilians-Universität München (Germany), ²Monash University Clayton Campus (Australia)

In nanophotonics, we introduce permittivity-driven quasi-BICs (ϵ -qBICs), achieved by embedding identical resonators in a refractive index-contrasting medium. Integrating electro-optic polyaniline enables electrically reconfigurable ϵ -qBICs with rapid switching and durability, advancing tunable metasurfaces for on-chip optics, sensing, and adaptive photonic applications without modifying resonator geometry.

15:30 : **Hybrid Self-assembled Plasmonic Metasurfaces For Applications In Photonics****Tomas Tamulevičius, Klaudijus Midveris, Gvidas Klyvis, Tomas Klinavičius, Asta Tamulevičienė, Mindaugas Juodėnas, Domantas Peckus, Joel Henzie, Sigitas Tamulevičius**

Kaunas University of Technology (Lithuania)

Chemically synthesized monodisperse plasmonic nanoparticle colloids self-assembled into soft lithography replicated elastomer templates and transferred onto desired surfaces serve as macroscopic scale metasurfaces. Regular noble metal nanoparticle arrays in organic dyes or semiconductor layers couple the scattered localized plasmon light into high-Q surface lattice resonances serving in nanolasing and photocatalysis.

15:45 : Invited talk

Finite Element Analysis of Light Scattering in Resonant Multi-Dielectric Coverslips for Enhanced Total Internal Reflection Fluorescence Microscopy

Y. Toumi¹, R. Gurram¹, F. Lemarchand¹, A. Moreau¹, C. Favard², J. Lumeau¹, G. Demesy¹, Aude Lereu¹

¹*Institut Fresnel CNRS (France)*, ²*University of Montpellier (France)*

We investigate the optimization and implementation of resonant dielectric multilayers (DM) coverslips to enhance total internal reflection fluorescence microscopy contrast. These DM can support surface waves resulting in amplifying the local excitation field, directly acting on fluorescence enhancement. However, scattering from substrate roughness can degrade performances that will be discussed.

14:00 - 14:40 — Veselago

Session 3A23

Symposium VI: Advanced Techniques for Computational Electromagnetics

Organized by: Maha Ben Rhouma

Chaired by: Maha Ben Rhouma

14:00 : Invited talk

Nonlinear-Nonlocal Flat Optics for Space-Time Image Processing

Costantino De Angelis

University of Brescia (Italy)

Digital signal processing has revolutionized many fields of science and engineering, but it still shows critical limits, a long-sought solution is optical analog computing. We demonstrate here that nonlinear phenomena combined with engineered nonlocality in flat optics can be leveraged to synthesize Volterra kernels able to outperform linear devices.

14:20 : Invited talk

Super-Bound States In The Continuum In One-Dimensional Gratings On a Substrate

Nan Zhang, Ya Yan Lu

City University of Hong Kong (Hong Kong)

Super-bound states in the continuum (super-BICs) are useful, since they are associated with ultrahigh-Q resonances for a wide range of wavevectors. Existing super-BICs are mostly found in periodic structures with up-down mirror symmetry. We show super-BICs in simple gratings on a substrate.

14:40 - 15:40 — Veselago

Session 3A24

Quantum Light Emitters and Photonic Heterogeneous Integration

Organized by: Han Htoon, Huan Zhao and Libai Huang

Chaired by: Shengxi Huang

14:40 : Invited talk**Exciton, Charge And Spin Lattices In Moiré Heterostructures****Alexander Högele***LMU Munich (Germany)*

Semiconductor van der Waals heterostructures manifest model systems for excitons, charges and spins localized on moiré lattices. Using cryogenic optical spectroscopy of moiré excitons, we study the effects of correlated charge and spin ordering in such moiré heterostructures with different twist-angle configurations, realizing effective monolayer and bilayer triangular Hubbard lattices.

15:00 : Invited talk**Electrical Control Of Quantum Emitters In Van Der Waals Crystals****Jieun Lee***Seoul National University (Korea)*

In this talk, we present our recent works on electrically excited quantum emission in h-BN by the voltage applied across 2D heterostructure composed of a graphene/h-BN/NbSe₂ stack. We also introduce van der Waals material, α -MoO₃, as an emerging platform for room temperature quantum emitters.

15:20 : Invited talk**Quantum Optical Description Of Nanophotonic Systems****Johannes Feist***Universidad Autónoma de Madrid (Spain)*

We show how to obtain a quantum-optics like description in terms of a few discrete "cavity" modes for the quantum light-matter interaction in arbitrary nanophotonic structures, while still taking into account the full nanophotonic complexity of light propagation and emission.

14:00 - 15:55 — Maxwell**Session 3A25****Non-Hermitian Photonics: Topological, Disordered and Quantum systems**

Organized by: Konstantinos Makris and Li Ge

Chaired by: Konstantinos Makris

14:00 : Invited talk**Emission Of Emitters Into The Bulk Or Photonic Graphene****Francesco Ciccarello***University of Palermo (Italy)*

We study quantum emitters in a 2D honeycomb resonator lattice. With non-local coupling and a synthetic electric field, bulk emitters emit chiral light without breaking time-reversal symmetry. At the edge, suitable geometries enable vacuum Rabi oscillations, long-range excitation transfer, and dipole-dipole interactions.

14:20 : Invited talk**Enhanced Sensing Using Hysteresis Loops Near Exceptional Points****Arunn Suntharalingam¹, Lucas Fernandez-Alcazar¹, Pablo Wagner-Boian², Mattis Reisner¹, Ulrich Kuhl³, Tsampikos Kottos¹**¹Wesleyan University (USA), ²Northeastern University of Argentina (Argentina), ³Université Côte d'Azur (France)

The Riemann Surface near exceptional point degeneracies (EPD) of nonlinear systems with dynamical parity-time symmetry demonstrates the formation of a hysteresis loop whose width scales sublinearly with the distance from the EPD. We show that this hysteresis can be utilized as a noise-resilient measurand for ultrasensitive sensing.

14:40 : Lasing And Coherent Perfect Absorption Beyond Canonical Pt-Symmetry Using Electrically-

Injected Dfb Lasers With Complex-Coupled Bragg Grating

Yaoyao Liang¹, Yara El Droubi¹, Jean-René Coudeville¹, Laurence Ferlazzo¹, Xavier Lafosse¹, Francois Maillard¹, Alexandre Garreau², Arnaud Wilk¹, Olivier Delorme¹, Henri Benisty¹, Abderrahim Ramdane¹, Anatole Lupu¹

¹ Université Paris-Saclay (France), ² III-V Lab. (France)

An analysis of lasing and coherent perfect absorption beyond canonical Parity-Time symmetry using internal emission of electrically-injected complex-coupled Bragg grating distributed feedback lasers a operated in a strong coherent feedback regime provided by an ultra-short micro-mirrors confined external cavities is reported.

14:55 : Quantum Walks Of Correlated Photons In Non-hermitian Photonic Lattices

Chong Sheng, H. Liu, S. N. Zhu

Nanjing University (China)

We propose and experimentally realize quantum walks of two indistinguishable photons in engineered non-Hermitian photonic lattices. We have successfully observed the unidirectional behavior of quantum walks caused by the skin effect. Moreover, we reveal the suppression of entanglement that is caused by the skin effect in non-Hermitian systems.

15:10 : Algebraic Skin Effect In Higher-dimensional Non-hermitian Metamaterials

Mingyang Li, Jing Lin, Kun Ding

Fudan University (China)

This work establishes criteria for algebraic skin effect (ASE) in 2D reciprocal non-Hermitian metamaterials, demonstrating power-law decay via anisotropic optical axes and geometry. A photonic crystal design validates ASE's quasi-long-range interactions, revealed through impurity-induced spectral/dynamic responses. The framework can be extended to 3D systems and classical waves.

15:25 : Reflectionless Transient Excitation in Complex Media

Clément Ferise¹, Philipp del Hougne², Matthieu Davy²

¹ Ecole Polytechnique Federale de Lausanne (EPFL) (Switzerland), ² University of Rennes 1 (France)

Reflectionless states corresponding to the zeroes of the reflection matrix enable reflectionless coupling of waves to a scattering sample. Here, we present a matrix approach to identifying these zeroes and determining the corresponding spatio-temporal input wavefronts. Theoretical results are verified experimentally in the microwave range within disordered multichannel cavities.

15:40 : Optimal Focusing On Non-linear Targets Embedded Within Complex Media

Antton Goicoechea¹, Jakob Hupfl², Stefan Rotter², François Sarrazin¹, Matthieu Davy¹

¹ IETR-Université de Rennes (France), ² Vienna University of Technology (TU Wien) (Austria)

We present a noninvasive matrix approach enabling detection and focusing on any nonlinear target embedded within a complex medium. By measuring a reflection matrix for two different incident powers, the local perturbation induced by the nonlinearity is used to identify the spatio-temporal incident wavefronts focusing on the target.

14:00 - 16:00 — Fresnel**Session 3A26****Symposium II: New Trends in Nanophotonics and Advanced Materials**

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Xuewen Shu

14:00 : Invited talk**Hybrid Photoresists In Multi-photon Lithography: Optical Properties Andpost-processing Strategies**

Dimitra Ladika¹, Michalis Stavrou², Gordon Zyla¹, Artur Harnik¹, Frederik Dumur³, Mikas Vengris¹,

Maria Kafesaki², David Gray², Saulius Juodlazi¹, Mangirdas Malinauskas¹, Maria Farsari²

¹*Vilnius University (Lithuania)*, ²*Foundation for Research and Technology-Hellas (Greece)*, ³*Aix Marseille Université (France)*

Multi-photon lithography (MPL) enables high-resolution 3D structuring using hybrid photoresists. The presence or absence of photoinitiators affects fabrication and application. Post-processing techniques, including selective coatings and heat treatments, enhance functionality without altering the material's chemistry. This work explores material characterization and post-processing strategies for advancing MPL.

14:20 : Invited talk

Optical Response In Twisted Bilayer Graphene

M. Sanchez, J. Gonzalez, Tobias Stauber

CSIC (Spain)

We report on the optical response of twisted bilayer graphene obtained from an atomistic tight-binding model. Within the Hartree-Fock approximation, the Drude response increases due to the renormalization of the Fermi velocity. We will also calculate the chiral response and the shift current related to the Berry curvature dipole.

14:40 : Invited talk

Optical Fresnel Zone Plate Lenses Fabricated Entirely Of colored Photoresist With I-line Stepper

Kuniaki Konishi

The University of Tokyo (Japan)

This study presents a method for fabricating optical Fresnel zone plate lenses using color photoresist, requiring only spin-coating, i-line stepper exposure, and development. The lenses achieved 1.1 μm resolution with 7.2 % focusing efficiency. This approach, utilizing resist as a metasurface material, enables mass production and significantly reduces fabrication costs.

15:00 : Invited talk

Scanning Near-field Optical Microscopy On Hyperuniform Disordered Photonic Materials

Nicoletta Granchi¹, Gabriele Calusi¹, Kris Stokkerei², Matteo Lodde³, Camilla Gonzini¹, Andrea Fiore³, Marian Florescu⁴, Francesca Intonti¹

¹*University of Florence (Italy)*, ²*University of Surrey (United Kingdom)*, ³*Eindhoven University of Technology (The Netherlands)*, ⁴*University of Southampton (United Kingdom)*

A special class of disordered photonic heterostructures, hyperuniform disordered (HuD) photonic structures, allows to deterministically tailor Anderson localization and diffusive transport. Here, we detect for the first time the presence of level repulsion between delocalized states in a HuD photonic platform, by means of the Scanning Near-field Optical Microscopy technique.

15:20 : Invited talk

Active Modulation Of Optical Response In Transparent Conducting Oxide Films

Stefania Benedetti¹, Alessandro di Bona¹, Sergio D'Addato¹, Alexandr Petrov², Piero Torelli², michele Magnozzi³, Stefano Colace³, Maurizio Canepa³, Francesco Bisio⁴

¹*CNR Istituto Nanoscienze (Italy)*, ²*CNR-IOM (Italy)*, ³*Università di Genova (Italy)*, ⁴*CNR-SPIN (Italy)*

We investigated the room temperature, low-voltage-enabled modulation of the optical response of a Al:ZnO film with controlled structural quality (from crystalline to amorphous) coupled with BaTiO₃ film by means of in-operando spectroscopic ellipsometry, ascribed to a combination of charge accumulation/depletion at the interface and Pockels effect in the BaTiO₃ layer.

15:40 : Invited talk

Polarization Optics Using Nonlocal Dielectric Metasurfaces

Yu Geun Ki¹, Changhyun Lee¹, SeokJae Yoo², Soo Jin Kim¹

¹*Korea University (Korea)*, ²*Inha University (Korea)*

In this work, we exploit nonlocal resonances including guided mode resonances (GMR) to realize ultrathin polarization optics with high efficiency and spin-selective responses. We experimentally demonstrate chiral optical behavior induced by symmetry-breaking in nanostructures, facilitating precise manipulation of polarization states and effective detection of Stokes parameters at the nanoscale.

14:00 - 16:00 — Bragg

Session 3A27

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Mark Hersam

14:00 : **Invited talk****Labyrinthine Magnetic Domains In Epitaxial Magneto-optical Garnet Films For Synchrotron Analysis And Optical Modulator Applications****Taichi Goto***Tohoku University (Japan)*

Ce-substituted yttrium iron garnet grown epitaxially on garnet substrates exhibits labyrinthine magnetic domains. We analyzed these domains in detail using synchrotron radiation facilities and applied them to modulation devices utilizing magneto-optical effects.

14:20 : **Invited talk****Infrared Electroluminescence And Energy Transfer In Hbn-encapsulated Graphene Devices Under High Bias Voltage****Yannick De Wilde***ESPCI Paris (France)*

We detect mid-infrared radiation from high-mobility graphene devices encapsulated in hexagonal boron nitride (hBN) under large bias voltage, and demonstrate that it results from the electroluminescence of hyperbolic phonon-polaritons. We show that the effect is concomitant with the onset of a highly efficient out-of-plane energy transfer process.

14:40 : **Invited talk****Multilayer And Microbead Structures For Ultraviolet To Near Infrared Spectroscopic Applications Based On Metal-free Phosphors****David Hernandez-Pinilla, Barun Kumar Barman, Keisuke Watanabe, Hiroyuki Yamada, Thien Duc Ngo, Tadaaki Nagao***National Institute for Materials Science (Japan)*

In this talk, we introduce some of our recently developed light-emitting devices combining metal-free carbogenic phosphors and DBR based microcavity as well as microbeads for controlling the sharp resonant emission and chromaticity via wavelength-selective photoluminescence as well as lasing and infrared emission.

15:00 : **Invited talk****Creation of Novel Scattering Singularities in Generic Non-Hermitian Systems Probed Through Complex Time Delay****Jared Erb, Nadav Shaibe, Thomas M. Antonsen, Steven Anlage***University of Maryland (USA)*

We utilize continuously tunable metasurfaces to find conditions for divergent complex time delay to create and identify numerous types of scattering singularities in generic complex microwave resonant systems in 1, 2, and 3-dimensions. We demonstrate novel properties of several composite scattering singularities in two- and three-dimensional parameter spaces.

15:20 : **Invited talk****Next-generation Implantable Neural Probes: Advanced Photonics On The Tip Of Multimode optical Fibers For Enhanced Endoscopic Sensing**

Linda Piscopo¹, Maria Samuela Andriani¹, Luciana Algieri², Liam Collard¹, Di Zheng¹, Muhammad Fayyaz Kashif¹, Cinzia Montinaro¹, Mohammadrahim Kazemzadeh¹, Stella Aslanoglou¹, Filippo Pisano³, Antonio Balena¹, Marco Bianco¹, Marco Pisanello⁴, Barbara Spagnolo¹, Michele Scaraggi¹, Tommaso Fellin¹, Massimo De Vittorio¹, Ferruccio Pisanello¹

¹ Italian Institute of Technology (Italy), ² Università del Salento (Italy), ³ University of Padova (Italy), ⁴ OptogeniX

s.r.l. (Italy)

Integrating photonic elements on multimode optical fibers combined with traditional wavefront shaping systems can enhance neural endoscope sensing. Here, we present our approaches to fabricating nano- and micro-photonic and plasmonic structures at the output of the fiber and achieve precise control over their coupling with thousands of guided modes.

15:40 : Invited talk

Incident Light Selective Metasurfaces

Kuang-Yu Yang

BrightEST Technology (Taiwan)

Photonic nanostructures can tailor the scattering phase from various polarizability induced by incident light. By introducing subwavelength meta-atoms with selective response of incident light, we have demonstrated additional design freedom to engineering dispersion, birefringence, wavevector selection and enhancement of second harmonic generation beyond arbitrary wavefront shaping for metasurfaces.

Coffee Break

Session 3P2

Poster session VI

16:00 - 16:30

P1: Optical Tweezers: A Powerful And Versatile Micro- And Nano Manipulation Tool With Applications From Space To Spaser

Melissa Infusino¹, Karen Caicedo², Maria Antonia Iatì¹, Onofrio Maragó¹, Maria Grazia Donato¹, Alessandro Veltri¹

¹IPCF-CNR (Italy), ²CNR ISASI Napoli (Italy)

In this work, we demonstrate the versatility of Optical Tweezers as a manipulation tool, using them for trapping and identifying extraterrestrial analogues. We also theoretically show that they serve as an experimental system for detecting the onset of spasing in gain-assisted plasmonic nanoshells.

P2: Higher-order Effects In Extended Conjugated Molecular Emitters Near Plasmonic Nanostructures

Mhamad Hantro, Gilles Rosolen, Bjorn Maes, Colin Van Dyck

University of Mons (Belgium)

In our study we investigate light emission from molecules near plasmonic nanostructures, addressing limitations of the point-dipole approximation. We employ a theoretical framework capturing higher-order effects. Results reveal significant deviations from the point-dipole approximation, crucial for accurate modeling in nanophotonics.

P3: Tunable Terahertz Polarization Converter Based On Liquid Crystal

Sheng Wang¹, Wei Zhu¹, Jingbo Wu¹, Hangbing Guo², Caihong Zhang¹, Kebin Fan¹, Biaobing Jin¹, Jian Chen¹, Peiheng Wu¹

¹Nanjing University (China), ²Purple Mountain Laboratories (China)

We propose liquid crystal metasurface using split ring resonators for tunable polarization conversion in the terahertz band. The device achieves a polarization conversion ratio ranging from 98.7 % to 4.8 % and maintains high stability at incident angles from -30° to 30°, making it suitable for various terahertz applications.

P4: Metasurface-enabled Dynamic Focusing Arrays For Transport Of Multiple Particles

Hyeonhee Kim, Taeyong Chang, Joonkyo Jung, Jonghwa Shin

KAIST (Korea)

We introduce and experimentally demonstrate, for the first time, metasurface-driven dynamic focusing arrays designed to accurately transport multiple microparticles along customized routes. By exploiting interference between polarization-multiplexed holographic images, our method enables simultaneous, precise movement of optically trapped microparticles.

P5: Far-field Patterns Of Second-harmonic Generation In Plasmonic Nanostructures: differentiating

Surface And Bulk Contributions**Ebru Buhara, Sergejs Boroviks, Olivier J. F. Martin***EPFL (Switzerland)*

Distinguishing between surface and bulk second-harmonic generation (SHG) remains a challenge in nonlinear plasmonics. We demonstrate that far-field SHG patterns can provide insights into the nature of these contributions, offering a way for differentiation. This study presents a comparative analysis of SHG far-field responses from plasmonic nanostructures with varying radii.

P6: Quantum Quasinormal Mode Theory For Dissipative Nano-optics And Magnetodielectric Cavity Quantum Electrodynamics**Lars Meschede, Daniel Clarke, Ortwin Hess***Trinity College Dublin (Ireland)*

The rapid evolution of nanoscale architectures for cavity quantum electrodynamics has posed crucial challenges for the theory of non-hermitian systems. We introduce a formalism for the quantization of quasinormal modes in the presence of magnetodielectric media, enabling a unified and rigorous approach for simulating photonic, plasmonic and magnonic cavities.

P7: Single-pixel Matrix Imaging In Reflection**Antton Goicoechea¹, Theodosios Karamanos², François Sarrazin¹, Mathias Fink³, Fabrice Lemoult³, Matthieu Davy¹**¹*IETR-Université de Rennes (France)*, ²*Sorbonne Université (France)*, ³*ESPCI Paris-Université PSL (France)*

We present a novel approach that allows to retrieve a reflection matrix in a single-input single-output configuration by using a reconfigurable intelligent metasurface (RIS). The system can be modeled as if the RIS was an array of antenna, opening exciting perspectives in the context of imaging and wave control.

