# Localized Acoustic Spoof Plasmons

**Mohamed Farhat**[1,*], **Pai-Yen Chen**[2], and **Hakan Bagci**[1]

[1] Division of Computer, Electrical, and Mathematical Sciences and Engineering,
King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia
[2]Department of Electrical and Computer Engineering,
Wayne State University, Detroit, MI 48202, USA

[*]corresponding author: mohamed.farhat@kaust.edu.sa

We introduce the concept of localized acoustic surface modes (ASMs) that exhibit the same dispersion characteristics as those of the surface plasmons in electromagnetics and photonics[1,2]. First, we demonstrate that, under the excitation by an incident acoustic plane wave, propagating ASMs are generated on a one-dimensional (1-D) rigid surface with sub-wavelength corrugations. Then, an analytical model developed to describe the dispersion characteristics of the 1-D modes is used to demonstrate their plasmonic-like behavior. Using this model as a guide, we design a 2-D rigid cylindrical surface with sub-wavelength corrugations to generate localized ASMs[3]. We demonstrate that this corrugated surface is acoustically equivalent to a cylinder with uniform mass density that can be represented using the Drude model. This indeed suggests that acoustic plasmonic materials can be engineered just like their counterparts in electromagnetics and photonics.

The results of our research, which will be presented in detail at the conference, demonstrate for the first time that localized plasmons can exist in acoustics. These results open up new vistas in designing acoustic devices with promising applications in many areas, including non-destructive sensing, sub-wavelength focusing and resolution, cloaking, and medical imaging.

## REFERENCES

1. J. B. Pendry, L. Martin-Moreno, and F. J. Garcia-Vidal, Science **305**, 847–848 (2004).
2. A. Pors, E. Moreno, L. Martin-Moreno, J. B. Pendry, and F. J. Garcia-Vidal, Phys. Rev. Lett. **108**, 223905 (2012).
3. M. Farhat, P. Y. Chen, and H. Bagci, under review (2015).