Project 6.1. Investigations of coupled photonic and plasmonic metasurface resonators for terahertz frequency range

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Background:

Recently, a profound scientific interest was devoted for the investigations of systems exhibiting strong light-matter type interactions. Such systems are of importance for a variety of fields including fundamental quantum optics, information processing and the realization of ultrahigh-resolution sensors which can be applied in a wide range of electromagnetic frequency spectrum. In particular, the investigation of fundamental strong-coupling phenomena in the terahertz frequency range is expected to enable novel applications such as ultra-low-threshold terahertz polariton lasing, voltage-controlled modulators and electrically-tunable filters as well as ultra-sensitive chemical and biological sensors.

This project will focus on the comprehensive modeling, design and experimental characterizations of coupled photonic and plasmonic metasurface structures tailored for terahertz frequency range. At this frequency range the wavelength of radiation and the advances in integrated circuit fabrication technologies enable realization of vertically coupled plasmonic metasurface and photonic structures which can exhibit variety of strong interaction related phenomena. Furthermore, the modern silicon processing technologies with minimal feature sizes from deep sub-micrometer length down to few tens of nanometers allow for direct integration of tuning elements which enable active control and local probing of coupled systems.

Aim:

The main goal of this activity is to perform comprehensive investigations of strongly coupled metasurface based resonators in sub terahertz frequency range. The activities comprise modeling and layout of vertically coupled photonic and plasmonic structures for silicon fabrication technologies including electrical as well as electromagnetic characterization.

Requirements:

- Master degree or equivalent in physics
- skills in high frequency electromagnetic modeling
- knowledge of semiconductor devices
- proper motivation to complete a doctorate degree
- fluent English in writing and speech.