P8: Terahertz Liquid Crystal Transmissive Metasurface With In-plane Switching Structure**Wei Zhu, Sheng Wang, Hangbing Guo, Jingbo Wu, Kebin Fan, Caihong Zhang, Biaobing Jin, Huabing Wang, Jian Chen, Peiheng Wu***Nanjing University (China)*

Liquid crystal (LC) metasurfaces exhibit excellent tunability in multidimensional control of terahertz waves. We design a programmable metasurface with in-plane switching to enhance the response speed of LC. The simulated spectral response agrees well with the experimental results, manifesting its applications in the fields of computational imaging and dynamic holography.

P9: Towards An Inverse-designed Low-cost Waveguide Absorber**Christoph Schmidt, Alexander Schossmann, Alexander Bergmann***Graz University of Technology (Austria)*

The paper introduces an inverse-designed waveguide absorber optimized for minimum reflections within the frequency range of 60GHz to 90GHz, with a structure that is manufacturable with cost-efficient, commercial 3D SLA printing. Validation of simulations indicates similar or even better performance than traditional absorbers, exhibiting an improved Voltage-Standing-Wave-Ratio of 1.03.

P10: Resistive Metamaterial Based Ultrathin Broadband Microwave Absorber**Jyoti Yadav, Kumar Vaibhav Srivastava, J. Ramkumar***IIT Kanpur (India)*

A novel unit cell for broadband microwave absorber is proposed. This polarization insensitive absorber exhibits more than 90 % absorption for (8.04 -19.30) GHz, covering X, and Ku bands. The absorption is maintained till incident angle 30° for both TE and TM modes. The absorption remains significant for higher angles, also.

P11: Phononic Quantum State Preparation And Ultrafast Coherent Control Via Pulsed Excitation Of Quantum Emitters**Seán French, Daniel D.A. Clarke, Daniel Wigger, Ortwin Hess***Trinity College Dublin (Ireland)*

Phonons are quintessential for emerging solid-state quantum technologies, yet coherent control is challenging. Using the independent boson model, we derive the pulse area condition for selective phononic quantum state preparation via optical excitation of quantum emitters. Optimized ultrashort pulses enable high-fidelity multiphonon generation despite dephasing and phonon decay.

P12: Fabrication Of Porous Au Nanowires On Flexible Substrates featuring High- Density Nanogaps Via Nanotransfer Printing For Sers

Hyojin An¹, Byeong-Kwon Ju¹, Joo-Yun Jung²

¹Korea Institute of Machinery and Materials (Korea), ²Korea University (Korea)

We report hierarchically porous Au nanostructures fabricated via nanotransfer printing to achieve sub 10 nm gaps and ultradense hotspots on flexible substrates. These structures showed a 9.6 fold SERS enhancement over flat Au nanowires using 4-mercaptobenzoic acid. The results demonstrate the significance of structural design in plasmonic systems.

P13: Characterization Of Flat Optical Devices In A Transformation Optics Context

Mircea Giloan

MG Data (Romania)

Optical devices are mainly based on wave path and wave vector manipulation. This can be obtained by specifically designing the surface of the interface between two media. In the last years flat optical devices have been intensively studied. In this study flat optical devices are characterized as transformation optics media.

P14: Self-assembly Of High-quality Single Crystals Of Dna-functionalized Gold Nanoparticle Superlattices For In-vivo SERS Detection

Taito Ikeuchi¹, Lidong Zhang¹, Saki Kozawa¹, Shoko Kojima¹, Hiromasa Niinomi², Makoto Kuwahara¹, Kotaro Hiramatsu³, Miho Tagawa¹

¹Nagoya University (Japan), ²Tohoku University (Japan), ³Kyushu University (Japan)

Superlattices of DNA-functionalized nanoparticle (DNA-NP) crystals offer high design flexibility and excellent biocompatibility, making them promising for reliable in-vivo SERS sensing applications. In this study, we successfully fabricated superlattices consisting of Au-Ag core-shell nanostructures with precise control of their nano-gap distances, showing highly reproducible SERS effect.

P15: Field Localization Metamaterial For Stable Pseudo Parity-time Symmetrical Wireless Power Transfer System.

Abdulrahman Alsaadi, Inki Kim

Sungkyunkwan University (Korea)

Wireless power systems suffer from low efficiency and performance instability. Our system provides extended-range power transfer using the physics of parity-time symmetry and metamaterials, increasing transfer efficiency stability against distance fluctuations with the ability to localize the power from a larger transmitter to smaller size receiver.

P16: Simultaneous Photonic And Phononic Topological Interface States In A Si-based Membrane Crystal

Nouh Krai, Gaëtan Lévêque, Bahram Djafari-rouhani, Yan Pennec

IEMN (France)

We investigate the emergence of topological interface states in a silicon-based crystal supporting both photonic and phononic modes. Our results demonstrate that these modes are robust and immune to certain defects, such as bends, ensuring stable wave propagation.

P17: Enhanced Light Harvesting And Photothermal Conversion With Anisotropic Gold nanoparticles

Runpeng Miao, M. Bissoli, V. Amendola

University of Padova (Italy)

Gold nanoparticles (Au NPs) face challenges in broadband light harvesting due to limited spectral coverage and low photothermal efficiency. This study compares spherical Au NPs with anisotropic Au nanostructures, including nanospheres and nanocorals, for enhanced absorption. Their optical and photothermal properties are tested in photo-thermoelectric generators for efficient energy conversion.

P18: Versatile Design Approach Of Switchable On-chip Emitter-coupled Meta-optics Photon Source

Sören im Sande¹, Torgom Yezekyan¹, Yinhui Kan¹, Danylo Komisar¹, Cuo Wu¹, Shailesh Kumar¹, Nur Qalishah Adanan², Golnoush Zamiri², Joel Yang¹, Sergey Bozhevolnyi¹, Fei Ding¹

¹University of Southern Denmark (Denmark), ²Singapore University of Technology and Design (SUTD) (Singapore)

We showcase a versatile metasurface-enabled design method for multichannel photon sources that enables arbitrary polarization control over multiple channels with distinct directions by exploiting the nonradiative interaction between quantum emitters and surrounding scattering meta-atoms. Furthermore, the integration of phase-change materials allows for the switching between multiple functionalities.

P19: Dynamic Local Strain Engineering In Suspended 2d Materials

Eric Herrmann, Sai Rahul Sitaram, Ke Ma, S M Jahadun Nobil, Xi Wang

University of Delaware (USA)

This talk presents a novel platform for dynamically engineering local strain in suspended 2D materials via nano-indentation. We demonstrate a measurable and reversible shift in the photoluminescence spectra in suspended two-dimensional materials. We further show that various types of strain distributions can be designed.

P20: Interaction Between Ag Nanoparticles And Excitons In Organic Light Emitting Diode: Plasmonic Enhancement And Quenching

Amadou Tierno Diallo, Nabil Khiri, Mahmoud Chakaroun, Azzedine Boudrioua

University Sorbonne Paris Nord (France)

We report the effect of the distance between Ag nanoparticles and the emitting layer of an OLED. A figure of merit is suggested, which includes LSPR, electrical and optical effects of nanoparticles.

P21: High-performance Nanotriboelectric Generator Integrating An Acoustic Metamaterial Absorber And Spring

Wei Zhi Weng, Tsung-Yu Huang

Ming Chi University of Technology (Taiwan)

This study integrates an acoustic metamaterial absorber, springs, and triboelectric nanogenerators to convert urban noise into electricity. By tuning absorber and spring resonance, the system achieves maximum displacement, enabling effective energy harvesting for low-power devices, offering a sustainable solution for noise pollution and green energy.

P22: Modeling Of The Zn/ag Related Lspr Peak Shift Due To Zinc Oxide Refractive Index Changing

Svitlana Redko, Grigorii Milenin, Vitaliy Shvalagin, Olga Kapush, Artem Fedorenko, Roman Redko

National Academy of Sciences of Ukraine (Ukraine)

The modeling of the absorbance of ZnO/Ag nanocomposites with MiePlot 4.16 Software were carried out to obtain information about principal possibility of LSPR peak position changing due to changing of ZnO nanoparticles refractive index due to magnetization in external magnetic field. Obtained results are in good agreement with experiment.

P23: Integrated Spectral Sensitivity As Physics-based Figure Of Merit For Spectral Transducers In Optical Sensing

Felix McCluskey, Anne van Klinken, Andrea Fiore

Eindhoven University of Technology (The Netherlands)

We introduce Integrated Spectral Sensitivity, a novel figure of merit for optical sensors, derived from the Cramér-Rao lower bound. This metric quantifies transducer performance across various readout methods, improving sensor design. We apply it to two transducer types, offering insights into optimizing spectral sensing systems for enhanced precision.

P24: Confined Mode Shift In A Photonic Crystal With A Cavity Infiltrated By Chikv Cells

Francis Segovia-Chaves

Universidad Surcolombiana (Colombia)

We calculate the transmittance spectrum in a defective one-dimensional photonic crystal. The cavity is filled with CHIKV-infected cells. We find a resonant peak inside the photonic band gap. Increasing the pressure decreases the confinement of the defective mode due to the decrease in quality factor.

P25: Calculation Of Density Of States In A One-dimensional Photonic Biosensor

Francis Segovia-Chaves

Universidad Surcolombiana (Colombia)

Using Green's functions we calculate the local density of states in a one-dimensional photonic biosensor. The

insertion of a cavity with a refractive index of four types of cells: Normal, Jurkat, PC12, and MCF-7. By increasing the dielectric constant, we observe that the localized mode shifts to shorter frequencies.

P26: High-Q microresonators unveil quantum rare events

Arghadip Koner, Sricharan Raghavan-Chitra, Joel-Yuen Zhou

University of California (USA)

Classical linear optics traditionally dictates light propagation through media. However, in high-Q cavities, rare quantum vacuum fluctuations imprint additional information about the medium, beyond the linear susceptibility, directly onto the linear response, revealing novel quantum corrections to the classical framework and enabling new quantum-enhanced insights into material response.

P27: Single Molecule Detection in hBN metasurfaces

S. Izadshenas, K. Slowik

Nicolaus Copernicus University in Torun (Poland)

We report complementary hBN metasurface hosting embedded nanocavities. Comprehensive optical characterization reveals visible-regime high-Q resonances due to the quasibound states in the continuum, which produce a spatially uniform electric fields. The cavity field enables single-molecule surface-enhanced Raman spectroscopy, which we here consider for ATTO 610-doped ethanol. Results demonstrate strong absorption–emission enhancement and signal levels exceeding those of conventional plasmonic platforms.

16:30 - 18:50 — Torremolinos

Session 3A28

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Charles Roques-Carmes

16:30 : Invited talk

Interfacing the brain by photonic technologies

Massimo De Vittorio¹, F. Pisanello²

¹*Istituto Italiano di Tecnologia (Italy)*, ²*Università del Salento (Italy)*

In this talk, new technological and methodological approaches for interfacing the brain by tapered optical fibers (TOFs) will be shown. TOFs are nanomachined to produce optical probes and optrodes for accessing deep brain regions in animal models with spatial and temporal resolution for both recording and controlling neural activity.

16:50 : Invited talk

Optical Pulling Forces For 3-dimensional Motion Control In Plasmonic Nanomotors

Guillermo Serrera¹, Yoshito Y. Tanaka², Pablo Albella¹

¹*University of Cantabria (Spain)*, ²*Hokkaido University (Japan)*

We present a novel nanomotor design that enables 3-dimensional control of motion. A moderate cone angle Bessel beam with azimuthal polarization, acting on a glass chassis, allows for stable optical pulling, while asymmetric plasmonic dimers embedded within this chassis provide lateral movements upon plane wave illumination.

17:10 : Invited talk

Non-noble metal plasmonic nanostructures

Michal Horák, Michael Foltýn, Tomáš Šíkola

Brno University of Technology (Czech Republic)

We present an investigation of localized surface plasmon resonances in nanostructured non-noble metals at a single particle level, with a focus on their spectral tunability. The study specifically examines silver amalgam, gallium, and bismuth while the latter has been identified as a viable substitute for gold.

17:30 : Invited talk**Injecting Physics Knowledge In Neural Networks For A Wide Range Of Photonic Devices: Qnm-net****Viktor Lilja, Albin Svärdsby, Timo Gahlmann, Philippe Tassin***Chalmers University of Technology (Sweden)*

We will present our work on QNM-Net, a physics-informed neural network for electromagnetic scattering. Our network incorporates physics knowledge through the quasi-normal-mode framework, which means it can model a vast range of (nano)photonic devices. By incorporating physics knowledge, we can achieve a tenfold reduction of training data needed.

17:50 : Invited talk**Electrically Tunable Free-electron Nonlinearity In Heavily-doped Ingaas****Valeria Giliberti¹, Tommaso Venanzi¹, Andrea Rossetti², Huatian Hu¹, Raffaella Polito³, Andrea Notargiacomo³, Antonio Valletta⁴, Francesco Mattioli³, Adel Bousseksou⁵, Gregoire Beaudoin⁵, Isabelle Sagnes⁵, Raffaele Colombelli⁵, Markus Ludwig², Daniele Brida², Marialilia Pea³, Cristian Ciraci¹, Michele Ortolani¹**¹ *Italian Institute of Technology (Italy)*, ² *University of Luxembourg (Luxembourg)*, ³ *Istituto di Fotonica e Nanotecnologie (Italy)*, ⁴ *Istituto per la microelettronica e microsistemi (Italy)*, ⁵ *University of Paris-Saclay (France)*

We report on the experimental investigation of the electrically tunable third harmonic generation of mid-infrared pulses from grating-gate field effect devices fabricated on n-doped InGaAs/InP heterostructure. Our findings pave the way for future exploitation of free-electron nonlinearities in all-semiconductor photonic integrated circuits.

18:10 : Invited talk**Developing quantitative multiscale models for nonlinear molecular plasmonics****Maxim Sukharev***Arizona State University (USA)*

The research program established in my group integrates computational electrodynamics in the nonlinear optical regime with the quantum dynamics of large molecular systems. This talk overviews our recent advances in the field of nonlinear nano-optics and molecular plasmonics highlighting newly developed computational method, namely molecular mapping technique.

18:30 : Invited talk**Single-shot Weak Measurement For Spin Hall Effect Of Light Using A Metasurface****Minkyung Kim***GIST (Korea)*

A metasurface-enabled weak measurement is devised for a single-shot observation of the spin Hall effect of light. By using a polarization beamsplitting metasurface, we achieve a real-time tracking of the spin Hall shift, thereby enabling high-precision optical sensing in dynamic environments.

16:30 - 17:20 — Alamos**Session 3A29****Quantum Nanophotonics Workshop**

Organized by: Ortwin Hess

Chaired by: Ortwin Hess

16:30 : Invited talk**Controlling Multiple Quantum Dots using Structured Light****Suraj Goel, Sheena Shaji, Julian Wiercinski, Antoine Borel, Natalia H. Valencia, Moritz Cygorek, Erik Gauger, Brian Gerardot, Mehul Malik***Heriot-Watt University (UK)*

We demonstrate the control of multiple, distinct quantum dots on one cryogenic sample via spatial light modulation, allowing us to observe cooperative emission from up to five dots and Hong-Ou-Mandel interference

from two dots enabled by multi-plane optical circuits.

16:50 : **Multimode And Collective Strong Coupling In Plasmonic Nanocavities**

Angus Crookes, Ben Yuen, Angela Demetriadou

University of Birmingham (United Kingdom)

Strong coupling in plasmonic nanocavities is often treated within a single mode approximation. However, here we show that off-resonant modes in-fact play a crucial role. In particular, we identify three regimes: single mode, multi-mode, and collective multimode strong coupling, advancing the understanding of quantum dynamics in realistic plasmonic nanocavities.

17:05 : **Colored Quantum Random Walks As A Route To Floquet States In Plasmonic Systems**

Zahra Jalali-Mola, Ortwin Hess

Trinity College Dublin (Ireland)

Plasmonic and metasurface platforms enable exploration of topological Floquet phenomena in nanophotonics. We show that colored quantum random walks exhibit Floquet states without external driving. Using SU(3) symmetry, we uncover color-induced band mixing, topological bands, and bound states in the continuum, offering a new route to quantum photonic control.

17:20 - 19:00 — Alamos

Session 3A30

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Ioannis Zeimpekis

17:20 : **Invited talk**

Programmable Nanophotonic Devices with Low-loss Phase-Change Materials

Fouad Bentata¹, Capucine Laprais¹, Stéphane Monfray², Nicolas Baboux¹, Xavier Letartre¹, Guillaume Saint-Girons¹, Patrice Genevet¹, Lotfi Berguiga¹, Sébastien Cuffe¹

¹Université Claude Bernard Lyon 1 (France), ²STMicroelectronics (France)

We exploit low-loss phase-change materials such as Sb₂S₃ to propose and demonstrate integrated photonic devices with original programmable functionalities.

17:40 : **Invited talk**

Design Of Broadband Multilayer Metamaterials Based On Genetic Algorithm And Neural Network

Kotaro Kajikawa

Institute of Science Tokyo (Japan)

I report on the design of broadband multilayer metamaterials based on genetic algorithms (GA) or a combination of GA and neural networks (NN). With many unknown parameters, preparing a dataset for NN is impossible within a realistic time scale. Thus, GA is a good choice for the design.

18:00 : **Invited talk**

Femtosecond Laser Delamination Cavities And Their Applications

Pavel Varlamov¹, Akira Barros¹, Aditya Swaminathan¹, Jan Marx², Andreas Ostendorf², Anna Semisalova³, Denys Makarov⁴, Alexey Lomonosov⁵, Paolo Vavassori⁶, Yannis Laplace¹, Michele Raynaud¹, Vasily Temnov¹

¹Ecole Polytechnique (France), ²Ruhr University Bochum (Germany), ³University of Duisburg-Essen (Germany), ⁴Helmholtz-Zentrum Dresden-Rossendorf e.V. (Germany), ⁵Offenburg University of Applied Sciences (Germany), ⁶CIC nanoGUNE-BRTA (Spain)

Nano-to-micrometer size single-shot *femtosecond laser delamination* (FLD) membranes or cavities of ferromagnetic thin films and multilayers are quantified using the Abbe-limited interferometric, ultrafast scanning photo-acoustic and magneto-plasmonic microscopies. Cavity formation mechanisms as well as their appli-

cations for ultrafast GHz-to-THz frequency acoustics and magneto-plasmonics in the Otto configuration are discussed.

18:20 : Invited talk

Laser Color Printing On Disordered Metal-dielectric Multilayer Structures

Piotr Nyga¹, Michal Nowak¹, Marcin Woszto¹, Tomasz Wojciechowski², Bartosz Bartosewicz¹, Przemyslaw Wachulak¹

¹*Military University of Technology (Poland)*, ²*Polish Academy of Sciences (Poland)*

We report plasmonic color printing through a femtosecond laser-induced modification of disordered metal-dielectric multilayer structures. The structures are fabricated by sequential deposition of subwavelength-thick dielectric layers and island-type layers of disordered metal nanoparticles. Colors are controlled by parameters of femtosecond laser pulses, e.g., fluence, polarization, repetition, and scanning parameters.

18:40 : Invited talk

Temporal Topological Aharonov-bhom Phase In Quantum-systems Under Electric And Gravitational Scalar Potentials

Michael Tobar¹, Michael Hatzon¹, Graeme Flower¹, Maxim Goryachev¹, Jeremy Bourhill¹, Raymond Chiao², Nader Inan², Michael Scheibner², Jay Sharping², Douglas Singleton³

¹*The University of Western Australia (Australia)*, ²*University of California (USA)*, ³*California State University Fresno (USA)*

We show that the electric-scalar Aharonov-Bohm effect is the temporal dual of the vector-magnetic effect and propose a setup to observe it using a quantum-system inside a Faraday cage. For the scalar-gravitational potential, we propose a quantum system in eccentric orbit, which manifests as a temporal generalization of the gravitational-redshift.

16:30 - 18:50 — Playamar

Session 3A31

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Peng Yan

16:30 : Invited talk

Fluctuation-Driven Phenomena in Chiral and Indefinite-Gain Systems

Daigo Oue¹, Mario Silveirinha²

¹*RIKEN (Japan)*, ²*University of Lisbon (Portugal)*

We explore fluctuation-induced effects in indefinite-gain systems, where gain and dissipation depend on the wave polarization or momentum. We examine their impact on optical forces and energy flow in steady-state regimes and how quantum fluctuations in such media modify a qubit's ground state, revealing new opportunities for nonreciprocal quantum engineering.

16:50 : Invited talk

Magnetoelectric Effect In Antiferromagnetic Chern Insulators

Tomoki Hirose, Daichi Komine, Nobuo Furukawa

Aoyama Gakuin University (Japan)

The magnetoelectric effect is a cross-correlation phenomenon between electric and magnetic dipole moments, which occurs when both the time-reversal and inversion symmetries are broken. In this work, we discuss the magnetoelectric effect in antiferromagnetic Chern insulators, which support spin-polarized chiral edge states.

