TRR 142

Tailored Nonlinear Photonics

TRR Guest Scientist Lecture / Seminar

Date/Time: 07.12.2016 / 4.15pm
Location: UPB A1

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Mie-resonant dielectric nanostructures as a platform for functional nanophotonics

Abstract:

This scheme gives the possibility of matching the coherence time of the broadband squeezed light to the response time of the photodetector. We finally discuss a temporal imaging scheme which allows to partially compensating the frequency dispersion of the OPA. All-dielectric nanoparticles with a high refractive index support strong localized electric and magnetic multipolar Mie-type resonances. Using the capabilities of modern nanotechnology, these resonances can be tuned by the size, shape, material composition, and arrangement of the nanoresonators. Furthermore, dielectric nanoresonators exhibit very low absorption losses at optical frequencies. Based on these unique optical properties, high-index dielectric nanoresonators represent versatile building blocks of resonant metasurfaces and nanoantennas with tailored linear and nonlinear optical properties.
This talk will provide an overview of our recent advances in controlling the generation and propagation of light with dielectric metasurfaces and nanoantennas composed of silicon or other high-index semiconductor materials.

On the one hand, metasurfaces composed of dielectric Mie-resonators can impose a spatially variant phase shift onto an incident light field, thereby providing control over its wave front. Based on the simultaneous excitation of electric and magnetic dipole resonances, the nanoresonators can be tailored to emulate the behavior of the forward-propagating elementary wavelets known from Huygens' principle. This concept allows for the realization of metasurfaces with high transmittance efficiency, full phase coverage, and a polarization insensitive response. Various examples of wave front control will be discussed, including beam shaping and holographic imaging, both of which we have experimentally demonstrated with high efficiency at telecom frequencies.

On the other hand, the possibility to employ dielectric Mie-resonators as optical nanoantennas for manipulating spontaneous emission will be discussed. In particular, the resonance structure and spatial arrangement of the Mie-resonators provide a handle for tailoring the spectral properties as well as the emission pattern of nanoemitters in their vicinity.

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