Present and Future Trends of Nanoplasmonics

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Nanoplasmonics deals with collective electron dynamics on the surface of metal nanostructures, which arises as a result of excitations called surface plasmons. The surface plasmons localize and concentrate optical energy in nanoscopic regions creating highly enhanced local optical fields. They undergo ultrafast dynamics with timescales as short as a few hundred attoseconds. We will review the numerous existing applications of nanoplasmonics: nanoantennas for photovoltaic cells and LEDs, nanoplasmonic labels, tests, and sensors for biology, medicine, industry, environmental monitoring and defense, ultramicroscopy, plasmonics-assisted magnetic recording, nanoshell-mediated cancer treatment, etc. From the latest developments and original work in nanoplasmonics, we will consider SPASER (quantum nanoscale optical generator and amplifier), which has earlier been predicted and recently observed, plasmonic nanolasers, generation of high harmonics in the EUV range, ultrafast optical modulator with THz bandwidth, generators and modulators of THz radiation, coherent control of ultrafast processes on the nanoscale, attosecond nanoplasmonic field microscope, etc., as time permits.