Brillouin light scattering from plasmonic nanostructures

Thomas Vasileiadis

Faculty of Physics, Adam Mickiewicz University,
Uniwersytetu Poznanskiego 2, 61-614 Poznan, Poland.

Abstract:

Irradiation of metallic nanostructures with light drives oscillations of charge-carriers, termed plasmons, and spatial confinement of light below its diffraction limit. Plasmonic nanostructures play a promising role in optoelectronics, photochemistry, photocatalysis, and single-molecule sensors for their ability to confine light and deliver energy into other microscopic excitations. For instance, in surface-enhanced Raman spectroscopy (SERS) the signal of molecular vibrations is enhanced by over 10^8 times using plasmons [1]. However, it is still unclear if plasmons can be used to enhance the spectroscopic signal of vibrations from nano-objects, such as nanostructures and colloidal crystals. In this talk, I will introduce the technique of Brillouin light scattering (BLS) that probes gigahertz (GHz) vibrations in bulk and nanoscale materials, and discuss how plasmons modify the signal and selection rules of BLS [2]. The systems under consideration are individual plasmonic nanostructures, and self-assembled superlattices of metallic nanospheres [3]. Based on preliminary results, the elastic properties of the superlattices can be tuned using laser light in resonance with the plasmons.

Acknowledgements:

This project is supported from the European Union's Horizon 2020 research and innovation program (No. 101003436). The speaker thanks his collaborators: Dr. Hab Bartlomiej Graczykowski (MSCA-WF supervisor) and Dr. Hab Wiktor Lewandowski.

References:

[1] J. Langer *et al*. ACS Nano 14, 28-117 (2020).

[2] A. Girard *et al*. Nano Letters 18, 3800-3806 (2018).

[3] W. Lewandowski *et al*. Nature Communications 6, 6590 (2015).