Nonlinear plasmonics with monocrystalline gold

Sergejs Boroviks

Nanophotonics and Metriology Laboratory,

Ecole Polytechnique Fédérale de Lausanne (EPFL)

Lausanne, Switzerland

sergejs.boroviks@epfl.ch

Plasmonic nanostructures allow to controllably enhance linear and nonlinear light-matter interactions by concentrating the electromagnetic fields at the scales below the diffraction limit. This feature is highly desired for many applications, e.g. bio- and chemical sensing, photocatalysis, metamaterials, etc. However, success of further advancements largely depends on the reduction of electromagnetic losses in plasmonic materials, which constitutes the most ubiquitous problem of current device prototypes. In this talk I will present experimental investigation of the plasmonic properties of (quasi-) monocrystalline gold flakes, [1] which emerged recently as a material platform to supersede the traditionally-used polycrystalline gold films. In particular, I will discuss anisotropy in the second-order nonlinear optical response from {111} surface of crystalline gold which is markedly absent at the polycrystalline surfaces. [2] Also, I will present our recent results on two-photon luminescence microscopy which reveals that hot carrier excitation and relaxation dynamics is significantly altered when the gold thickness approaches mesoscopic dimensions.

[1] S.Boroviks et al., Interference in edge-scattering from monocrystalline gold flakes, Optical Materials Express 8 (**2018**) 3688, DOI: 10.1364/OME.8.003688
[2] S.Boroviks et al., Anisotropic second-harmonic generation from monocrystalline gold flakes, Optics Letters 46 (**2021**) 833, DOI: 10.1364/OL.413003