Radiation Nanofocusing using Surface Plasmons

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Nanofocusing of electromagnetic radiation, i.e. its concentrating well below the diffraction limit, is one of the most fundamental research directions in optics, in general, and in plasmonics, in particular, rich with prospective applications ranging from quantum optics to nanosensing.

In this presentation, the radiation nanofocusing by making use of *suitable* surface plasmon (SP) modes supported by metal waveguides, i.e. the SP modes that scale down in size linearly with the waveguide cross section, is discussed. Nanofocusing with short-range SP modes of thin metal stripes, channel plasmon polaritons (which are SP modes supported by grooves cut into metal) and gap SP modes (existing in a narrow gap between metal surfaces) is considered in detail, presenting the underlying physics involved and reporting on design, fabrication and characterization of radiation nanofocusing. Efficient plasmon nanofocusing at telecom wavelengths with the estimated field intensity enhancement of up to ~ 100 is demonstrated and careful electromagnetic simulations predict intensity enhancements by three orders of magnitude. Further developments and possible applications of radiation nanofocusing using surface plasmons are also discussed.