17:10 : Invited talk

Nonlinear Response Of Truly Chiral Phonons: Light-induced Phonon Angular Momentum And Peltier Effect

Hiroaki Ishizuka, Masahiro Sato

Institute of Science Tokyo (Japan)

The nonlinear response of chiral phonons to electromagnetic waves is theoretically studied. We show that chiral phonons give rise to large angular momentum compared to ordinary phonons. In addition, we show that the Peltier effect by chiral phonons occurs from a mechanism distinct from those proposed recently.

17:30 : Invited talk

Sensing And Generating Structured And Twisted Light Through Photonic Integrated Circuits

Marko Šimić, J. Butow, V. Sharma, D. Brandmuller, J. S. Eismann, Peter Banzer

University of Graz (Austria)

Advances in photonics enable precise control of structured light for imaging, sensing, and quantum applications. While bulky optics limit scalability, photonic integrated circuits (PICs) offer compact solutions. Here we present a reconfigurable PIC to measure and generate structured and twisted light, enhancing applications in imaging, sensing, and manipulation.

17:50 : Invited talk

Enhanced Chiral Sensing And Unambiguous Enantiomer Differentiation With Achiral Anisotropic Photonic Metasurfaces

Sotiris Droulias

University of Piraeus (Greece)

Achiral anisotropic photonic metasurfaces can provide enhanced sensing and unambiguous enantiomer differentiation of weak chiralities at the nanoscale. In this work it is demonstrated how the additional degrees of freedom offered by anisotropic metasurfaces with respect to their isotropic counterparts can enable chiroptical signals with unprecedented enhancement.

18:10 : Invited talk

Magneto Nanophotonics Platform Based On Monocrystalline Yttrium Iron Garnets

Yasutomo Ota¹, Siyuan Gao¹, Kota Taniguchi¹, Takeru Yambe¹, Yuta Tanimura¹, Satoshi Iwamoto²

¹Keio University (Japan), ²The University of Tokyo (Japan)

Monocrystalline yttrium iron garnets (YIGs) are an outstanding material for magneto-optics. However, their application to nanophotonics has been limited due to the difficulty of fine nanopatterning. Here, we report a platform of magneto-nanophotonics based on YIG realized by the development of high-quality YIG membranes and their nanopatterning using dry etching.

18:30 : Invited talk

Development Of Carbon Fiber Composites With Ferromagnetic Microwire Inclusions For Free Space Microwave Sensing

Valentina Zhukova¹, Johan Malm², Christer Johansson², Rafael García-Etxabe³, Francisco Javier Vallejo⁴, Peio Olaskoaga⁴, Arcady Zhukov¹

¹University of Basque Country (Spain), ²Digital Systems (Sweden), ³GAIKER Technology Centre (Spain),

⁴Basque Research and Technology Alliance (BRTA) (Spain)

We provide free space microwave measurements of composites made from carbon fibers and ferromagnetic microwires inclusion focusing on the electromagnetic properties. We observed that a low frequency modulating AC magnetic field allows to distinguish the microwave signals originated by ferromagnetic microwires inclusions from that generated by the carbon fibers.

16:30 - 18:20 — Bajondillo

Session 3A32

Symposium III: Advanced passive and active metasurfaces

Organized by: Howard Lee, Pin-Chieh Wu and Wen-Hui (Sophia) Cheng

Chaired by: Sophia Cheng and Howard Lee

16:30 : Invited talk**Electrochemically-tunable Oxide Materials For Metasurfaces****Vivian Ferry***University of Minnesota (USA)*

This talk will discuss the use of electrolyte gating to control the optical properties of materials, focusing on $\text{La}_{1-x}\text{Sr}_x\text{CoO}_{3-d}$ (LSCO) as an exemplary case. We create electric double layer transistors of LSCO, and show that on application of gate voltage there is sustained cycling between metallic and dielectric states.

16:50 : Invited talk**High Contrast Nanoscale Chirality Imaging****Seongmin Im, Gayatri Chandran, Yang Zhao***University of Illinois Urbana Champaign (USA)*

Near-field optical force imaging reveals nanoscale light-matter interactions but suffers from overlapping effects. I will present our recent advances in Decoupled optical force nanoscopy (Dofn), a technique that isolates optical forces to enable high-contrast, nanometer-resolution imaging of nanoscale light-matter interactions, in particular, chiral light-matter interactions in nanoparticle systems.

17:10 : Invited talk**Bright and Dark Lasing in Nanoplasmonic Metasurfaces****Ortwin Hess***University of Dublin (Ireland)*

We investigate the dynamic competition between bright (radiation-coupled) and dark (non-radiative) lasing modes in nanoplasmonic double-fishnet metasurfaces. Employing advanced Maxwell-Bloch Langevin simulations, we demonstrate methods for selectively enhancing bright mode lasing despite significant competition from dark modes, offering pathways toward controlled nanoscale coherent emission.

17:30 : Invited talk**Merging Nanophotonics and Optical Fibers for Flexible Beam Control Using 3D Nanoprinting****Markus Schmidt, Bennet Fischer, Matthias Zeisberger, Mohammad Khosravi, Shahrzad Hosseinabadi, Oleh Yermakov***IPHT (Germany)*

We show that combining optical fibers with 3D nanoprinted nanostructures creates a new category of fiber-integrated devices - metafibers - that enable novel applications, including high-NA holographic meta-lenses on fibers for trapping and flexible light focussing, on-fiber achromatic metasurface-based lenses and beam shapers, and ring-like gratings to boost coupling efficiency.

17:50 : All-dielectric Electrically-tunable Metasurface For Efficient Beam Steering**Junghyun Park, Byung Gil Jeong, Sun Il Kim, Minkyung Lee, Young Kim, Jang-Woo You, Wontaek Seo, Byung-Hoon Ko, Seokho Yun***Samsung Advanced Institute of Technology (Korea)*

We present an all-dielectric phase-modulating metasurface composed of Si and SiO_2 , at 940 nm with high efficiency and directivity. By tuning the resonance between the top high contrast grating and the bottom distributed Bragg reflector via thermal control, we achieve over 20 %-efficiency and 12 dB-directivity for 1-D beam steering.

18:05 : Transient Optical Symmetry Breaking For The Ultrafast Switching Of A Metasurface Quasi-bic**Giulia Crotti¹, Andrea Schirato¹, Olesiya Pashina², Olga Sergaeva³, Mihail Petrov², Costantino De Angelis³, Giuseppe Della Valle¹**¹Politecnico di Milano (Italy), ²ITMO University (Russia), ³Università di Brescia (Italy)

We theoretically propose an innovative strategy to obtain an ultrafast, fully reversible switch from a photonic bound state in the continuum (BIC) to a quasi-BIC leaky mode in a semiconductor metasurface via transient optical symmetry breaking, by exploiting inhomogeneities of the photo-induced free carriers population at the nanoscale.

16:30 - 19:05 — Carihuela

Session 3A33

Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and Noé Jiménez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

16:30 : **Invited talk**

Acoustic trapping, emission enhancement, and harvesting from bound states in the continuum

Sibo Huang¹, Yong Li², Jie Zhu², Din Ping Tsai¹

¹City University of Hong Kong (Hong Kong), ²Tongji University (China)

Acoustic bound states in the continuum (BICs) are special modes characterized by high quality factors and strong localization. By constructing a series of coupled Friedrich-Wintgen BICs and appropriately tuning their radiation and intrinsic losses, we achieved novel and efficient acoustic trapping, emission enhancement, and energy harvesting.

16:50 : **Invited talk**

Sensitivity And Nonlinear Effects In Non-Hermitian Quasi-Periodic Lattices

Ananya Ghatak¹, Dimitrios H. Kaltsas², Manas Kulkarni³, Konstantinos G. Makris¹

¹FORTH (Greece), ²University of Crete (Greece), ³International Centre for Theoretical Sciences-TIFR (India)

We study the sensitivity of non-Hermitian quasiperiodic lattices in terms of their corresponding pseudospectra. In particular, we investigate PT-symmetry transitions, and the dependence of the spectral sensitivity around the underlying multiple exceptional points. Nonlinear effects that stem from the gain saturation, are also examined.

17:10 : **Invited talk**

Metastructures: New Approaches To Enhancing Disaster Resilience And Reduced Embodied Carbon

Oreste S. Bursi, Tugberk Guner

University of Trento (Italy)

Locally resonant linear and nonlinear metafoundations have been conceived for seismic isolation of small modular reactors also for significant vertical components of earthquakes. Along the same lines, metastructures have been introduced into typical steel frames enhanced with locally resonant metastructures in view of weight reduction and, hence, reduced embodied carbon.

17:30 : **Invited talk**

Electromechanical Excitation Of Nanostructures By Bulk Acoustic Wave Transducers

Tapani Makkonen, Oili Ylivaara, Sara Pourjamal, Jouni Ahopelto

VTT Technical Research Centre of Finland Ltd. (Finland)

An efficient broadband bulk acoustic wave electromechanical transducer at GHz range is demonstrated. The free-standing transducer with a small footprint can be integrated directly into nanostructures to guarantee efficient coupling. The potential applications include optomechanics and topological phononics.

17:50 : **Invited talk**

Elastic Spin Angular Momentum In Continuum And Metamaterials Rod Structures

Jinfeng Zhao, Yuxuan Zhang, Yongdong Pan

Tongji University (China)

Elastic spin angular momentum is reported for all three basic modes in continuum rods. Elastic spin controlled unidirectional wave routing is observed in experiment. Similar phenomena are observed for guided modes in rods made of metamaterials.

18:10 : Invited talk

Microenvironment Responsive Bio-Acoustic Metamaterials for Precision Medicine

Hanchuan Tang

Huazhong University of Science and Technology (China)

This study develops injectable ultrasonic sensors using bio-acoustic metamaterials, enabling wireless monitoring of pressure, temperature, and pH via wearable ultrasound devices. These biodegradable sensors eliminate surgical removal needs, offering minimally invasive implantation and multi-signal detection capabilities for advanced healthcare monitoring.

18:30 : Invited talk

Springtronics: Towards advanced information processing in elastic metamaterials

F. Bohte, S. Zahedi Fard, P. Omidvar, T. Louvet, S. Zohoori, M. Serra-Garcia

AMOLF (Netherlands)

We introduce a design framework for information-processing phononic metamaterials. The key idea consists in encoding the desired functionality as a mass-spring network, that is then translated into a metamaterial geometry and, eventually, into an experimental realization. The talk will discuss mass-spring and geometry design strategies, as well as example applications.

18:50 : Realization Of Weyl Elastic Metamaterials with Spin Skyrmions

Yuang Pan, Yihao Yang

Zhejiang University (China)

Topological elastic metamaterials provide a topologically robust way to manipulate the phononic energy and information beyond the conventional approaches. Among various topological elastic metamaterials, Weyl elastic metamaterials stand out. Here, we realize an ideal, 3D printed, all-metallic Weyl elastic metamaterial with low dissipation losses.

16:30 - 18:30 — Montemar

Session 3A34

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Che Ting Chan

16:30 : Invited talk

Time-resolved vector polarimetry for identifying topological features of surface plasmon polaritons

Pascal Dreher¹, Alexander Neuhaus¹, Timothy Davis¹, Bettina Frank², Harald Giessen², Frank Meyer zu Heringdorf¹

¹University of Duisburg-Essen (Germany), ²University of Stuttgart (Germany)

Determining the electric field vectors of surface plasmon polaritons (SPPs) in space and time is a challenging endeavor. It is accomplished with nanometer resolution in a time-resolved photoemission microscopy experiment. After reconstruction of the time-dependent electromagnetic field vectors, local topological properties of the SPPs are derived.

16:50 : Invited talk

Manipulation Of Light Propagation In Photonic Crystals Via Non-hermitian Photonic Band Engineering

Takuya Inoue, Masahiro Yoshida, Susumu Noda

Kyoto University (Japan)

Non-Hermitian photonic systems are known to exhibit unique light propagation phenomena, where non-Hermiticity is typically introduced by material loss or gain. Here, we propose and experimentally demonstrate manipulation of light propagation solely based on radiation loss via non-Hermitian photonic band engineering of photonic crystals.

17:10 : Invited talk

UV Upconversion in Lanthanides-doped Thin Films Assisted by Photonic Crystals.

Damien Rinnert¹, Emmanuel Drouard¹, Antonio Pereira², Céline Chevalier³, Aziz Benamrouche¹, Benjamin Fornacciari³, Hai Son Nguyen¹, Gilles Ledoux², Christian Seassal¹

¹Ecole Centrale de Lyon (France), ²Université Claude Bernard Lyon 1 (France), ³INSA de Lyon (France)

Upconverting the solar spectrum to ultra-violet using lanthanides is of major interest for photocatalysis applications, but limited by their low absorption cross-sections. We have designed, fabricated and characterized two dimensional photonic crystals enhancing multisolar upconversion process from near infra-red and visible to ultra-violet in Yb³⁺, Tm³⁺.

17:30 : Invited talk

Thermal Photonics For Advanced Energy Conversion Systems

Atsushi Sakurai

Niigata University (Japan)

We investigate thermal photonics strategies for improving energy conversion efficiency. Emphasis is placed on near-field radiation, spectral control of emission, and carbon-based films. These approaches demonstrate the potential to surpass classical thermal limits, offering scalable routes to high-performance energy harvesting.

17:50 : Invited talk

Quadrupole Topological Phase Constructed By Gyromagnetic Photonic Crystal

Peiheng Zhou¹, Gui-Geng Liu², Qindong Xie¹, Longjiang Deng¹, Baile Zhang²

¹University of Electronic Science and Technology of China (China), ²Nanyang Technological University (Singapore)

We report the study of a quadrupole topological states in a gyromagnetic PhC, and verify its topological phase transition from the Chern insulator phase, as well as the formation of topological bound states in the continuum.

18:10 : Invited talk

Colloidal Self-Assembly As Templating For 3d Second-harmonic Photonic Crystals

Thomas Kainz¹, Helena Weigand², Ülle-Linda Talts², Rachel Grange², Ullrich Steiner¹, Viola Vogler-Neuling¹

¹University of Fribourg (Switzerland), ²ETH Zurich (Switzerland)

We present fully 3D scalable $\chi(2)$ photonic crystals with unprecedented domain sizes (>100 unit cells), overcoming previous z-direction limitations. We combine colloidal self-assembly of polystyrene opals for templating and sol-gel barium titanate chemistry for replication. These nonlinear crystals facilitate controlled second harmonic generation within a fabrication-tunable photonic bandgap.

16:30 - 18:25 — Litoral

Session 3A35

Bottom-up approaches, new fabrication routes and ENSEMBLE3

Organized by: Dorota Pawlak and Virginie Ponsinet

Chaired by: Dorota Pawlak

16:30 : Invited talk

Mie Resonant Silicon Particles Via Bottom-up Synthetic Routes And Assembled Into 2d Metasurfaces

Glenna L. Drisko¹, Megan A. Parker², Lucien Roach², Maria Letizia De Marco², Mathieu Gonidec², Pa-

trick Rosa², Brian A. Korgel³, Virginie Ponsinet², Peter R. Wiecha⁴, Alexander Grigorenko⁵, Philippe Barois²

¹ Université de Lyon (France), ² Université de Bordeaux (France), ³ The University of Texas at Austin (USA),
⁴ Université de Toulouse (France), ⁵ University of Manchester (United Kingdom)

Mie resonant silicon particles have strong scattering and thus are highly desirable building-blocks in metamaterials and metasurfaces. Most silicon resonators are produced via top-down fabrication methods. We present two bottom-up syntheses followed by particle self-assembly, producing a silicon-based metasurface having a degree of disorder, and yet a high quality factor.

16:50 : Invited talk

Grow With The Flow: Bottom-up Synthesis Of Anisotropic Plasmonic Nanoparticles Within Microfluidic Channels

Martina Lanza¹, Gail Vinnacombe-Willson², Francisco Bevilacqua¹, Leonardo Scarabelli³, Luis Liz-Marzán¹, Gail Vinnacombe-Willson²

¹ CIC biomaGUNE (Spain), ² CIC BiomaGUNE (Spain), ³ University of Cantabria (Spain)

Bottom-up colloidal synthesis is the "gold standard" approach for preparing plasmonic gold nanomaterials with select compositions, sizes, and shapes, with high uniformity.¹ Here, we take a chemical approach towards translating traditional colloidal synthesis to in situ growth - the direct formation of morphology-controlled nanostructures directly on a substrate surface.

17:10 : Invited talk

Harnessing Plasmonic Phenomena In Glass Composites Obtained By Crystal Growth Techniques

Piotr Piotrowski¹, Govindan Vadivel¹, Krzysztof Wyrwas¹, Piotr Paszke¹, Rafal Nowaczyński², Barbara Surma¹, Nuttawut Kongsuwan³, Johann Toudert¹, Ortwin Hess⁴, Dorota A. Pawlak¹

¹ Centre of Excellence Ensemble3 (Poland), ² University of Warsaw (Poland), ³ Quantum Technology Foundation (Thailand), ⁴ Trinity College Dublin (Ireland)

Volumetric glass materials grown by micro-pulling-down technique will be presented, particularly from the perspective of their enhanced optical properties upon doping with plasmonic nanoparticles.

17:30 : Invited talk

3d Topological Insulator-based Eutectic Heterostructures: Fabrication And Potential Applications

Kingshuk Bandopadhyay¹, Krzysztof Markus¹, Andrzej Materna¹, Federico Mazzola², Craig Polley³, Masayoshi Tonouchi⁴, Rainer Hillenbrand⁵, Dorota A Pawlak¹

¹ ENSEMBLE3 (Poland), ² CNR - SPIN (Italy), ³ Lund Universit (Sweden), ⁴ Osaka University (Japan), ⁵ CIC nanoGUNE (Spain)

We report the fabrication of three-dimensional topological insulator heterostructures using a single-step bottom-up approach based on directional solidification. These materials exhibit atomically smooth interfaces, preserving topological surface states and enabling hetero-junction formation. This scalable approach paves the way for advancements in spintronics, quantum computing, and novel optoelectronic applications.

17:50 : Invited talk

Metal oxide metasurfaces elaborated by nanoimprint and derived methods

David Grosso¹, B. Kerzabi¹, M. Abbarchi¹, M. Putero², A. Gourdin¹, M. Bouabdellaoui¹, E. Daher¹, L. Weber¹

¹ SOLNIL (France), ² Institut of Materials Microelectronics and Nanosciences of Provence (France)

Sol-gel chemistry combined to direct nanoimprint lithography was developed to elaborate robust metal-oxide meta-surfaces. Different material/structures systems, dedicated to biosensing (DNA sequencing), high LIDT optics (Lasers), augmented reality and structural colours applications, are presented.

18:10 : Intriguing Electromagnetic Coupling In Eutectic ZnO-ZnWO4 From Visible To Medium Infrared Range

Emilija Petronijevic¹, Alessandro Belardini¹, Maria Cristina Larciprete¹, Marco Centini¹, Grigore Leahu¹, Roberto Li Voti¹, Monica Tomczyk², Pawel Osewski², Piotr Piotrowski², Dorota Anna Pawlak², Concita Sibilia¹

¹ Sapienza University of Rome (Italy), ² ENSEMBLE3 (Poland)

Bottom-up approaches in fabrication of eutectic metamaterials has opened new routes in designing intriguing electromagnetic properties. Here we show remarkable behavior of ZnO-ZnWO4 eutectic, from second har-

monic generation and polarization-dependent luminescence in the visible to metamaterial response in the medium infrared range.

16:30 - 18:10 — Manantiales

Session 3A36

Advanced Theoretical Methods for Nanoplasmonics and Molecular Plasmonics

Organized by: Tommaso Giovannini and Stefano Corni

Chaired by: Tommaso Giovannini

16:30 : **Invited talk**

Optical Properties Of Au-based Nanoparticles

Mirko Vanzan¹, Giacomo Becatti¹, Sofia Zinzani¹, Rilinda Plakaj², Mauro Stener², Francesca Baletto¹
¹University of Milan (Italy), ²University of Trieste (Italy)

By classical MD simulations, we model the coalescence of Au-hybrid nanostructures -bimetallic nanoantennas- introducing proper geometrical descriptors to capture the kinetics of the process. We calculate the absorption and ECD spectra employing TDDFT as in the AMS/ADF/poITDDFT tool2, contrasting them against classical electromagnetic prediction from the pyGDM library.

16:50 : **Invited talk**

Ultrafast Thermodynamics In SrTiO₃: Beyond Perturbation

Fredrik Eriksson, Yulong Qiao, Erik Fransson, Matthias Geilfhufer, Paul Erhart
 Chalmers University of Technology (Sweden)

We investigate ultrafast dynamics in SrTiO₃ using molecular dynamics and phonon analysis. Exciting the ferroelectric mode mimicking laser response, we observe upconversion in line with experiments. Our approach provides insights into entropy production and microscopic upconversion mechanisms.

