Hybrid nanophotonics: when plasmonics met dielectrics

Dmitry Zuev

Faculty of Physics , ITMO University, Saint Petersburg, Russia.

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ABSTRACT: Unification of different materials in a single nanophotonic system expands the frontiers of its functionalities providing wide field for optical properties engineering. Interaction of light with such nanostructures demonstrates interesting optical effects making them very attractive for different areas of science from quantum optics to biophotonics and chemistry. Therefore, design of such systems opens the door to the world of unique optical effects and non-standard applications.

The resonant structures made of plasmonic metals or high-refractive index (dielectric) materials are currently considered to be the building blocks of nanophotonics. In turn, hybrid nanophotonics unifying metal and dielectric materials in a single system moves beyond basic plasmonics and all-dielectric concepts. In this talk the fabrication approaches and investigation results of such metal-dielectric nanosystems are represented. We start from nanophotonic systems composing of the mixture of metal and dielectric materials. Then the more complicated geometries are considered like nanocavities, hybrid nanosponges and asymmetrical nanosystems utilizing interference of resonances inherent to the nanostructure components. The potential of hybrid nanostructures for the applications in optically reconfigurable devices, nanoscale light sources, security labels and biosensors is also discussed.

Short BIO: Dmitry Zuev received the Ph.D. degree in physics at the Institute on Laser and Information Technologies of the Russian Academy of Sciences (ILIT RAS) in 2012. In 2015 he joined Metamaterials laboratory (ITMO University, Saint Petersburg) as a postdoc. Currently he is an Assistant professor of the Faculty of Physics at the ITMO University. His research interests include: plasmonics, dielectric nanophotonics, laser-matter interaction, nanofabrication. The main topic of his research group is hybrid nanophotonics, were resonant metal-dielectric nanostructures are developed and utilized to control optical fields at nanoscale for the application in quantum nanotechnologies, sensing, data storage and security labels. For his research he was awarded the Medal of the Russian Academy of Sciences for young scientists in the field of general physics and astronomy (2018) as well as the Awards of the Committee for Science and Higher Education of Saint Petersburg (2020 and 2021).

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info: d.zuev@metalab.ifmo.ru