Nanophotonics: From light manipulation to quantum levitation at the nanoscale

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Surface plasmon polaritons (SPPs) allow one to achieve concentration of light into sub-wavelength regions, thus opening up rich new directions in physical optics and photonics.

A wide range of phenomena and applications enabled by SPPs and bridging several fields, are currently being investigated by our group and will be presented in this talk:

(a) plasmonic collimators that make it possible to dramatically reduce the divergence of semiconductor lasers, creating exciting opportunities in beam engineering and opening the door to wave-front engineering of a broad variety of light sources;

(b) plasmonic polarizers for arbitrary control of laser polarization;

(c) new light sources, such as plasmonic laser antennas, capable of creating intense nanospots for spatially resolved chemical imaging and ultra-high-density optical storage;

(d) antenna arrays for surface-enhanced Raman scattering;

(e) frequency-selective surfaces enabled by new soft lithography techniques;

(f) optomechanical forces between waveguides at sub-wavelength distances.

Finally, at this distance scale forces arising from quantum fluctuations of the electromagnetic field cannot be neglected. They give rise to both attractive and *repulsive* Casimir forces. The latter, recently measured by us for the first time, could lead to mechanical devices based on quantum levitation that would exhibit ultra-low friction.

A unifying theme of this talk will be the new device and system functionalities brought about by nanophotonics and nanomechanics to go beyond the traditional application confines of photonics and electronics.