17:10 : **Invited talk**

Mechanisms Of Plasmon-molecule Energy And Charge Transfer

Andrei Stefancu, Emiliano Cortes
 Ludwig-Maximilians Universität (Germany)

Plasmon-molecule energy transfer is essential for advancing plasmon-driven catalysis, molecular sensing, and energy conversion. It enhances chemical reactions at lower energy inputs, enables selective molecular excitation, and improves spectroscopic techniques like surface-enhanced Raman scattering (SERS). Understanding this process aids in designing efficient nanomaterials for sustainable chemical and technological applications.

17:30 : **Invited talk**

A computational Maxwell solver for nonlocal Feibelman parameters in Plasmonics

Lorenz Huber, Ulrich Hohenester
 University of Graz (Austria)

In extreme vicinity of metallic nanoparticles, quantum surface effects play a significant role. We develop a computational Maxwell solver based on the boundary element method, accounting for quantum corrections through mesoscopic boundary conditions with nonlocal Feibelman parameters. We demonstrate the versatility and accuracy of our approach for various model systems.

17:50 : **Invited talk**

Time-dependent quantum/continuum modeling of plasmon-enhanced electronic circular dichroism

L. Biancorosso¹, P. D'Antoni¹, S. Corni², M. Stener¹, Emanuele Coccia¹
¹University of Trieste (Italy), ²Università di Padova (Italy)

We present a multiscale real-time approach to study plasmonic effects of a metal nanoparticle (NP) on the electronic circular-dichroism spectrum of a chiral molecule interacting with it. The method is based on a

quantum description of the molecular system is coupled to a classical representation of the NP.

16:30 - 18:30 — Veselago

Session 3A37

Nano-Lasers, Spasers, and Nanostructures with Quantum Elements

Organized by: Alessandro Veltri and Ashod Aradian

Chaired by: Alessandro Veltri and Ashod Aradian

16:30 : Invited talk

Enhancement Of Lasing And Spasing Phenomena Via Individual, Periodic And Complex Plasmonic Resonators

Dávid Vass, András Szenes, Miklós Waldhauser, Emese Tóth, Olivér Fekete, Balázs Bánhelyi, Mária Csete

University of Szeged (Hungary)

Amplification, nanolasing and spasing phenomena can be controlled by designing individual nanoresonators of different composition that are randomly distributed, periodically arranged along 1D gratings, compose 3D multilayers and construct 2D patterns of a miniarrays. By considering the local impact of the plasmonic nanoresonators, the 4D optimization enables tailored lasing characteristics.

16:50 : Invited talk

Light goes Nano: The T-matrix method in nanoplasmonics with active gain media

Maria Antonia Iati, Rosalba Saija

CNR-IPCF (Italy)

The T-matrix method has proven to be a powerful approach to study the opto-plasmonic behaviour at the nanoscale. Particle shape, composition, and material hybridization strongly affect the opto-mechanical behavior and imply the need for an accurate theoretical modeling to address the experimental effort and the interpretation of the results.

17:10 : Invited talk

Emission Landscape And Spectrum Of Plasmonic Nanoshell Lasers

Karen Gabriela Caicedo Santamaria¹, Melissa Infusino², Ashod Aradian³, Alessandro Veltri²

¹ISASI - CNR (Italy), ²Universidad San Francisco de Quito (Ecuador), ³University of Bordeaux (France)

We present comprehensive modeling of gain-enhanced metallic nanoshells, analyzing their lasing characteristics through optical Bloch equations coupled to free-electron dynamics. By comparing symmetric and antisymmetric plasmon resonances and examining detuning effects between gain and resonance frequencies, we identify optimal conditions for emission thresholds, spectral tunability, and frequency pull-out dynamics.

17:30 : Invited talk

Geometric Antibunching And Directional Shaping Of Photon Anticorrelations

Blas Durá-Azorín¹, Alejandro Manjavacas², Antonio I. Fernández-Domínguez¹

¹Universidad Autónoma de Madrid (Spain), ²Instituto de Química Física Blas Cabrera (Spain)

In this work, we investigate the directional characteristics of photon statistics in dimers of quantum emitters placed in different photonic environments. We find a new mechanism for photon anticorrelation, termed as geometric antibunching, that is completely agnostic to the quantum state of the emitters and emerges from quantum interference effects.

17:50 : Invited talk

Exploring Extreme Dielectric Confinement For Nano-lasers

Yi Yu, M. Xiong, Y. Berdnikov, S. K. Borregaard, A. H. Dubré, E. Semenova, K. Yvind, J. Mørk

Technical University of Denmark (Denmark)

In this talk, I will present our recent work on nanolasers that leverage extreme dielectric confinement to localize

both photons and electrons, achieving a sub-diffraction-limited mode volume and continuous-wave lasing at room temperature. This approach enhances light-matter interactions, lowers the lasing threshold, and paves the way for ultra-efficient optoelectronic devices.

18:10 : Invited talk

Interface Engineering In Surface Plasmon Polariton Nanolasers For Integrated Photonic Applications

Yu-Hsun Chou

National Cheng Kung University (Taiwan)

We report interface-engineered SPP nanolasers featuring optimized dielectric-metal coupling, enabling ultra-compact mode confinement, low-threshold lasing, and substrate-free transferability for scalable integration.

16:30 - 18:10 — Maxwell

Session 3A38

Non-Hermitian Photonics: Topological, Disordered and Quantum systems

Organized by: Konstantinos Makris and Li Ge

Chaired by: Konstantinos Makris

16:30 : Invited talk

Non-Hermitian Topology Solely from Optical Loss Modulation

Amin Hashemi¹, Elizabeth L. Pereira², Hongwei Li³, Jose L. Lado², Andrea Blanco-Redondo¹

¹University of Central Florida (USA), ²Aalto University (Finland), ³Nokia Bell Labs. (United Kingdom)

We report the observation of topology arising solely from optical loss modulation. Specifically, we implement a non-Hermitian generalization of the Aubry-André-Harper model in a programmable integrated photonics platform, where the loss of each element can be controlled precisely, showing that loss modulation, alone, can create topology in photonic systems.

16:50 : Invited talk

Geometrical Phase Resonators

Yuma Kawaguchi¹, Daria Smirnova², Filipp Komissarenko¹, Daria Kafeeva¹, Svetlana Kiriushchikina¹, Anton Vakulenko¹, Jeffery Allen³, Monica Allen³, Alexander B. Khanikaev⁴

¹The City College of New York (USA), ²The Australian National University (Australia), ³Air Force Research Laboratory (USA), ⁴CREOL-University of Central Florida (USA)

We introduce new type of resonators defined solely by a geometrical phase. Topological boundary mode undergo an adiabatic evolution that gives rise to the geometrical phase of 360 deg. without propagation phase. This renders the resonance condition independent from its shape and length, which we confirmed by simulations and experiments.

17:10 : Use of Complex Time Delay to Control Propagation Through Generic Non-Hermitian Scattering Systems

Isabella Giovannelli, Nadav Shaibe, Jared Erb, Thomas M. Antonsen, Steven Anlage

University of Maryland (USA)

We establish the physical meaning of the imaginary part of complex time delay through experiments. We find universal statistics for complex time delay and utilize its divergences to identify a large variety of scattering singularities, including new ones that we create with our microwave graph and billiard experiments.

17:25 : Fock space skin effects in many body systems

Masatoshi Sato

Kyoto University (Japan)

I will discuss a general criterion for non-Hermitian skin effects that works for any finite-dimensional system evolved by a linear operator. Applying this criterion, I will argue for a new type of non-Hermitian skin effect in many-body systems: the Fock space skin effect. I will also discuss the experimental signal.

17:40 : Correlation Between Topological Effects In Photonic Crystal Slabs: A Theoretical And Experimental Exploration Of Bic, Weyl Points And Fermi Arcs

Karen Caicedo, Sivia Romano, Gianluigi Zito, Ivo Rendina, Vito Mocella
CNR-ISASI (Italy)

We present a theoretical-experimental framework that reveals how bound states in the continuum, Weyl-points and Fermi arcs are connected in photonic crystal slabs. A novel setup allowing high-precision equi-frequency surface measurements confirms these topological phenomena and their far-field polarisation singularities, enabling robust device designs for optical communication and quantum technologies.

17:55 : Multi-Order Exceptional Points In Higher Dimensions

Athanasios Athanasopoulos, Dimitrios Kaltsas, Konstantinos Makris
University of Crete (Greece)

We introduce a new class of Multi-order Exceptional Points (MoEPs) in 2D and 3D non-Hermitian systems. These MoEPs are Higher-order Exceptional Points (HEPs) coexisting at the same gain-loss parameter. We analyze their ultra-sensitivity using pseudospectra, highlighting their potential applications in precision sensing for optical systems.

18:10 - 18:50 — Maxwell**Session 3A39****Symposium II: New Trends in Nanophotonics and Advanced Materials**

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Joseph Tischler

18:10 : Invited talk**Multi-Photon Lithography For Advanced Micro-optics And Large-Area Metasurfaces**

Gordon Zyla¹, Dimitra Ladika¹, Vasileia Melissinaki², Michalis Stavrou², Ivan Kassamakov³, Savvas Papamakarios², Dimitrios Zografopoulos⁴, Anna Christoforidou⁵, George Kenanakis², Odysseas Tsilipakos⁶, Mangirdas Malinauskas¹, Maria Farsari²

¹Vilnius University (Lithuania), ²Foundation for Research and Technology-Hellas (Greece), ³University of Helsinki (Finland), ⁴Aristotle University of Thessaloniki (Greece), ⁵Lund University (Sweden), ⁶National Hellenic Research Foundation (Greece)

This work demonstrates the flexibility of micro- and nanoscale 3D printing via multi-photon lithography for the realization of advanced micro-optics in the field of photonic nanojets, the fabrication of flat optics for wavefront manipulation in the visible range, and the production of large-area metasurfaces for the mid-infrared and terahertz regimes.

18:30 : Invited talk**Strong Light-Matter Interaction In Dielectric Hybrid Metasurfaces**

Giorgio Adamo, Marco Marangi, Alexander M Dubrovkin, Andrea Zacheo, Cesare Soci
Nanyang Technological University Singapore (Singapore)

Low-loss, high-Q dielectric metasurfaces are versatile platforms to manipulate strong light-matter interaction. By using silicon metasurfaces, we are able to realize strong-coupling-induced enhancement and phase-transition in molecular J-aggregates superradiance and exciton-polariton condensation and lasing in polycrystalline perovskite films. These works establish scalable pathways for polaritonic devices compatible with silicon photonics.

16:30 - 19:00 — Fresnel

Session 3A40

Parity-Time and quasi-normal modes in Photonics, Plasmonics, Acoustics

Organized by: Anatole Lupu and Henri Benisty

Chaired by: Anatole Lupu and Henri Benisty

16:30 : Invited talk**Fermi Arcs In Dielectric Resonators****Nikolay Solodovchenko, Mikhail Bochkarev, Kirill Samusev, Andrey Bogdanov, Mikhail Limonov***ITMO University (Russia)*

Fermi arcs in coordinate space link topological degeneracies, with surface Fermi arcs linking Weyl points and bulk Fermi arcs linking exceptional points. We present the results of an experimental observation of a bulk Fermi arc in a single dielectric ring resonator.

16:50 : Invited talk**Active Parabolic Waveguide Amplifiers With Non-hermitian Mode Control****Nayeem Akhter, Ramon Herrero, Kestutis Staliunas, Muriel Botey***Universitat Politècnica de Catalunya (Spain)*

We demonstrate a non-Hermitian mode management mechanism in nonlinear parabolic waveguide amplifiers, exploiting asymmetric mode growth via refractive index and gain/loss modulations. This enables flexible mode combination, higher-order mode excitation and photon concentration into the lowest-order Hermite mode for all-optical cleaning. The effect is analytically predicted, numerically validated, and robust.

17:10 : Invited talk**Exceptional Points And Large Chirality In Coupled Photonic Waveguides****Alice De Corte¹, Stefanos Koufidis², Martin McCall², Bjorn Maes¹**¹*University of Mons (Belgium)*, ²*Imperial College London (United Kingdom)*

In coupled waveguides, exceptional points can stem from the coupling of either counter-propagating modes or co-propagating modes. We utilize both methods, by implementing extreme chirality in a homogeneous waveguide, thereby realizing backward mode propagation, and by inserting a chiral material in the slot between waveguides exhibiting balanced gain and loss.

17:30 : Invited talk**Resonant States Of Photonic Time Crystals****Adria Canos Valero¹, Sergei Gladyshev¹, David Globosits², Stefan Rotter², Egor Muljarov³, Thomas Weiss¹**¹*University of Graz (Austria)*, ²*Vienna University of Technology (Austria)*, ³*Cardiff University (United Kingdom)*

Realizing photonic time crystals in optics requires imparting fast temporal modulations to nanostructures of finite spatial extent. We show that these systems exhibit cavity effects driven by resonant states, which dominate their exotic optical response. We present a general framework to calculate these eigenmodes, uncovering their underlying non-Hermitian physics.

17:50 : Invited talk**Bright And Dark Soliton Blending Stabilized By Non-hermitian Potentials In Kerr Ring Cavities****Salim Benadouda Ivars¹, Muriel Botey¹, Kestutis Staliunas², Ramon Herrero¹**¹*Universitat Politècnica de Catalunya (Spain)*, ²*ICREA (Spain)*

Bright and dark solitons, separately observed in systems with opposite dispersion, are blended in a hybridized scenario by introducing periodic non-Hermitian potentials in the damped-driven nonlinear Schrödinger equation. New patterns, solitonic structures, and molecules are generated, become accessible, and can be stabilized.

18:10 : Invited talk**Exceptional Points In Open Quantum Systems: A Quantum Channel Approach****Jensen Li¹, Wai Chun Wong², Bei Zeng³**¹*Hong Kong University of Science and Technology (Hong Kong)*, ²*University of Exeter (United Kingdom)*,

³ *The University of Texas at Dallas (USA)*

We propose interpolating quantum channels to construct exceptional points. We show that a second-order exceptional point emerges by interpolating two quantum channels. Quantum circuits are constructed to verify the exceptional point on a nuclear magnetic resonance quantum computer. A classical metasurface simulation of the quantum channel will also be discussed.

18:30 : Spherical Representation Of (anti-)parity-time States Of Bragg Gratings

Tianyi Hao¹, Pavel Cheben¹, Jens Schmid², Pierre Berini¹

¹ *University of Ottawa (Canada)*, ² *National Research Council Canada (Canada)*

Parity-time (PT) symmetry and anti-PT symmetry are two types of non-Hermitian Hamiltonian systems. Waveguide Bragg gratings with phase-shifted perturbations in real and imaginary refractive index can reach any (anti-)PT symmetry state. A spherical surface of the grating design space is proposed, illustrating (un)broken and exceptional point (anti-)PT symmetry states.

18:45 : Trapping Light At An Exceptional Point

Adria Canos Valero¹, Zoltan Sztranyovszky², Egor A. Muljarov³, Andrey Bogdanov⁴, Thomas Weiss¹

¹ *University of Graz (Austria)*, ² *University of Birmingham (United Kingdom)*, ³ *Cardiff University (United Kingdom)*, ⁴ *Harbin Engineering University (China)*

Bound states in the continuum and exceptional points are unique singularities of non-Hermitian systems. We demonstrate that multiple bound states in the continuum can merge into a single exceptional point, creating a novel kind of singularity. This state combines non-radiative behavior with extreme sensitivity, opening new prospects for nanoscale sensing.

16:30 - 19:10 — Bragg

Session 3A41

New Advances in Metamaterials and Their Functional Applications

Organized by: Weiren Zhu, Zhenfei Li and Jin Zhang

Chaired by: Zhenfei Li and Jin Zhang

16:30 : Invited talk

Dynamical Manipulation of Terahertz Waves based on Moiré Metamaterials

Jin Zhang, Zhipei Sun

Aalto University (Finland)

In recent years, moiré metamaterials have emerged as a fascinating and promising area of research, offering unique and unprecedented opportunities for controlling and manipulating electromagnetic waves. Here we propose a bilayer graphene-based metamaterial for the tunable manipulation of THz waves.

16:50 : Invited talk

Optical near-field enhancement by metal particles at higher-order plasmon resonances

Sagar Sehrawat, Andriy Shevchenko

Aalto University (Finland)

We demonstrate that higher-order plasmon resonances in small groups of metal nanoparticles or their arrays can significantly enhance optical near-fields, exceeding the most common dipole-induced enhancement. The finding is important for the development of new approaches to the design of plasmonic devices, such as plasmonic sensors and nonlinear optical components.

17:10 : Invited talk

One-time Pad Encryption With Optical Metasurface Ciphertext And Dynamic Visual Keys

Zhenfei Li¹, K. Song¹, W. R. Zhu²

¹ *Northwestern Polytechnical University (China)*, ² *Shanghai Jiao Tong University (China)*

We propose a novel one-time pad encryption scheme based on optical metasurface ciphertext and dynamic visual keys. By utilizing metasurfaces for encoding ciphertext and spatial light modulators for dynamic key generation, the system ensures high security through randomness and variability, offering robust solutions for secure communication and data protection.

17:30 : Invited talk

Relaxing Symmetry Constraints And Enhancing Robustness Of Photonic Bound States In The Continuum

Huayu Bai, Andriy Shevchenko, Radoslaw Kolkowski

Aalto University (Finland)

We present new approaches to enhance robustness and flexibility of photonic bound states in the continuum (BICs) for practical applications. Our methods allow BICs to exist in structures with lower symmetry and provide significant enhancement of the quality factor around BICs across a wide range of parameter values.

17:50 : Invited talk

Anomalous Reflection Multifunctional Metagrating

Yahong Liu, Wenyu Gao, Xin Zhou, Peng Li

Northwestern Polytechnical University (China)

We design a multifunctional metagrating that can maintain high efficiency in an incident angle range of 10° - 60° in a broadband frequency range. The unit cell of the metagrating consists of two metal rings, which exhibits a π phase difference and can shut down the 0th order diffraction mode.

18:10 : Invited talk

Electric Field Reconfigurable Mechanical Metamaterials

Haoming Pang, Jianbo Yin

Northwestern Polytechnical University (China)

A beam embedded with electrorheological fluids is designed, whose bending stiffness can be adjusted by an electric field, thereby the direction of buckling can be controlled. Based on this, an electric field-reconfigurable mechanical metamaterial is designed, whose Poisson's ratio can switch between positive and negative by regulating the electric field.

18:30 : Invited talk

Dual-band acoustic topological metamaterials with valley-locked waveguide states

Changlin Ding, Yang Sun

Northwestern Polytechnical University (China)

We present two kinds of valley topological metamaterial with topological valley-locked waveguide states (TVWSs) composed of local resonant meta-atoms or meta-molecules. The work frequency can be tuned by the geometry size of local resonant structures. Arraying the two structures together, the composite topological metamaterial can realize TVWSs in two bands.

18:50 : Invited talk

Chirality Nonlinear Optics With Two-dimensional Materials

Yi Zhang

Northwestern Polytechnical University (China)

We demonstrate ultrafast, coherent manipulation of valley-selective nonlinear optics in monolayer molybdenum disulfide through time-reversal symmetry breaking via Floquet engineering.

Conference Dinner

20:00 - 23:30

Friday 25th July, 2025

8:30 - 10:40 — Torremolinos

Session 4A1

Symposium VI: Advanced Techniques for Computational Electromagnetics

Organized by: Maha Ben Rhouma

Chaired by: Maha Ben Rhouma

08:30 : **Keynote talk**

Certain Intersections Of Ai And Photonics

Marin Soljacic

MIT (USA)

This talk will explore how photonics can enhance AI hardware and how AI can accelerate photonics research. Topics will include large language models for scientific discovery and robotics for photonics experiments, highlighting key opportunities and challenges at this intersection.

09:00 : **Invited talk**

Resonances In Doubly Anisotropic, High-index Nanoplatelets

Bingying You, Tom Sistermans, Alberto Curto

Ghent University (Belgium)

Optical anisotropy plays a crucial role in manipulating light. Its strength is, however, limited to low values in conventional materials. Transition metal dichalcogenides possess both high refractive index and birefringence. Here, we investigate optical resonances in nanoplatelets with both geometrical and refractive index anisotropies to control light scattering and emission.

09:20 : **Invited talk**

Analysis Of A Tunable Terahertz Waveguide Using The Frequency-dependent Hie-fdtd Method

Jun Shibayama, Hiroto Miyao

Hosei University (Japan)

A tunable terahertz waveguide with InAs sidewalls and air buffers is efficiently analyzed using a newly developed frequency-dependent hybrid-implicit-explicit FDTD method based on the trapezoidal recursive convolution technique. The waveguide acts as a TE/TM-pass waveguide, while it acts as a TE-stop/TM-pass waveguide polarizer with the buffer being filled with water.

09:40 : **Invited talk**

Variational Optical Processors

Charles Roques-Carmes, Aviv Karnieli, David A. B. Miller, Shanhui Fan

Stanford University (USA)

We introduce "variational optical processors," self-configuring photonic networks that learn modal representations of partially coherent or quantum optical fields through optimization, applicable to diverse classical and quantum optical processing tasks.

