

Project title: Investigation of field enhancement effect in nanostructures with scanning two-photon photoluminescence microscopy

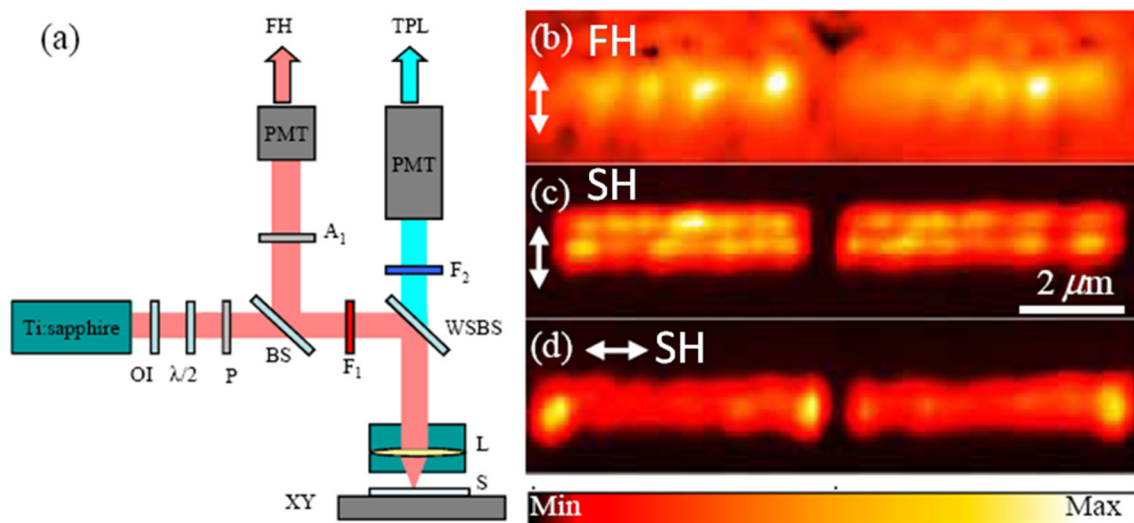
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PROJECT DESCRIPTION:

Enhancement of electromagnetic field localized down to the nm-size scale is extremely important for very sensitive detectors / optical sensors such as detectors of low molecule concentrations or even single-molecule sensors. Metal nanostructures support strongly localized (so-called) surface-plasmon resonances and are very useful for effective enhancement of incident electromagnetic fields. These surface plasmons are coupled oscillations of the incident electromagnetic field in air and free electrons inside a metal nanoparticle or at the metal surface. An important direction of research is therefore design of robust metal nanostructures with predictable plasmon resonances and evaluation of the produced electromagnetic-field enhancement.

A wide range of metal nanostructures, for instance individual gold or silver nanoparticles, large assemblies of randomly distributed gold particles and even variously designed periodic structures with gold particles changing in size and periodicity can be used to enhance electromagnetic fields and exploited in very sensitive detectors.



This project deals with design, fabrication, characterization, and modeling of flat metal nanostructures for electromagnetic-field enhancement via utilization of resonance interaction of surface plasmon modes in various configurations. The goal is to obtain field enhancement effect in a wavelength range of 750-800 nm and to evaluate the field enhancement factor by two-photon photoluminescence scanning optical microscopy, which, as an essential part, will also be introduced in the project. Depending on interests and on whether the project is chosen as bachelor or master, there is of course a possibility to go into details with various parts of the project, including for instance non-linear optics, which is related to two-photon luminescence measurements.