10:00 : **Invited talk**

Bounds as Blueprints: Towards Optimal and Accelerated Photonic Inverse Design

Pengning Chao¹, Alessio Amaolo², Sean Molesky³, Alejandro Rodriguez²

¹Massachusetts Institute of Technology (USA), ²Princeton University (USA), ³Polytechnique Montreal (Canada)

We present a "verlan" design method that exploits global wave information encoded in performance bounds to guide inverse design towards better-performing structures. Structures informed by limits outperform standard inverse-design by an order of magnitude and approach fundamental performance limits within a factor of two,

highlighting access to untapped performance improvements.

10:20 : Invited talk

Scattering-matrix-based Optical Property Analysis And Simulation Acceleration For Periodic Photonic Structures And Metasurfaces

Yijia Cheng, Chengnian Huang, Wei Sha

Zhejiang University (China)

The scattering matrix method (SMM) enables spectral/field analysis of periodic photonic structures. Leveraging S-matrix physical properties, finite-difference matrix differentiation accelerates complex pole extraction in band-structure eigenvalue solutions. By decomposing non-periodic metasurfaces into coupled quasi-periodic subunits with parallel computation, SMM extends to large-scale aperiodic simulations bypassing full-wave modeling.

8:30 - 10:25 — Alamos

Session 4A2

Light-matter interaction on a chip

Organized by: Alina Karabchevsky

Chaired by: Alina Karabchevsky

08:30 : Invited talk

Dynamically reconfigurable topological routing in nonlinear photonic systems

Stephan Wong¹, Simon Betzold², Sven Hofling², Alexander Cerjan¹

¹*Sandia National Laboratories (USA)*, ²*Julius-Maximilians-Universität Würzburg (Germany)*

We propose a mechanism for dynamic control over a driven-dissipative system's local Chern topology, yielding reconfigurable topological interfaces and tunable paths for protected routing. We illustrate our approach in non-resonantly-pumped polariton lattices, where the nonlinear-interaction between the polaritons and the exciton reservoir can yield a dynamical change of the topology.

08:50 : Invited talk

Transformation And Amplification Of Light In Optical Resonators Modulated By A Relatively Slow Travelling Wave

Misha Sumetsky

Aston University (United Kingdom)

We investigate the transmission spectrum of optical waveguides and resonators modulated by relatively slow travelling waves and show that an acoustic wave having the phase velocity satisfying the Brillouin phase matching condition can significantly amplify light in a racetrack optical resonator within a small transmission bandwidth.

09:10 : Invited talk

Tunable On-chip Meta-waveguides

Atefeh Habibpourmoghadam, Wenyong Xie, Antonio Calà Lesina

Leibniz University Hannover (Germany)

We demonstrate optical mode tuning in meta-waveguides. Our results underscore the potential of electrically-controlled optical waveguides for adaptive optical integrated systems.

09:30 : Invited talk

Telecom Wavelength Quantum Dot Single Photon Sources For Photonic Quantum Technologies

Andreas Pfenning, Tobias Huber-Loyola, Sven Hoeffling

Julius-Maximilians-Universität Würzburg (Germany)

We present an overview of recent developments in our group on the engineering of single-photon sources for quantum photonic applications made from III-V semiconductor quantum dots grown by molecular beam

epitaxy with a focus on telecom band emission.

09:50 : Invited talk

On The Shapes Of The Rogue Waves In Optical Fibers

Stanislav Derevyanko¹, S. K. Turitsyn²

¹Ben Gurion University of the Negev (Israel), ²Aston University (United Kingdom)

We analyze the necessary conditions for the given pulse shape to be a rogue wave occurring in optical fiber. We provide general criteria for the parameters of the candidate pulses and illustrate the results by considering several pulse shapes.

10:10 : Microscopic Theory Of Collimated Light Propagation In Dipolar Arrays With Emergent Epsilon-Near-Zero Responses

Lewis Ruks¹, Janne Ruostekoski²

¹NTT Corporation (Japan), ²Lancaster University (United Kingdom)

We demonstrate how macroscopic optical responses of epsilon-near-zero media emerge from discrete dipolar scatterers by employing essentially exact microscopic simulations of light propagation. Collective responses of dipoles exhibit dramatic increases in excitation wavelengths as the system parameters are tuned closer to the onset of epsilon-near-zero behaviour.

8:30 - 10:30 — Playamar

Session 4A3

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Eugene Kamenetskii

08:30 : Invited talk

Magnonic φ Josephson Junctions and Synchronized Precession

Kouki Nakata¹, Ji Zou², Jelena Klinovaja², Daniel Loss²

¹Japan Atomic Energy Agency (Japan), ²University of Basel (Switzerland)

We uncover theoretically that a surprisingly rich dynamics can emerge in magnetic junctions due to intrinsic nonlocal damping, using analytical and numerical methods. In particular, under microwave pumping, we show that coherent spin precession in the right and left insulating ferromagnet of the junction becomes synchronized by nonlocal damping.

08:50 : Invited talk

Classifying Fragile Topology Using Matrix Homotopy

Alexander Cerjan

Sandia National Laboratories (USA)

We develop a Z2 energy-resolved topological marker for classifying fragile phases using a system's position-space description, enabling the direct classification of finite, disordered, and aperiodic materials, and illustrate this marker's application in both material and photonic crystal systems.

09:10 : Invited talk

Electromagnetic Helicity in Twisted Cavity Resonators

Jeremy Bourhill, Emma Paterson, Maxim Goryachev, Michael Tobar

The University of Western Australia (Australia)

Twisting the conducting boundary conditions of an electromagnetic cavity with an equilateral triangle cross-section generates eigenmodes with electromagnetic helicity - a result of the coupling of previously degenerate TE and TM modes. This can be interpreted as an emergence of magnetoelectricity, which produces a confimable shift in resonant mode frequency.

09:30 : Invited talk**Electrical control of ultrastrong coupling of 2-dimensional electronic systems to single meta-atoms**

Elsa Jöchl¹, Felix Helmrigh¹, Anna-Lydia Vieli¹, Lucy Hale¹, Deniz Turan², Mona Jarrahi², Mattias Beck¹, Atac Imamoglu¹, Jerome Faist¹, Tobia Nova¹, Giacomo Scalari¹

¹ETH Zurich (Switzerland), ²UCLA (USA)

We demonstrate electrical control of ultrastrong light-matter coupling regime in high mobility III-V 2DEG and bilayer graphene at THz and sub-THz frequencies. The meta-atom surface is of the order of 10 micron², allowing the THz (0.05-10 THz) study of exfoliated bilayer graphene devices and other 2D systems.

09:50 : Invited talk**Chiral Polaritons in Bulk van der Waals Metasurfaces**

Alexander Antonov¹, Connor Heimig¹, Maxim Gorkunov², Yuri Kivshar³, Andreas Tittl¹

¹Ludwig-Maximilians-Universität München (Germany), ²Shubnikov Institute of Crystallography - NRC "Kurchatov Institute"(Russia), ³Australian National University (Australia)

We analyze a maximally chiral metasurface composed of van der Waals (vdW) material within the strong light-matter coupling regime. We demonstrate that, due to specific photonic eigenstates - chiral quasi-bound state in the continuum (quasi-BIC) uncoupled from light of specific circular polarization, chiral self-hybridized exciton-polaritons of certain handedness are formed.

10:10 : Invited talk**Manipulating Light-driven Nanoscale Vectorial Currents**

Hou-Tong Chen

Los Alamos National Laboratory (USA)

By breaking the inversion symmetry in a class of optoelectronic metasurfaces, nanoscale vectorial photocurrents and terahertz cylindrical vector beams have been successfully demonstrated through integrating raindrop-shaped plasmonic nanoantennas on graphene as a model system. Appropriate symmetry designs further enable the control of the photocurrent direction utilizing the incident light polarization.

8:30 - 10:30 — Bajondillo**Session 4A4****Symposium II: New Trends in Nanophotonics and Advanced Materials**

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Emilio Pisanty

08:30 : Invited talk**Building Complex Nanophotonic Device With Self-Assembled Colloidal Particles**

Weihua Zhang

Nanjing University (China)

Deterministic self-assembly techniques were developed for functional colloidal nanomaterials, including semiconductor, dielectric, plasmonic, and magnetic micro-/nanoparticles, with single-particle, nanometer precision. Using these techniques, novel devices such as subwavelength non-replicable QR codes and unidirectional optical antennas were demonstrated, presenting a new approach for fabricating complex nanophotonic devices.

08:50 : Invited talk**Coexisting And Cooperating Light-matter Interaction Regimes In Apolaritonic Photovoltaic System**

Roberto Termine¹, Vincenzo Caligiuri¹, Svetlana Siprova¹, Attilio Golemme¹, Aniket Patra², Giuseppe E. Lio³, Antonio De Luca¹

¹CNR-NANOTEC (Italy), ²University of Calabria (Italy), ³CNR-INO (Italy)

We studied the properties of a perovskite photovoltaic cell engineered to behave as an optical cavity tuned to the excitonic transition of the embedded active material to study how the cooperation of the strong coupling

regime and the photovoltaic effect can enhance the photovoltaic properties of the cell..

09:10 : Invited talk

Active IR and THz Light Modulators Based on Epsilon-Near Zero InAs and GaSb Semiconductor Frequency-Selective Surfaces

Julien Guise, Fernando Gonzalez-posada Flores, Stephan Blin, Thierry Taliercio

University of Montpellier (France)

Our research explores light-matter interaction applications, focusing on surface field-enhanced optical filters and transducers in the mid-infrared (MIR) and terahertz (THz) spectral ranges using plasmonic effects. We present thermal and optical activation of epsilon-near-zero (ENZ) materials based on epitaxial InAs and GaSb semiconductors, with emphasis on frequency-selective surface optical devices.

09:30 : Invited talk

Sub-1-volt, Reconfigurable Gires-tournois Resonators For Colored Monopixel Array

Young Min Song

Gwangju Institute of Science and Technology (Korea)

We present an electrically reconfigurable Gires-Tournois resonator integrated with polyaniline for full-colour, energy-efficient modulation at CMOS-compatible voltages. This system achieves vibrant colour shifts across the visible spectrum within a sub-1V range, supporting ultrahigh pixel densities and wafer-scale fabrication, with bistable memory-in-pixel functionality for low-power passive matrix addressing in display applications.

09:50 : Invited talk

Exploring Channelrhodopsin-2 And Gold Nanoparticle Interaction For Optogenetics

Roberto Messina¹, Luca Bellucci², Stefano Corni³, Lucia Cascino¹, Stefania D'Agostino¹, Laura Zannetti Polzi⁴

¹University of Salento (Italy), ²CNR Institute of Nanoscience (Italy), ³University of Padova (Italy), ⁴CNR-Institute of Nanoscience (Italy)

A molecular dynamics study revealed that functionalized gold nanoparticles are able to form stable complexes with Channelrhodopsin-2, without disturbing the protein structure and dynamics. The results pave the way for exploiting the polaritonic properties of nanoparticles to tune the photoactivity of light-gated ion channels in a controlled way.

10:10 : Invited talk

Pixelated plasmonic metasurfaces as a platform for sensing applications in mid-IR

Amirmostafa Amirjani, Ewald Janssens

KU Leuven (Belgium)

In this study, we present the pixelated plasmonic metasurface for detecting mid-infrared molecular fingerprints and for the chemical identification and compositional analysis of surface-bound analytes. The pixelated plasmonic metasurface successfully detected the molecular fingerprints of glucose (1 nM) in the wavenumber range of 1000 cm⁻¹ to 1800 cm⁻¹.

8:30 - 10:30 — Carihuela

Session 4A5

Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and Noé Jiménez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

08:30 : Invited talk

Phase-matching Holographic Metasurfaces For Accurate Acoustic Image Generation

Víctor Vegas-Luque, Diana Andrés Bautista, Alba Eroles Simó, Juan José Rodríguez García, Francis-

co Camarena Femenia, Noé Jiménez González

Universitat Politècnica de Valencia (Spain)

Holographic metasurfaces can tailor acoustic wavefronts to produce arbitrary acoustic images, however, current methods are not able to accurately encode the target phase distribution. We propose a novel technique for designing the metasurface by matching the phase at the lens exit with the target phase over a whole volume.

08:50 : Invited talk

Visualization Of Topological Edge And Boundary Modes In Mechanical Metamaterials

Motonobu Tomoda¹, Konosuke Yamaguchi², Gun Yoon², Hayato Takeda², Ryoya Minami², Osamu Matsuda², Oliver Wright²

¹*Oita University (Japan)*, ²*Hokkaido University (Japan)*

We developed two types of two-dimensional mechanical wave machines to investigate topologically protected edge and boundary vibration modes. One system simulates quantum Hall effects by breaking time-reversal symmetry through the Coriolis force. The other replicates quantum valley Hall effects, where vibrations propagate along a topological interface.

09:10 : Invited talk

Compact Elastic Plate For Bound State In The Continuum

Zhihui Wen¹, Marc Marti-Sabaté², Yabin Jin³, Daniel Torrent⁴, Yegao Qu¹

¹*Shanghai Jiao Tong University (China)*, ²*Imperial College London (United Kingdom)*, ³*East China University of Science and Technology (China)*, ⁴*Universitat Jaume I (Spain)*

We demonstrate high-quality flexural wave localization mechanism in symmetric scatterer clusters, where resonance quality (Q) escalates with energy density, approaching bound states in the continuum (BICs) with infinite Q. High-multipole modes form whispering galleries. A cylindrical-shelled metaplate achieves symmetry-protected BICs, enabling compact, high-efficiency wave control for on-chip applications.

09:30 : Invited talk

On The Practical Use Of Wooden Logs Sonic Crystals As Road Traffic Noise Barriers

Paulo Amado-Mendes, Luis Godinho

University of Coimbra (Portugal)

The concept of sonic crystals for road traffic noise mitigation has been explored, making use of a highly sustainable solution made of wooden logs. Complementary approaches have been adopted, with extensive numerical analyses, concept validation in laboratory conditions and in situ prototype acoustic characterization.

09:50 : Invited talk

Topological Modes In Phononic Waveguide Interfaces

Kojam Monika Devi¹, Clivia M. SotomayorTorres², Yan Pennec¹, Bahram Djafari-rouhani¹

¹*Université de Lille (France)*, ²*INL International Iberian Nanotechnology Laboratory (Portugal)*

We report phononic waveguide interfaces capable of supporting topological edge modes. We investigate the topological properties of the edge modes in different waveguide interfaces, revealing robust propagation with negligible backscattering. Our results provide valuable insights for the design of low-loss phononic components for device applications.

10:10 : Invited talk

Accurate Fem Investigation Of Acoustic Properties In Aerospace Sandwich Structures With Metamaterial Core

Maria Cinefra¹, Martino Carlo Moruzzi², Marco Petrolo³, Matteo Filippi³, Giuseppe Petrone⁴

¹*Politecnico di Bari (Italy)*, ²*Università di Bologna (Italy)*, ³*Politecnico di Torino (Italy)*, ⁴*Università degli Studi di Napoli Federico II (Italy)*

Noise and vibrations in aircraft can deeply affect the passengers comfort and pilots well-being, on the other hand, spacecraft and its payload are subjected to severe structural vibrations during launch phase. A possible solution is the use of metamaterials as acoustic treatments for the trim panels of these vehicles.

8:30 - 10:30 — Montemar

Session 4A6

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Giuseppe Della Valle

08:30 : **Invited talk****Surface Acoustic Wave Stimulated Brillouin Scattering****Moritz Merklein***The University of Sydney (Australia)*

In this talk, I will introduce a new type of on-chip stimulated Brillouin scattering (SBS) interaction that harnesses surface acoustic waves (SAWs) travelling along the surface of the waveguide rather than in the waveguide core. SAW-SBS opens a path toward new Brillouin material platforms and on-chip sensing applications.

08:50 : **Invited talk****Photonic Force Microscopy In Front Of Epsilon-near-zero (enz) Surfaces****Maria Grazia Donato¹, Michael Hinczewski², Theodore Letsou², Mohamed ElKabbash², Rosalba Saija¹, Pietro Giuseppe Gucciardi¹, Nader Engheta³, Giuseppe Strangi², Onofrio Maria Maragò¹**¹CNR-IPCF (Italy), ²Case Western Reserve University (USA), ³University of Pennsylvania (USA)

Photonic force microscopy has been used to highlight a pN-range levitation force on a 1 micron polarizable particle trapped in proximity of an Epsilon-near-zero (ENZ) surface.

09:10 : **Invited talk****Highly Sensitive CMOS Image Sensor Integrating Color-routing Nanostructures****Choonlae Cho, Sangyun Lee, Sookyoung Roh, Sungmo Ahn, Suyeon Lee, Junho Lee, Subeom Song, Seokho Yun***Samsung Advanced Institute of Technology (Korea)*

We present CMOS image sensor with tailored color-routing nanostructures, which significantly enhances sensitivity while preserving most of its spatial resolution as well. Furthermore, by adjusting the arrangement of nanostructures based on relative position, we mitigates oblique light incidence, enabling commercial CMOS image sensors.

09:30 : **Invited talk****Integration Technique Of Micro- And Nano-lasers On Si By Epitaxial Growth Using Iii-v-on-si Wafer****Takuro Fujii, Koji Takeda, Erina Kanno, Takuma Tsurugaya, Tomonari Sato, Shinji Matsuo***NTT (Japan)*

We present our integration technique of low-power-consumption III-V lasers on Si. We use a directly bonded III-V membrane on SiO₂ as an integration platform and perform epitaxial growth to fabricate a buried-heterostructure. Based on this technique, direct modulation of membrane lasers and photonic crystal lasers with low-power consumption are reported.

09:50 : **Invited talk****Photodegradation Of Dyes Using Fe₃O₄-Au-Pd Hybrid Nanoparticles Synthesized Liquid-Phase****Yukie Yokota, Taiga Uehara, Mao Takeda***Sophia University (Japan)*

We focused on iron oxide nanoparticles that can be recovered using magnets. and synthesized Iron oxide-gold-palladium nanoparticles (Fe₃O₄-Au-Pd hybrid nanoparticles) were prepared in the liquid phase under different synthesis conditions. The catalytic activity of these hybrid nanoparticles was investigated in dye degradation reactions.

10:10 : **Invited talk****Snapshot Polarimetric Stereoscopic Imaging And On-Chip High Dynamic Range Correction System****Shuming Wang**

Nanjing University (China)

We present a snapshot polarimetric stereoscopic imaging (SPSIM) system based on a polarimetric metalens that decouples and focuses six distinct polarizations, enabling high-resolution 3D reconstruction with a neural network-mediated algorithm. Beyond 3D imaging, we introduce an on-chip metasurface-based non-uniform transmittance array for single-exposure HDR imaging.

8:30 - 10:15 — Litoral

Session 4A7

Metasurfaces and Flat Optics

Chaired by: Jensen Li

08:30 : Enhanced Frequency Conversion By Plasmonic-Dielectric Metasurfaces With High-Q Quasi-bics In The Visible Spectral Range

Timo Stolt, Huayu Bai, Andriy Shevchenko, Radoslaw Kolkowski

Aalto University (Finland)

We numerically demonstrate plasmonic-dielectric metasurfaces with narrow-band resonances in the visible spectral range, showing exceptionally high quality factors ($Q \sim 6400$). These arise from hybridization between guided modes of different order. We predict up to 750-fold enhancement of second- and third-harmonic generation in these metasurfaces, revealing their potential for nonlinear nanophotonics.

08:45 : Highly-efficient meta-surface for vectorial holography generation

Tong Liu¹, Changhong Dai², Dongyi Wang³, C. T. Chan¹, Lei Zhou²

¹The Hong Kong University of Science and Technology (Hong Kong), ²Fudan University (China), ³The University of Hong Kong (Hong Kong)

In this work, an efficient meta-platform is proposed and experimentally demonstrated for high-resolution vectorial holography generation at the incidence of arbitrary polarization. Employing a series of highly-efficient and ultra-thin single-structure metaatoms with arbitrarily designated scattered phases and polarization-conversion capabilities, various vectorial holographic images are experimentally realized at 1064 nm.

09:00 : Designing Temperature Invariant All-dielectric Photothermal Metasurfaces

Gopal Narmada Naidu, Can O. Karaman, Giulia Tagliabue

EPFL (Switzerland)

The diffusion-driven nature of temperature fields complicates spatial manipulation, making it challenging to achieve uniform or complex temperature distributions at the micro- and nanoscale. To address this, we developed an algorithm for designing temperature invariant all-dielectric photothermal metasurfaces, enabling precise, scalable thermal control and reconfigurable optical properties.

09:15 : A Dual Bound States In The Continuum Mid-ir Metasurface

Giovanni Piscopo¹, Artem Vorobev¹, Jesus Hernan Mendoza Castro², Giovanni Magno³, William Whelan-Curtin¹

¹Munster Technological University (Ireland), ²Technische Universität Wien (Austria), ³Politecnico di Bari (Italy)

We numerically demonstrate a dual Bound States in the Continuum metasurface operating in the Mid-IR region, with calculated Q-factors exceeding 105 and 106 and broad wavelength tunability. The choice of materials and structural dimensions makes our design a promising candidate for large-scale application as a highly efficient resonator.

09:30 : Dispersive Meta-lens Temperature Detector

Yulun He¹, Mu Ku Chen², Mingrui Huang¹, Yifei Zhang³, Shengxian Shi¹

¹Shanghai Jiao Tong University (China), ²City University of Hong Kong (China), ³Tsinghua University (China)

Temperature measurement is crucial for energy transfer, particularly in extreme high-temperature environments. Traditional radiation thermometry struggle with bulky optical systems. We introduce Dispersive Meta-

lens Temperature Detector (DMTD), which uses dispersive meta-lens to achieve miniaturized, high-precision temperature measurements with a reduced error ($<0.32\%$), compared to state-of-the-art multi-spectral light-field thermometry (MSLF, $<2\%$).

09:45 : Tunable Impedance Matching Layer Based On Piezoelectric Materials With External Circuits
Han Jia, Yuzhen Yang

Chinese Academy of Sciences (China)

A tunable impedance matching layer is designed and fabricated. It is composed of periodical piezoelectric disks with shunting capacitors. An external digital control system is introduced to adjust the effective acoustic impedance of the PZT disks through digital potentiometers and microprogrammed control unit, enabling digital manipulation of wave transmission.

10:00 : Quantum Two-photon Density-matrix Holography With Metasurfaces

Qinmiao Chen¹, Guangzhou Geng², Hong Liang¹, Tailin An¹, Wai Chun Wong¹, Junjie Li², Jensen Li¹

¹The Hong Kong University of Science and Technology (China), ²Chinese Academy of Sciences (China)

We demonstrate quantum density-matrix holography by leveraging the interaction between a metasurface and entangled photon pairs. The entanglement property of this quantum hologram is further examined using quantum hologram tomography. By projecting onto different polarization-Bell states, we reveal distinct, tailor-made holographic patterns at the level of the photon density matrix.

8:30 - 10:30 — Manantiales

Session 4A8

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Oleksandr Pylypovskyi

08:30 : Invited talk

Lasing Emission From Guided Mode-Assisted Quasi-Bound States In The Continuum In All-Dielectric Metasurfaces

Ayesheh Bashiri, Aleksandr Vaskin, Muyi Yang, Katsuya Tanaka, Marijn Rikers, Thomas Pertsch, Isabelle Staude

Friedrich Schiller University Jena (Germany)

We demonstrated lasing action in quasi-BIC all-dielectric metasurfaces integrated with a slab waveguide containing laser dyes. Our system offers both single and multimode lasing emission directed toward true zeroth-order and oblique angles with the ability for passive tunability of the emission wavelength within the spectral range of the gain medium.

08:50 : Invited talk

From Exceptional Point To Bound States In The Continuum And From Lasing To Coherent Perfect Absorption, Or There And Back Again Using Non-hermitian Metasurfaces

Yaoyao Liang¹, Yara El Droubi¹, Liubov Ivzhenko², Maciej Krawczyk², Andriy Serebryannikov², Anatole Lupu¹

¹Université Paris-Saclay (France), ²Adam Mickiewicz University (Poland)

The objective is to provide guidelines for the engineering of Fano resonances and metasurfaces composed of coupled antenna-like resonators, possibly integrating gain and loss. The large number of degrees of freedom of these systems allows for great design versatility, allowing to tailor on demand spectral properties.

09:10 : Invited talk

Imaging Method Of The Photodegradation Mechanism At The Nanoscale Over A Gold Metasurface

Marlo Vega, Paul-Ludovic Karsenti, Paul G. Charette, Julien Moreau, Michael Canva, Jean-François Bryche

Université de Sherbrooke (Canada)

This study explores the photothermal heating of asymmetric gold nano-crosses using ultrashort light pulses. We demonstrate the control at the nanoscale of thermal energy via polarization and then introduce a new method for nanoscale surface chemistry imaging that relies on photothermal degradation.

09:30 : Invited talk

Higher-Order Mie Resonant Metasurfaces For Ultrafast All-Optical Light Manipulation

Claudio Hail, Lior Michaeli, Harry Atwater

University of California Berkeley (USA)

We report on high-Q dielectric optical metasurfaces for ultrafast spatiotemporal light manipulation leveraging the optical Kerr effect and free-carrier effects from two-photon absorption.

09:50 : Invited talk

Strong Coupling of Surface Plasmons and Excitons in a Semiconductor Organic Material

Zouheir Sekkat

Mohammed VI Polytechnic (Morocco)

We report on strong coupling between surface plasmons and excitons in an optically nonmetallic excitonic dye-polymer material of different thicknesses. We carried experiments of angular scans of reflectivity from silver and dye-polymer layers in a Kretschmann-Raether configuration, and we obtained the dispersive dielectric constant of the dye solutions for different dye concentrations using Lorentz model.

10:10 : Invited talk

Fabrication Of Polymer Structures In The Sub-micron Range As Potential Landscapes For Photon Bose-einstein Condensates Via Direct Laser Writing

Sven Enns¹, Julian Schulz¹, Kirankumar Karkihalli Umesh², Frank Vewinger², Georg von Freymann¹

¹RPTU Kaiserslautern-Landau (Germany), ²University of Bonn (Germany)

Using the technology of Direct Laser Writing, we fabricate sub-micron polymer structures on top of a cavity mirror, serving as potential landscapes to experimentally investigate the properties of photon gases, such as the 2D to 1D crossover of a photon Bose-Einstein condensate or topological edge states in a SSH-chain.

8:30 - 09:10 — Veselago

Session 4A9

Bottom-up approaches, new fabrication routes and ENSEMBLE3

Organized by: Dorota Pawlak and Virginie Ponsinet

Chaired by: Dorota Pawlak

08:30 : Invited talk

Deterministic Bottom-up Fabrication Of Plasmonic Nanostructures On Tapered Optical Nanofibers Via Blurred Electron Beam Deposition

Antonio Balena¹, Marianna D'Amato¹, Muhammad Fayyaz Kashif², Chengjie Ding¹, Massimo De Vittorio², Ferruccio Pisanello², Alberto Bramati¹

¹Sorbonne Université (France), ²Istituto Italiano di Tecnologia (Italy)

We present a bottom-up method for fabricating plasmonic nanostructures on tapered optical nanofibers using Blurred Electron Beam Induced Deposition. The technique enables sub-20 nm precision, and the nanostructures show polarization-sensitive scattering, and directional emission, offering a versatile platform for on-fiber plasmonics with applications in sensing, light routing, and quantum photonics.

08:50 : Invited talk

Bottom-up Wet-chemical Synthesis Of Nanometals Assisted By Ultrafast Irradiation

Andrés Guerrero-Martínez

Universidad Complutense de Madrid (Spain)

Metal nanoparticles' unique optical properties have driven research into their synthesis for nanoplasmonic devices. Ultrafast pulse lasers enable precise control of electron dynamics, leading to uniform nanoparticle production and controlled assembly. This advances applications in photonics, sensing, and catalysis by enhancing optical functionality and structural precision.

09:10 - 10:30 — Veselago

Session 4A10

Quantum metaphotonics

Organized by: Fei Ding and Sergey I. Bozhevolnyi

Chaired by: Sören im Sande

09:10 : Invited talk

Broadband And Bright Photon Pairs From Periodically Poled Triple-resonance Metasurface

Jihua Zhang¹, Chaoxin Shi¹, Jinyong Ma², Frank Setzpfandt³, Thomas Pertsch³, Chunxiong Bao⁴, Jianjun Zhang¹, Andrey Sukhorukov²

¹Songshan Lake Materials Laboratory (China), ²The Australian National University (Australia), ³Friedrich Schiller University Jena (Germany), ⁴Nanjing University (China)

We propose a periodically poled triple-resonance metasurface capable of generating photon pairs with high brightness and broad bandwidth in both frequency and momentum.

09:30 : Invited talk

Highly Directional Photon-emitter Interactions In Slow-light Waveguides

Hamidreza Siampour

Queen's University Belfast (United Kingdom)

In this talk, I will present our work on remote excitation of a single quantum emitter in a slow-light waveguide. Exploiting waveguide chirality, we achieve both directional absorption and emission, resulting in 90 % directional contrast and a β -factor of $\sim 97\%$. This approach advances waveguide quantum optics for spin-based quantum technologies.

09:50 : Invited talk

Quantum metasurfaces of quantum emitters arrays

Uri Israeli, Ada Krasnosky, Itai David, Shahar Levi, Rivka Bekenstein

Hebrew University of Jerusalem (Israel)

We implement quantum metasurfaces by deterministically preparing atomic-like arrays in subwavelength spacing. These devices are promising tools for cavity-free quantum optics and the generation of large-scale atom-photon entanglement.

10:10 : Invited talk

Shaping the emission directivity of single quantum dots in dielectric nanodisks exploiting Mie resonances

A. Genco¹, C. Cruciano¹, D. Rocco², A. Tognazzi³, A. Locatelli², L. Carletti², A. Fedorov¹, C. Trovatiello¹, G. Di Blasio¹, I. Bargigia¹, C. Louca¹, P. Gubian², G. Tavani², L. Lovisolo⁴, A. Tuktamyshev⁵, L. C. Andreani⁶, M. Galli⁶, G. Cerullo¹, G. Leo⁴, S. Sanguinetti⁵, C. De Angelis², M. Bollani⁷

¹Politecnico di Milano (Italy), ²University of Brescia (Italy), ³University of Palermo (Italy), ⁴Université Paris Cité - CNRS (France), ⁵University of Milano (Italy), ⁶University of Pavia (Italy), ⁷Institute of photonics and of nanotechnologies (IFN-CNR) (Italy)

Manipulating the optical landscape of single quantum dots (QDs) is essential to increase the emitted photons output. In this work, we exploit the Kerker condition for precise control of single GaAs QDs emission directivity when embedded in AlGaAs nanocylinders, as proved by angle-resolved PL micro-spectroscopy experiments and confirmed by theory.

8:30 - 10:10 — Maxwell

Session 4A11

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Cesare Soci

08:30 : **Invited talk****Room-Temperature Exciton-Polariton Condensation In Prism-Shaped Gan Microcavity Structures****Yong-Hoon Cho***KAIST (Korea)*

We fabricated GaN-based hexagonal and triangular microcavity structures by using selective area growth. We formed room-temperature exciton-polariton condensation with whispering gallery mode and superscar mode in the hexagonal and triangular microcavities, respectively. Angle-resolved micro-photoluminescence experiments with varying excitation power were conducted to investigate the processes of polariton formation and condensation.

08:50 : **Invited talk****Optical Properties Of Nanoporous Gold And Their Change Upon Electrochemical Oxidation****Maurice Pfeiffer, Xinyan Wu, Manfred Eich, Alexander Petrov***Hamburg University of Technology (Germany)*

Nanoporous gold shows a strong change of color upon electrochemical oxidation. This can result from a reduced volume of plasmonic gold, dielectric coating on the gold surface or an increase of electron collision frequency. Using brute-force simulations we identify the contribution of these effects.

09:10 : **Invited talk****Controlled Synthesis Of Silver-coated Gold Nanostars For Tunable Optical Properties****Nicolas Pazos Perez***Universitat Rovira i Virgili (Spain)*

This study explores the controlled epitaxial deposition of Ag onto Au nanostars, enhancing their SERS properties while maintaining their branched morphology. The silver coating enables plasmon resonance tuning and boosts SERS brightness by an order of magnitude. These findings present silver-coated NSTs as promising substrates for advanced plasmonic sensing applications.

09:30 : **Invited talk****Natural Hyperbolic Van Der Waals Materials Towards Low-loss Near Unity Linear Dichroism****Nicola Melchioni, Andrea Mancini, Lin Nan, Anastasiia Efimova, Giacomo Venturi, Antonio Ambrosio***Istituto Italiano di Tecnologia (Italy)*

In-plane hyperbolic crystals, enable nearly perfect linear dichroism by exhibiting metallic behavior in one direction and dielectric in the orthogonal. MoOCl₂ achieves strong polarization control with low loss, making it promising for miniaturized photonic devices, including direct integration into optical fibers.

09:50 : **Invited talk****Exfoliation Of Millimeter-sized Flakes Of 2d Transition Metal Dichalcogenides On Arbitrary Substrates****Ermes Peci¹, Riccardo Galafassi², Valentina Venturino¹, Emma Spotorno¹, Francesca Telesio¹, Michele Magnozzi¹, Maurizio Canepa¹, Francesco Bisio²**¹ *Università di Genova (Italy)*, ² *CNR-SPIN (Italy)*

Gold-assisted exfoliation techniques yield large-area monolayers of 2D materials on gold films, but transferring them to final substrates remains challenging. This innovative approach enables the effortless exfoliation of millimeter-sized 2D materials onto arbitrary substrates, providing an efficient and refined solution for large-area transition metal dichalcogenide exfoliation.

8:30 - 10:30 — Fresnel

Session 4A12

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Tomohiro Amemiya

08:30 : **Invited talk****Fabrication Of Plasmonic Transition Metal Nitride Thin Films And Nano-arrays****Ryan Bower¹, Ethan Muir², Gwilherm Kerherve¹, Bruno Rente¹, Arutiun Ehasarian², Peter Petrov¹**¹Imperial College London (United Kingdom), ²Sheffield Hallam University (United Kingdom)

Transition metal nitrides (TMNs), have emerged as promising alternative plasmonic materials, displaying spectral tunability, thermal stability and mechanical stability. This work reports the CMOS compatible deposition of plasmonic TMN films at low temperature. We also describe dry etching methods for the scalable production of TMN metamaterial nano-arrays.

08:50 : **Invited talk****Detection Of Ammonia In Water Using Self-assembled Plasmonic Colorimetric Sensor****M. Soudi, P. Cencillo-Abad, S. Ghimire, Debashis Chanda, Kausik Mukhopadhyay***University of Central Florida (USA)*

Monitoring chemicals, such as elevated ammonia levels, is crucial for safeguarding public health and the environment. Elevated ammonia indicates contamination from agriculture, industry, or sewage. We have developed a plasmonic sensor to detect ammonia by correlating changes in optical response to analyte concentration, developing a portable, high-resolution, and affordable solution.

09:10 : **Invited talk****Harnessing Plasmonic Nanostructures For Selective Light-driven Co2 Reduction****Anjalie Edirisooriya¹, Zelio Fusco Beck¹, Ning Lyu¹, Christin David², Fiona Beck¹**¹Australian National University (Australia), ²University of Applied Sciences Landshut (Germany)

Plasmonic nanostructures offer a strategy for selective CO₂ reduction, addressing challenges in conventional catalysis. By enhancing plasmonic effects with dendritic morphologies, we drive efficient C-C coupling under light excitation. This talk explores our integrated approach using simulations, spectroscopy, and nanoscale modeling to advance scalable, energy-efficient CO₂ conversion.

09:30 : **Invited talk****BICs and Quasi-BICs in Unpatterned Media****Rodrigo Berte¹, T. Possmayer¹, A. Tittl¹, L. de S. Menezes¹, S. A. Maier²**¹Ludwig-Maximilians-Universität (Germany), ²Imperial College London (United Kingdom)

In this talk we discuss an addition to this toolkit, where permittivity symmetry breaking via optical means is used for the excitation of photonic BICs in an unpatterned medium. Tailored ultrafast resonances and spectrally-selective third harmonic generation are demonstrated in an amorphous Si thin film.

09:50 : **Invited talk****Flat Band Finetuning and its Photonic Applications****Sergej Flach***Institute for Basic Science (Korea)*

In this talk we consider the recently proposed systematic ways to construct flat band networks based on symmetries or fine-tuning. We then discuss how the construction methods can be further extended, adapted or exploited in presence of perturbations, both single-particle and many-body.

10:10 : **Invited talk****Bulk Embedded Laue type Photonic Crystals****D. Gailevicius, E. Aleksandravicius, G. Tamošauskas, G. Kontenis, A. Dubietis, K. Staliūnas***Vilnius University (Lithuania)*

Traditionally, photonic crystals are associated with the Bragg condition requiring subwavelength periods. However, over the recent years we developed direct laser written long period photonic crystals based on the Laue diffraction condition, as spatial filters. Development of such bulk structures evolving into spatial dispersion shaping for nonlinearity control.

8:30 - 10:30 — Bragg

Session 4A13

Nanolasers : prospects and challenges

Organized by: Alessandro Veltri and Ashod Aradian

Chaired by: Ashod Aradian

08:30 : **Invited talk**

Plasmonic slot waveguides: a quantum leap in nonlinear nanophotonics

L. Rojas Yanez, H. Hu, C. Ciraci, J. A. Scott, L. Sortino, M. Toth, P. G. Zotev, A. I. Tartakovski, Stefano Palomba

The University of Sydney (Australia)

In this work, we theoretically show that integrating epsilon-near-zero materials within metal-dielectric-metal slot waveguides would boost the nonlinear conversion efficiency, exhibiting unprecedented nonlinear optical conversion efficiency in an ultra-compact device. Furthermore, we have developed a novel nanofabrication process flow to fabricate these slot waveguides with high aspect ratio, sub-nm gaps.

08:50 : **Laser Cooling Of Hybrid Nanoparticles**

Onofrio Marago¹, Alessandro Veltri², Melissa Infusino¹, Rosalba Saija³, Maria Antonia Iati¹

¹*Istituto per i Processi Chimico-Fisici (CNR-IPCF) (Italy)*, ²*Universidad San Francisco de Quito (Italy)*, ³*University of Messina (Italy)*

After an introduction to optical forces at the nanoscale, we discuss some ideas on laser cooling of hybrid nanostructures, where localized surface plasmons are coupled to excitons, and of gain-assisted nanoparticles, where the strong coupling between plasmons and excitons controls their optomechanical behavior.

09:05 : **Round Table: Nanolasers: prospects and challenges**

Ashod Aradian

University of Bordeaux (France)

This roundtable is open to everybody, whether they attended or not the "nanolaser"SP17 session. This will be a time to discuss and exchange views informally around the following themes, as well as others: (i) challenges and prospects in the field of nanolasers, (ii) state of the theory versus the state of experiments, (iii) nanolasers versus classical lasers, (iv) what are the obstacles towards the commercialization of nanolaser-based devices? All colleagues are more than welcome to participate.

Coffee Break

Session 4P1

Poster session VII

10:30 - 11:00

P1: Broadband Anti-reflectance By Disordered Si Nanodisks For Thin-film Solar Cells

Hanna Kylhammar, Sarah Zayouna, Ada Dumitrescu, Mikko Kjellberg, Srinivasan Anand

KTH Royal Institute of Technology (Sweden)

We design and fabricate spatially disordered Si nanodisks by colloidal lithography for broadband antireflection and light trapping. Absorption is optimized for thin-film solar cells through control of the geometrical features,

dimensions, and density of the nanodisks. For comparison, periodic arrangements with unit cells containing more than one disk are investigated.

P2: Study of the Scattering of Elastic Surface Waves by Nano-Resonators

S. C. Baltogiannis, Olga Boyko, B. Tallon

Institut des Nanosciences de Paris (INSP) (France)

Investigation of the interaction between elastic surface waves and nano-cylinder scatterers to identify resonant regimes and thereby extract crucial transport parameters in multiple scattering experiments aimed at exploring two-dimensional sub-diffusive Anderson localization. Using a Ti:Sapphire pump-probe setup we recorded spatial maps of the displacement.

P3: Deep Learning and Nano-Optics: Designing nanoscale polariton propagations in twisted van der Waals multilayers

Lucía F. Alvarez-Tomillo¹, José Álvarez-Cuervo², Pablo Calvo-Barlés³, Sergio Gutierrez Rodrigo⁴, Enrique Terán García², Aitana Taragaza Martín-Luengo², Kirill Voronin⁵, Alexey Y. Nikitin⁵, Luis Martín Moreno³, Pablo Alonso-González²

¹Universidad de Oviedo (Spain), ²University of Oviedo (Spain), ³Universidad de Zaragoza (Spain), ⁴CSIC-Universidad de Zaragoza (Spain), ⁵Donostia International Physics Center (DIPC) (Spain)

We demonstrate the design of nanoscale phonon polariton propagations by combining artificial intelligence and nanophotonics. Using neural networks and twisted α -MoO₃ multilayers, we achieve desired polariton propagations such as canalization and bi-canalization in unexplored frequency ranges, showcasing a powerful method for on-demand control of light at the nanoscale.

P4: Flat Optics For Hybrid Grafted Vortex Beams And Azimuthally Tailored Multispectral Oam Combs

Hammad Ahmed, Xianzhong Chen

Heriot-Watt University (United Kingdom)

We demonstrate a compact flat-optics (metasurface) platform for generating and dynamically controlling hybrid grafted vortex beams and azimuthally tailored multispectral OAM combs. By superposing multiple helical phase profiles, beams with precisely customized topological charges and multispectral OAM spectra are achieved, offering new avenues for optical encryption, communications, and particle manipulation.

P5: Optical "writing" of Stable Single-atom Features In Plasmonic Nanogaps

Paul Kerner¹, Rakesh Arul¹, Damien Thompson², Jeremy Baumberg¹, Bart de Nijs¹

¹University of Cambridge (United Kingdom), ²University of Limerick (Ireland)

We demonstrate all-optical creation and low-power readout of stable single-atom features in plasmonic nanogaps. These deterministically "written" picocavities exhibit week-long ambient stability in darkness, enabling applications in single-atom devices and catalysis.

P6: Large Purcell Enhancement With High-Quality Factor In Dielectric Nanoantenna-Microtoroid Structure

Zihan Mo, Yali Jia, Xinchun Zhang, Yu Tian, Ying Gu

Peking University (China)

By combining the advantages of the high-quality factor of microtoroids and the ultra-small mode volume of a nanoantenna, we theoretically achieve large Purcell enhancement with narrow linewidth in dielectric nanoantenna-microtoroid structure.

P7: Cascade Enhancement Of Magnetic Purcell Effect And Efficient Collection Of Photons In Hybrid Topological Structure

Zihan Mo, Yali Jia, Zhaohua Tian, Qi Liu, Zhengyang Mou, Yu Tian, Qihuang Gong, Ying Gu

Peking University (China)

We theoretically demonstrate that both cascade enhancement and high collection efficiency of emitted photons from a single emitter can be achieved simultaneously in a topological photonic crystal containing a resonant dielectric nanodisk.

P8: Superscatterers For Tailoring Electromagnetic Interactions: Radar Visibility And Scattering Suppression

Pavel Ginzburg

Tel Aviv University (Israel)

Experimental demonstration of superscattering is among the long-standing challenges in electromagnetic theory. We will present several strategies to design superscatterers with the aid of generic optimization and demonstrate their state-of-the-art performances experimentally. A solution to an emerging problem of small UAV tracking and monitoring with radar-visible superscatterers will be demonstrated.

P9: Spectrum And Polarization-Resolved Nonlinear Optical Near-Field Imaging Of Plasmonic Nano-Antennas

Yaxin Liu, Jiajun Wang, Lei Shi, Zhensheng Tao

Fudan University (China)

Plasmonic nano-antennas concentrate light into tiny volumes, but high-resolution near-field imaging remains challenging. We introduce a nonlinear microscopy technique using four-wave mixing to achieve spectrum- and polarization-resolved imaging. With mid-infrared pump and near-infrared probe, we reveal plasmon-enhanced near-field intensity, polarization patterns, and spectral shifts, advancing nano optics research.

P10: Inherent Spin-Orbit Locking In Topological Bound State In The Continuum Lasing

Jiajun Wang¹, Xinhao Wang¹, Lei Shi¹, Yuri Kivshar², Jian Zi¹

¹*Fudan University (China)*, ²*The Australian National University (Australia)*

Bound states in the continuum (BICs) are exotic optical states, enabling lasing with hidden topological properties in momentum space. We theoretically and experimentally demonstrate the inherent spin-orbit locking in topological BIC lasing, opening new possibilities for topological photonic sources.

P11: Au Core/Nanoporous Shell SERS Nanoprobe For Ultrasensitive Detection Of Small Pesticide Molecule

Ryeong Myeong Kim, Afsana Mimi, Eun-Ah You

Korea Research Institute of Standards and Science (Korea)

We developed a nanoporous gold core-shell SERS nanoprobe enabling sensitive thiram detection down to 10^{-8} ~M. Incorporating TFMBA as an internal standard allows simultaneous evaluation of nanoparticle quality and concentration. This versatile platform offers potential for environmental monitoring, food safety, and biomedical diagnostics.

P12: Dual-Functional Metalenses For The Generation Of 2d And 3d Structured Beams

Andrea Vogliardi, Gianluca Ruffato, Daniele Bonaldo, Simone Dal Zilio, Filippo Romanato

University of Padova (Italy)

We report on spin-decoupled metasurfaces for compact generation of vector beams with non-separable polarization and spatial profiles, enabling three-dimensional light shaping along customizable spirals for applications in optical manipulation and quantum photonics.

P13: Fabrication Of Optical Phase Elements In Bulk Sapphire By Ultrashort Pulses

Edvinas Aleksandravičius, Gabrielius Kontenis, Indrė Meskelaite, Darius Gailevičius

Vilnius University (Lithuania)

Sapphire possesses many desirable properties for use in photonics, however there are many challenges when it comes to fabricating optical phase elements in it. We show that the use of ultrashort pulses <100 fs can alleviate many of these issues, particularly the formation of cracks in larger structures.

P14: Design Of A Metasurface Deflector Integrated With A Grating Coupler To Collimate A gaussian Beam From An Optical Fiber For Vertical Coupling

Suhee Shin, Jaewon Jang, Minsu Park, Yeonsang Park

Chungnam National University (Korea)

The light from an optical fiber has a very high divergence angle. We propose a metasurface that collimates the Gaussian beam and at the same time deflects it into a grating coupler. This enables the vertical coupling of the optical fiber and enhances the coupling efficiency.

P15: Singular Flat Band In Metallic Kagomé Lattice

Dongho Lee¹, Hyeon Gi Park², Donghak Oh¹, Yung Kim¹, Soojeong Baek¹, Bumki Min¹

¹*KAIST (Korea)*, ²*University of Ulsan (Korea)*

Our study focuses on reconstructing the singular flat band structure of a THz metallic Kagomé lattice, analyzing transmission spectra and eigenstates, and confirming a singularity through quantum distance calculations.

P16: Theoretical Comparison Of Longitudinal And Transverse Interactions Between Plasmon And Electron-Hole Pairs In Ag Thin Film

Soshun Inoue¹, Takeshi Inaoka², Hajime Ishihara¹

¹Osaka University (Japan), ²University of the Ryukyus (Japan)

Plasmon excitations in metals generate hot carriers, crucial for photoelectric conversion. While conventional theories attribute carrier generation to Landau damping, recent experiments reveal an unexplained IQE peak. Our theory shows that the radiative coupling produces resonant effects near the light energy, offering a compelling explanation for the observed IQE enhancement.

P17: Complete Asymmetric Polarization Conversion Through Zero-eigenvalued Exceptional Points Of Non-Hermitian Metasurfaces

Donghak Oh¹, Soojeong Baek¹, Sangha Lee¹, Kyungmin Lee¹, Jagang Park², Zhaowei Liu¹, Teun-Teun Kim³, Bumki Min¹

¹KAIST (Korea), ²University of California (USA), ³University of Ulsan (Korea)

We propose a non-Hermitian metasurface that achieves complete asymmetric polarization conversion at an exceptional point with a zero eigenvalue by introducing gain. Numerical verification confirms this design, which converts right to left circular polarization, blocks the opposite conversion, and eliminates co-polarized transmission.

P18: Spectrally Tailored Surface-Enhanced Raman Spectroscopy (sers) With Polarization-Sensitive Metasurface

Julia Lövgren, Angelos Xomalis

Norwegian University of Science and Technology (Norway)

While SERS is a powerful sensing technique with single-molecule resolution, plasmonic SERS antenna arrays lack precise spectral control. Here, we present a metasurface with polarization-dependent optical resonances designed to overlap with individual vibrational modes of a molecule. Spectrally tailored SERS has applications in biosensing, molecular optomechanics and plasmon-based nano-optics.

P19: Synthesis And Characterization Of Dielectric Metamaterials Based On Bltf Ceramics

Beata Wodecka-Dus, Malgorzata Adamczyk-Habrajska, Jolanta Makowska

University of Silesia (Poland)

Dielectric BLTF metamaterials with a perovskite structure were obtained using solid-state synthesis. Analysis of the microstructure, crystal structure, and electrical properties confirmed their high dielectric permittivity and low dielectric losses. Increasing Fe³⁺ doping significantly enhances the piezoelectric properties, indicating their potential for modern technological applications.

P20: Fabrication And Study Of Nd-doped Bct-based Dielectric Ceramics For Functional Metamaterial Applications

Jolanta Makowska, Kamil Feliksik, Malgorzata Adamczyk-Habrajska, Beata Wodecka-Dus

University of Silesia (Poland)

Nd-doped Ba_{0.75}Ca_{0.25}TiO₃ ceramics were synthesized using the solid-state method to improve dielectric properties. Due to their low losses and thermal stability, these materials show strong potential for applications in functional metamaterials.

P21: TMDCs' Monolayer PL Enhancement Using h-BN and SiO₂ Gratings

Mahan Bakhshikhah¹, C. Palekar², Y. Yang², M. Podhorský², B. Sankar Sahoo², S. Machchhar², I. Limame², M. Ries², M. Hrton¹, J. Liška¹, T. Šikola¹, S. Reitzenstein²

¹Brno University of Technology (Czech Republic), ²Technical University Berlin (Germany)

Light-matter interactions in transition-metal dichalcogenides (TMDCs) for optoelectronic applications enable advanced nanophotonics functionalities. This work demonstrates photoluminescence enhancement in TMDCs monolayer on patterned SiO₂ and h-BN using an optical microcavity approach. The method enables efficient light confinement to optimize light-matter interactions in two-dimensional materials at room temperature.

P22: Electrical Control Of Light Emission Process Of Two-Dimensional Materials On The Nanoscale
Elysé Laurent¹, Elizabeth Boer-Duchemin¹, Séverine Le Moal¹, Guillaume Schull², Stéphane Berciaud², Eric Le Moal¹

¹*Institute of Molecular Sciences of Orsay (ISMO) (France)*, ²*Institute of Materials Physics and Chemistry of Strasbourg (IPCMS) (France)*

A scanning tunneling microscope (STM) is used to tailor the excitonic properties of transition metal dichalcogenides (TMD). We demonstrated STM-induced generation of neutral and charged excitons in TMD monolayers and achieved full control of the TMD photoluminescence quantum yield at a submicrometer scale.

P23: Frozen Plasmons On Uniformly Moving Surface**Stephane Azar, Francisco J. Rodríguez-Fortuño**

King's College London (United Kingdom)

We revisited the problem of a dielectric medium moving uniformly along its surface, focusing on the dispersion relation of its surface modes. We discovered a mode with no group velocity, a frozen mode. Moreover, the surface motion induces a lateral force on a nearby source, maximised by frozen modes.

P24: Mid-infrared Spectroscopy Enhanced By Means Of Surface Electromagnetic States On One-dimensional Photonic Crystals**Agostino Occhicone¹, Marialilia Pea², Raffaella Polito², Valeria Giliberti³, Alberto Sinibaldi¹, Francesco Mattioli², Sara Cibella², Andrea Notargiacomo², Alessandro Nucara¹, Michele Ortolani¹, Leonetta Baldassarre¹, Francesco Michelotti¹**

¹*Sapienza University (Italy)*, ²*CNR-IFN (Italy)*, ³*Istituto Italiano di Tecnologia (Italy)*

In this study, we exploit surface electromagnetic localized states in one-dimensional periodic dielectric structures (photonic crystals, 1DPCs) to develop an advanced spectroscopic technique in the Mid-IR range. This approach introduces new degrees of freedom for molecular sensing, offering innovative solutions to critical challenges in chemical detection and materials science.

P25: Linear Logic Operations In A Quasi-Digital System**Ross Glyn Macdonald, Alex Yakovlev, Victor Pacheco-Peña**

Newcastle University (United Kingdom)

Electromagnetic (EM) wave-based quasi-digital logic operations are realized by carefully controlling the superposition of incident signals in a network of waveguides. Information is encoded into the wave characteristics of the incident signals (amplitude, phase or both). The encoding scheme is carefully selected to maximize the distinguishability of the operations.

P26: Photonic Routing In A Multiple-input Valley Photonic Crystal Junction**Christian Johnson-Richards, Ross Glyn MacDonald, Alex Yakovlev, Victor Pacheco-Peña**

Newcastle University (United Kingdom)

Topological waveguides have demonstrated their potential to enable the design of photonic circuits without scattering from defects such as sharp bends. In this work the routing of information using multiple inputs at a 6-port topological valley junction is investigated by calculating the scattering that defines the proposed structure.

P27: Calculating Analogue Solutions To Pdes With Waves**Ross Glyn Macdonald, Alex Yakovlev, Victor Pacheco-Peña**

Newcastle University (United Kingdom)

An electromagnetic (EM) wave-based method of computing approximate analogue solutions to the Helmholtz equation is presented. This is done by exploiting a grid-like network of metatronic circuits at microwave frequencies. The behavior of the network is analogous to a numerical finite difference grid.

P28: Synthesis of silver and gold nanoparticles with tunable plasmonic properties for light-assisted anticancer therapy**Aleš Panáček, Lucie Válková, Lucie Hochvaldová, Anastassiya Pedan, Hana Kolářová, Libor Kvítek**

Palacký University (Czech Republic)

Noble metal NPs with tunable plasmonic properties were synthesized using two step reduction process and applied for in vitro anticancer photothermal efficacy. The highest photothermal anticancer effect with cell viability decreasing under 20 % was induced using AuNPs irradiated by 660 nm laser at irradiation energy of

20 J.

11:00 - 12:00 — Torremolinos**Session 4A14****Symposium II: New Trends in Nanophotonics and Advanced Materials**

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Kestutis Staliunas

11:00 : Invited talk**Ultrafast Plasmonic Hot Carriers: From Light Generation To Pulsed Photocatalysis****Andrea Schirato¹, Yang Luo², Shaoxiang Sheng², Giulio Cerullo¹, Alessandro Alabastri³, Manish Garg², Peter Nordlander³, Giuseppe Della Valle¹**¹Politecnico di Milano (Italy), ²Max Planck Institute for Solid State Research (Germany), ³Rice University (USA)

Photoexcited plasmonic hot carriers unlock opportunities in applications ranging from nonlinear optics to photocatalysis. Here, we combine simulations and experiments to track these nonequilibrium carriers with spatial (sub-nm), temporal (few fs), and energy (meV) resolution, and then discuss an example of photocatalytic reaction leveraging hot carriers under ultrafast pulse illumination.

11:20 : Invited talk**Chiral Photoacoustic Spectroscopy On Plasmonic Materials****Claudia Skubisz¹, Emilija Petronijevic¹, Grigore Leahu¹, Teemu Hakkarainen², Eero Koivusalo², Mircea Guina², Roberto Li Voti¹, Concita Sibilis¹, Alessandro Belardini¹**¹Università di Roma 'La Sapienza' (Italy), ²Tampere University of Technology (Finland)

The Photoacoustic spectroscopy is a technique that allow to study the local absorption of the sample. The new set-up allows for spatial and spectral mapping of absorption enabling the study of extrinsic chirality in nanostructured metasurfaces and the homogeneity of the nanostructures.

11:40 : Invited talk**Development of three-dimensional bulk metamaterials suppliable as meta-atomic grains****Yoshiaki Kanamori***Tohoku University (Japan)*

With the aim of realizing terahertz optical elements that can be formed into any shapes and have arbitrary refractive indices, our group has succeeded in developing a technology to manufacture grains containing meta-atoms and in putting them into a mold to produce three-dimensional bulk metamaterials.

11:00 - 12:35 — Alamos**Session 4A15****Ultrafast Light-Matter Interaction in Photocatalytic Systems**

Organized by: Aswathi K. Sivan and Alejandro Galan Gonzalez

Chaired by: Aswathi K. Sivan

11:00 : Invited talk**X-ray Techniques For Probing And Inducing Ultrafast Dynamics At Nanoscale****Naman Agarwal**

Elettra Sincrotrone Trieste (Italy)

I will overview X-ray techniques for probing ultrafast nanoscale dynamics, with a focus on Coherent Diffraction Imaging (CDI) and X-ray Transient Grating Spectroscopy (XTG). I will present recent results on imaging ultrafast phase transition in VO₂ using CDI and discuss the application of XTG to induce and probe nanoscale dynamics.

11:20 : Invited talk

Sensitizing Diamond To Visible Light To Increase Electron Emission Under Solar Radiation

Patrick O’Keeffe, Giuseppe Ammirati, Bellucci Alessandro, Daniele Catone, Faustino Martelli, Matteo Mastellone, Silvia Orlanducci, Alessandra Paladini, Riccardo Polini, Raffaella Salerno, Francesco Toschi, Daniele M. Trucchi, Stefano Trucchi, Veronica Valentini

National Research Council (Italy)

We exploit the negative electron affinity of the surface of hydrogenated diamond combined with the efficient absorption of visible light by plasmonic nanoparticles to emit electrons using solar light. In this way, we simultaneously increase the photoconductivity of the diamond and enhance photoemission of electrons from the surface.

11:40 : Invited talk

Time-Resolved Raman Spectroscopy In Photoexcited Mos2: Transient Doping, Resonance Effects And Electron-phonon Coupling

Claudia Fasolato¹, A. M. Finardi², M. Capeccia¹, A. Giugni², R. Cucini³, E. Cappelluti⁴, G. Panaccione³, F. Sacchetti³, P. Postorino¹, C. Petrillo⁵, G. Ross¹

¹Sapienza University (Italy), ²Università di Milano (Italy), ³Istituto Officina dei Materiali (IOM)-CNR (Italy),

⁴Istituto di Struttura della Materia (ISM)-CNR (Italy), ⁵Università di Perugia (Italy)

I will present a time-resolved Raman spectroscopy (TRRS) study on the layered semiconductor MoS₂, under resonant optical pumping with the excitonic gap at Brillouin zone K point. TRRS allows mapping the redistribution of energy among the system degrees of freedom, from the photoexcited electronic subsystem to specific zone-center phonon modes.

12:00 : Invited talk

Ultrafast Chiral Spectroscopy For Stereocontrolled Photochemistry

Malte Oppermann

University of Basel (Switzerland)

We present an ultrafast circular dichroism technique to capture the dynamics of chiral excited states in solution. By combining sub-picosecond time resolution with high chiral sensitivity, we resolve the stereochemical evolution of photoexcited molecules, such as a chiral Fe(II) spin-crossover complex and a chiral lanthanide complex with circularly polarized luminescence.

12:20 : Elucidating Charge Transfer Processes In Plasmonic And Semiconductor Photocatalysts

Giulia Tagliabue

EPFL (Switzerland)

The combination of optical nanoantennas and scanning photoelectrochemical microscopy opens new door for the in-situ investigation of non-equilibrium charge transfer processes.

11:00 - 12:20 — Playamar

Session 4A16

Symposium IV: Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures

Organized by: Eugene Kamenetskii

Chaired by: Oleksandr Pylypovskyi

11:00 : Invited talk**Optical Response Of Periodic Arrays Of Graphene Nanostructures Under Static Magnetic Fields**

Juan R. Deop-Ruano¹, Mikkel H. Eriksen², Juan J. Alvarez-Serrano¹, Alejandro Manjavacas¹, Joel D. Cox³

¹Instituto de Quimica-Fisica (IQF-CSIC) (Spain), ²POLIMA-Center for Polariton-driven Light-Matter Interactions (Denmark), ³University of Southern Denmark (Denmark)

We study the optical properties of periodic arrays of graphene nanostructures under static magnetic fields. We demonstrate the magnetic-field-controlled activation and deactivation of collective modes, offering new possibilities for tunable graphene-based photonic devices. Furthermore, our findings reveal magneto-optic phenomena such as chiral response and Faraday rotation.

11:20 : Invited talk**Unified Dipolar Interactions in Bispinor Formalism and the Energy Symmetry Sphere**

Sebastian Golt, Alex J. Vernon, Francisco J. Rodriguez Fortuno

King's College London (United Kingdom)

We present a unified bispinor framework that simplifies dipolar interaction expressions. Our approach leads to the concept of an energy symmetry sphere, which captures how broken parity and time-reversal symmetry give rise to chiroptical and magnetoelectric effects and offers new insights into light-matter interactions.

11:40 : Invited talk**Topological And Geometric Effects In Magnetic Nanowires**

Oleksandr Pylypovskyi

Helmholtz-Zentrum Dresden-Rossendorf e.V. (Germany)

We analyze the relation between the magnetic state in low-dimensional curvilinear magnets and global characteristics of geometry, such as topology and knotting. It is shown that (i)~ferromagnetic wireframes support the topologically-protected high-order negative vorticity states, and (ii)~sharp knots in antiferromagnetic spin chains allow tailoring signatures of geometric frustration.

12:00 : Invited talk**Quantum Theory Of Polarization In Inhomogeneous Crystals And Its Relation To Orbital Magnetoelectric Effect**

Nobuhiro Arai¹, Yang Gao², Di Xiao³, Shuichi Murakami⁴

¹Institute of Science Tokyo (Japan), ²University of Science and Technology of China (China), ³University of Washington (USA), ⁴University of Tokyo (Japan)

We derive a formula for the polarization in a crystal induced by a perturbation linear in the coordinates. We use the linear response theory, and found that there appears an additional correction term to the previous work on the semiclassical theory. We confirm this result in a model calculation.

11:00 - 12:15 — Bajondillo**Session 4A17****Metamaterials for Sustainable Energy and Environmental Solutions**

Organized by: Alicia Torres-García, Miguel Beruete, Iñigo Liberal and Jorge S. Dolado

Chaired by: Alicia Torres-García and Miguel Beruete

11:00 : Invited talk**Computational Design Of Crystalline Chalcogenides For Intermediate-band Solar Cells**

Matteo Cagnoni

Politecnico di Torino (Italy)

Intermediate-band solar cells are a promising concept to exceed the Shockley-Queisser limit. Yet, photo-converting materials fully exploiting the intermediate-band paradigm remain elusive thus far. In this contribution, their possible realization with Earth-abundant crystalline chalcogenides is explored by state-of-the-art

computational methods.

11:20 : Invited talk

Radiative Cooling and Metalens for Advanced Micro-Concentrating Photovoltaic Systems

Pietro Testa¹, Matteo Cagnoni¹, David Osuna-Ruiz², Alicia Elena Torres-Garcia², Miguel Beruete², Federica Cappelluti¹

¹Politecnico di Torino (Italy), ²Universidad P blica de Navarra (Spain)

Aiming to advance next-generation photovoltaic architectures, we explore radiative cooling as a cooling system for multi-junction solar cells under high concentration. Additionally, we investigate the feasibility of metalenses for micro-concentrating photovoltaics, offering high design flexibility and compactness to enhance system efficiency.

11:40 : Invited talk

Advanced Light-Scattering Control For High-performance Radiative Cooling Surfaces

Rainer Bravo-Pino¹, Alicia Elena Torres Garc a², Jorge Sanchez Dolado¹, Miguel Beruete²,  nigo Liberal²

¹Centro de F sica de los Materiales(CFM-CSIC) (Spain), ²Public University of Navarre (Spain)

Multipole engineering is employed to enhance backscattering in core-shell spherical particles by optimizing the refractive index contrast. By aligning the electric dipole with the magnetic quadrupole in a TiO₂ particle, a significant increase in backscattering is achieved. These findings are highly relevant for passive radiative cooling applications

12:00 : Making The Miracle Possible: Concrete As A Radiative Cooling Material

Jorge Dolado¹, Guido Goracci¹, Ghizlane Moutaoukil¹, Ridwan Agbaoye¹, Miguel Beruete², Alicia Elena Torres-Garc a², Laura Carlosena²,  nigo Liberal², Achutha Prabhu³, Jos  Antonio Iba ez³, Nick Adams⁴, Nicole van Lipzig⁴, Karen Allacker⁴

¹CSIC-UPV/EHU (Spain), ²Public University of Navarre (UPNA) (Spain), ³TECNALIA (Spain), ⁴KU Leuven (Belgium)

Over the past four years, the MIRACLE project has been dedicated to developing innovative cement-based materials with radiative cooling properties. This work highlights some of the most promising results achieved, emphasizing the significant impact of these new concretes in reducing building energy consumption and mitigating the urban heat island effect.

11:00 - 12:15 — Carihuela

Session 4A18

Symposium V: Architected Elastic, Acoustic Metamaterials and Phononic Crystals

Organized by: Marco Miniaci, Jensen Li, Jean-Philippe Groby, Vincent Pagneux and No  Jim nez

Chaired by: Marco Miniaci, Jensen Li and Jean-Philippe Groby

11:00 : Invited talk

Ultrathin architected plates and their applications

Igor Bargatin

University of Pennsylvania (USA)

Ultralight architected plates, like nanocardboard, offer unprecedented stiffness-to-weight ratios and shape recovery. Made from nanometer-thick films, these metamaterials enable macroscopic photophoretic levitation via thermal transpiration. They also inform designs for relativistic lightsails, where high bending stiffness and engineered curvature (billowing) are crucial for managing intense photon pressure stresses.

11:20 : Invited talk

Design of Underwater Noise Reduction Ultra-Thin Metabarriers

Vinicius Fonseca Dal Poggetto, M. Miniaci

Université de Lille (France)

In this work, we propose a metabarrier with a tailored elastic anisotropy for efficient underwater noise reduction. The constitutive unit cell of the metabarrier is optimized to enhance wave mode coupling to effectively operate in the sub-wavelength regime and also exhibit high sound transmission loss at higher frequencies.

11:40 : Invited talk

Optomechanical Su-Schrieffer-Heeger States in a Nanobeam Cavity

Hicham Mangach, Abdellatif Gueddida, Ricardo Alcorta-Galvan, Gaëtan Lévêque, Marco Miniaci, Yan Pennec, Bahram Djafari-Rouhani

Université de Lille (France)

We design an optomechanical nanobeam cavity based on the Su-Schrieffer-Heeger (SSH) model, created via alternating two mechanical/optical domains at the interface through controlled holes and stubs spacing. The system provides topologically protected photon-phonon coupling ($g/2\pi = 782$ KHz) and a high optical quality factor ($Q = 3.77 \times 10^5$).

12:00 : Nonreciprocal Acoustic Wave Control With Field-transforming Metasurface

Xinhua Wen¹, Choonlae Cho², Xinghong Zhu¹, Namkyoo Park², Jensen Li¹

¹ *The University of Hong Kong (China)*, ² *Seoul National University (Korea)*

Field transformation, as an extension of the transformation optics, provides a possible means for nonreciprocal field manipulation. Due to the stringent constraint on material parameters, the experimental realization of nonreciprocal field transformation is elusive. We realize a field-transforming metasurface, which enables tailor-made field distribution manipulation and nonreciprocal wave control.

11:00 - 12:00 — Montemar

Session 4A19

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Moritz Merklein

11:00 : Invited talk

Hyperuniform Disordered Materials for Solar and Solar-Thermal Absorbers

Marian Florescu

University of Southampton (United Kingdom)

Hyperuniform disordered structures demonstrate great potential to enhance light absorption in solar cell and solar-thermal absorber architectures and due to unique light trapping mechanisms capable of attaining absorption enhancements up to 85 % over the visible spectrum and record solar cell efficiency in ultra-thin film solar cells.

11:20 : Invited talk

Structurally engineered phosphors for high color-conversion efficiency

Tae-Yun Lee, Hansol Lee, Heonsu Jeon

Seoul National University (Korea)

Phosphors have enabled modern full-color display technologies as well as solid-state lighting. In this talk, a paradigm-shifting novel approach is introduced to improve the color-conversion efficiency of phosphor: structural engineering under the principles of nanophotonics. Two structural platforms to be discussed are lateral photonic crystal and vertical resonant cavity.

11:40 : Invited talk

Susceptibility Invariance And Disorder-induced Statistical Properties In Time-varying Media

Bo Zhou, Enzong Wu, Zuojia Wang

Zhejiang University (China)

We present theoretical and analytical frameworks for perpendicular-moving metasurfaces, where susceptibility invariance and duality-matching conditions are derived via generalized sheet transition conditions and Lorentz transformations. We also discuss the emergent wave dynamics in disordered time-varying cavities, where temporal reflections lead to non-normal electromagnetic field distributions, contrasting classical spatial localization.

11:00 - 12:40 — Litoral

Session 4A20

Nanostructures meet Perovskites: Advanced Applications and Future Challenges

Organized by: Angela Barreda and Eduardo López Fraguas

Chaired by: Eduardo López Fraguas and Angela Barreda

11:00 : Invited talk

Tailoring The Metal-insulator Transition Of Rare Earth Nickelates Thin Films Towards Optical Applications

Luigi Matera¹, Julian Peiro¹, Laurent Divay², Christophe Galindo², Paolo Bortolotti¹, Manuel Bibes¹, Lucía Iglesias Bernardo¹

¹ Université de Paris-Saclay (France), ² Thales Research and Technology (France)

Rare-earth perovskite nickelates, ReNiO_3 , are characterized by a large number of structural and physical properties, presenting a sharp metal-to-insulator transition, MIT. During the MIT, a rapid change of optical and electrical properties occurs. Here we will show how to tune the MIT and shift it around room temperature.

11:20 : Invited talk

Electrically And Optically Driven Exciton-polaritons In All-perovskite Metasurfaces

Andrea Zacheo, Yutao Wang, Giorgio Adamo, Cesare Soci

Nanyang Technological University (Singapore)

Electrical control of exciton-polaritons is hindered by their inherent charge neutrality. We show that active perovskite metasurfaces allow optical and electrical generation of exciton-polaritons and control of their emission properties, including spin-polarized luminescence from Bose-Einstein condensates and electroluminescence from integrated light-emitting transistors.

11:40 : Invited talk

Indoor Energy Harvesting Enhancement With Nanostructured Grating Contact

Daniel Sarcanean¹, Ángela Barreda¹, Braulio Garcia-Camara¹, Eduardo Lopez-Fraguas¹, Ricardo Vergaz Benito¹, Iván M. Mora-Seró²

¹ Universidad Carlos III de Madrid (Spain), ² Universitat Jaume I de Castellon (Spain)

We present a comprehensive design of a dielectric TiO_2 -based nanostructured metasurface into a novel perovskite solar cell to optimize power generation in indoor environments. An absorption improvement of the solar cell efficiency with respect to the planar case is obtained. This highlights dielectric metasurfaces potential for next-generation photovoltaic devices.

12:00 : Invited talk

Controllable Suppression of Non-Hermitian Skin Effects

Chao Xu, Zhiqiang Guan, Hongxing Xu

Wuhan University (China)

We propose a universal strategy to regulate non-Hermitian skin effects (NHSEs) through onsite potential engineering. By constructing magnetic-field-like on-site and randomlike on-site potentials, we reveal nonmonotonic and monotonic suppression patterns of skin modes. Combining the scaling theory, we have extended the concept of controllable suppression of NHSEs to higher-dimensional systems.

12:20 : Invited talk

Strong Light-Matter Coupling in Perovskite Quantum Dot Solids**F.J. Coto-Ruiz¹, R. Tao², C. Bujalance¹, L. Calì¹, D.N. Dirin², M.V. Kovalenko², H. Míguez¹**¹CSIC - Universidad de Sevilla (Spain), ²ETH Zurich (Switzerland)

Recent advances in the monodispersity and ligand engineering of perovskite quantum dot dispersions have allowed the realization of high optical quality films amenable for integration in optical cavities. Rational and precise design of these resonators yields the formation of exciton-polaritons in quantum dot solids, opening new routes in optoelectronics.

11:00 - 12:00 — Manantiales**Session 4A21****Micro/Nano Fabrication and Characterization Techniques**

Chaired by: Joel Loh

11:00 : Deep and vertical etching technique using hydrogen fluoride gas for glass-based metasurfaces**Yoshitaka Ono, Kohei Sano, Akira Ueno, Yasuo Hayashi***AGC Inc. (Japan)*

This report introduces a glass-etching technique using hydrogen fluoride gas, where the photoresist, which typically acts as a mask, serves as a catalyst. This technique, enabling selective, faster, deeper, and more vertical etching than conventional reactive-ion etching, is promising for glass-based metasurface applications.

11:15 : Gold nanostructure gratings produced using direct laser writing with pulse energy-dependent morphology for SERS substrates**Kernius Vilkevicius, Ilja Ignatjev, Gediminas Niaura, Evaldas Stankevicius***Center for Physical Sciences and Technology (Lithuania)*

Direct laser writing is a versatile tool for producing free-form periodic arrays of gold nanostructures by modification. Pulse energy, grating period, and film thickness lead to variations in produced structure morphology, which in turn provide tunable resonant properties. The formation and application of such structures for SERS are presented.

11:30 : Comparative Study of Nanocrystalline Dy₂O₃ Thin Films deposited on Sapphire and Silicon Wafers by Means of Electron Beam**Faisal Alresheedi***Qassim University (Saudi Arabia)*

A comparative study of Dy₂O₃ thin films deposited on sapphire and silicon substrates by electron beam. XRD, SEM, spectroscopic ellipsometry, and UV spectrophotometer were used to study the crystal structural, morphology, optical properties of both thin films.

11:45 : Rainbow Trapping with Graded Triangular Grooves for Enhanced Raman Spectroscopy of Biomolecules**Yi Loh***National University of Singapore (Singapore)*

Graded triangular gratings can be used in rainbow trapping biosensors. The wavelength-dependent phase reflection requires precise adjustments to the groove depths to maintain adiabatic conditions. Optimized tapered grooves enable superior multi-wavelength trapping and localized field enhancement, significantly boosting SERS sensitivity, with enhancement factors reaching up to 10^{10} for molecules larger than 10 nm.

12:00 - 12:30 — Manantiales

Session 4A22

AI empowered meta-optics

Organized by: Benfeng Bai, Guixin Li and Baohua Jia

Chaired by: Heng Wang

12:00 : Optical Polarization Modulation Based On Metasurfaces**Chen Chen***Nanjing University (China)*

We realized independent wavefront manipulation of different polarization channels including two cross-polarizations, and co- and two cross-polarizations, applications like achromatism, polarimetry and encryption were successfully demonstrated.

12:15 : All-optical Ultrafast Polarization Switching With Nonlinear Plasmonic Metasurfaces**Heng Wang, Guixin Li***Southern University of Science and Technology (China)*

We demonstrate all-optical ultrafast polarization switching of second harmonic waves with nonlinear plasmonic metasurfaces. By leveraging geometric phase controlled symmetry-selective polarization switching via second-harmonic generation, ~ 520 fs switching time, $\sim 97\%$ modulation depth and dual-channel switching are achieved. The metasurface platform offers promising applications in ultrafast optical information processing.

11:00 - 12:30 — Veselago

Session 4A23

Nanophotonics and Plasmonics Applications

Chaired by: Wei Sha

11:00 : A phenomenon of noise avalanche in bosonic chains with random off-diagonal disorder and its quantum quenching**Vladislav Stefanov¹, André Stefanov¹, Lea Sirota², Gregory Slepian², Dmitri Mogilevtsev³***¹University of Bern (Switzerland), ²Tel Aviv University (Israel), ³B.I.Stefanov Institute of Physics - NAS of Belarus (Belarus)*

We discuss a sharp increase in photon number noise in bosonic chains with off-diagonal disorder. This "noise avalanche" occurs under coherent excitation of a bosonic mode, leading to super-thermal photon bunching in the lattice. Single-photon excitation of another mode can quench the avalanche, while classical excitation only slows it.

11:15 : Peem Based Near-field Imaging Of Plasmonic Topological Harper Nanochains**Qiuchen Yan¹, Boheng Zhao², Xiaoyong Hu¹, Qihuang Gong¹***¹Peking University (China), ²Tsinghua University (China)*

We propose a novel approach to regulate coupling intensity by integrating gold nanodisks with connecting waveguides. The topological properties of Aubry-André-Harper configuration are directly characterized using photoemission electron microscopy. This work provides direct in-situ measurements of topological states at nanoscale, advancing the practical applications of integrated plasmonic topological photonics.

11:30 : Slot Mode Optomechanical System For Mass Sensing**Cheeru Thrideep¹, Miroslav Belov², Wayne K. Hiebert¹***¹University of Alberta (Canada), ²National Research Council Canada (Canada)*

Optomechanical systems have demonstrated their significance in sensing applications. We study a slot mode optomechanical system where in a THz optical mode from a Photonic Crystal (PhC) cavity is coupled to a

MHz mechanical mode of the cantilever to construct an effective mass sensitive device specifically operating at low-frequency region.

11:45 : Enhancing Anti-reflective Coating Performance Through Binary Optimization Of structural Parameters With Concurrent Material Selection And Thickness optimization

Serang Jung, Eungkyu Lee

Kyung Hee University (Korea)

Optimizing planar multilayer coatings is challenging due to vast parametric space and complex requirements. This study proposes an adaptive scheme using active learning for concurrent material selection and thickness optimization. Applied to antireflective coatings for infrared camera, it identified a five-layer design with 0.47 % reflectance, reducing computational cost.

12:00 : High Purcell Values From Inverse Design Of Bullseye Cavities By Machine Learning

F. M. Sanchez, C. Everly, L. M. Weituschat, L. N. Goduguluri, P. K. Anwla, Pablo A. Postigo

University of Rochester (USA)

We present a Tandem Neural Network (TNN) approach for the inverse design of Bullseye cavities, optimizing Purcell enhancement and emission efficiency. This method reduces computational demands, integrates fabrication constraints, and generalizes across materials, enabling efficient design of photonic structures with high performance and applicability to other complex cavity systems.

12:15 : Polarization-dependent Au Nanopillar Array For Resonance-driven Photocatalysis

Ning Lyu, Anjalie Edirisooriya, Zelio Fusco, Fiona Beck, Christin David

Friedrich-Schiller-Universitat Jena (Germany)

A polarization-dependent metasurface of elliptical Au nanopillars selectively catalyzes reactions via localized surface plasmonic resonance. Asymmetric nanopillars allow tuning the resonance wavelengths to maximize yield under x-polarization while suppressing activity under y-polarization, demonstrating a promising approach for controlling selectivity in multibranched reactions.

11:00 - 12:20 — Maxwell

Session 4A24

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Khaled Mnaymneh

11:00 : Invited talk

Complex Modulation Of Light In Polarization And Space Using Laser-written Multi-plane Light Conversion

Oussama Korichi, Markus Hiekkamäki, Robert Fickler

Tampere University (Finland)

We introduce a novel MPLC system using laser-written silica waveplates for high-resolution, low-loss light modulation. Our compact, multi-pass design enables polarization control, spatial mode manipulation, and quantum operations. This scalable approach surpasses spatial light modulators, offering applications in optical communications, imaging, sensing, and high-dimensional quantum processing.

11:20 : Invited talk

Multi-Temperature Modeling Of Hot-Carrier Dynamics In Photonic Metastructures

Andrea Schirato, Giulia Crotti, Giuseppe Della Valle

Politecnico di Milano (Italy)

Photonic metastructures can be made reconfigurable and switchable via hot carriers photogenerated by fs-laser pulses. Here we show how multi-temperature modeling of hot-carrier dynamics can be exploited to design active metastructures made of plasmonic or dielectric media for a variety of applications, including

ultrafast all-optical modulation and pulsed photocatalysis.

11:40 : Invited talk

Low-Loss Phase Change Materials For Integrated Photonics

Ioannis Zeimpekis, A. Shoa, Q. Luo, I. Johnson, D. Lawson, L. Rozaqi, P. Deoli, D. Trubacs, S. Blundell, O. L. Muskens, F. Gardes

University of Southampton (United Kingdom)

Optical phase change materials (PCMs), such as Sb₂Se₃ and Sb₂S₃, have created a paradigm shift for integrated photonics. Ought to the decoupling of phase and amplitude they enable more complex functions and lower losses. This talk will discuss the development of low-loss PCMs for higher transparency and longer switching durability.

12:00 : Invited talk

Photon Manipulation with the Interface of Synthetic Temporal Photonic Lattices

Bing Wang

Huazhong University of Science and Technology (China)

By constructing an interface in the synthetic temporal photonic lattice based on dual-loop coupled fibers, we demonstrate the effects of refraction and perfect imaging in the time dimension. The temporal Goos-Hänchen shift and nonlinear non-Hermitian skin effects are also investigated. The study may find great applications in optical pulse manipulation.

11:00 - 12:00 — Fresnel

Session 4A25

Symposium II: New Trends in Nanophotonics and Advanced Materials

Organized by: Junsuk Rho, Hakjoo Lee, Namkyoo Park and Seong Ok Han

Chaired by: Xianzhong Chen

11:00 : Invited talk

Vectorial Metasurface For Polarization Encoding And Imaging

Fengjun Li, Zilan Deng, Xiangping Li

Jinan University (China)

We present the vectorial metasurface design that enables polarization encoding in the 2D parametric space of polarizations including both rotation angle and ellipticity. In addition, we show the monolithic metasurface design by fusing vectorial grating and lens functions to enable ultra-compact polarization camera for large field-of-view full stokes polarization imaging.

11:20 : Invited talk

Near-Unity Absorption in Semiconductor Nanowire Metasurfaces

Michael Reimer

University of Waterloo (Canada)

Semiconductor nanowire metasurfaces can be engineered to realize near-unity absorption efficiency to enhance the performance of photodetectors. We demonstrate ~95% absorption efficiency by controlling the nanowire geometry and spacing. This also improves the photodetector response time by significantly reducing device capacitance and controlling the spatial location of the absorption profile.

11:40 : Invited talk

Switching of Topological Edge Transmission in Si Photonics Platform

Tomohiro Amemiya¹, Sho Okada², Liyan Hu¹, Qianshuo Wang¹, XingXiang Wang¹, Xiao Hu³

¹*Institute of Science Tokyo (Japan)*, ²*National Institute of Information and Communications Technology (Japan)*, ³*Shanghai University (China)*

Topological photonics allows us to systematically handle information derived from the topology of light, such

as optical spin and orbital angular momentum. In this talk, we focus on an ultra-compact and low-power-consumption optical switch by manipulating the interference effect of orbital angular momentum using topological photonics.

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