Near-field mediated Enhancement of Two-Photon induced Fluorescence on Plasmonic Nanostructures

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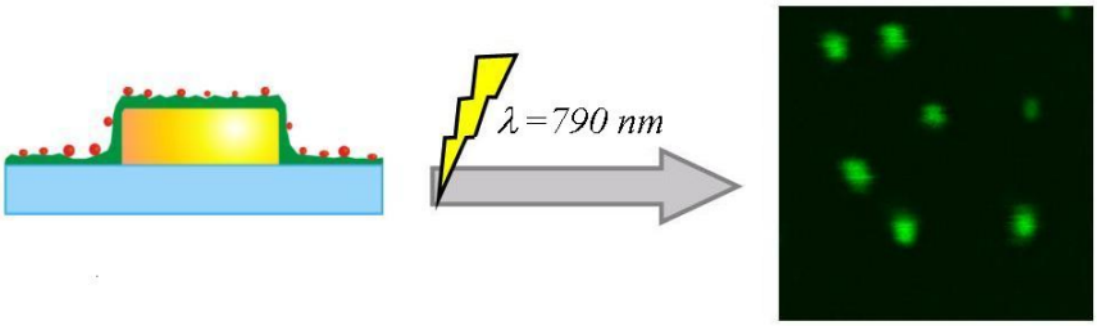
Fluorescence microscopy is a popular imaging technique. Generally, high emission intensities are desired, especially in short-lived or dynamic samples, because this allows shortening of the exposure time. Additionally, detailed studies of local effects demand a high resolution and a good signal-to-noise ratio.
The enhancement of fluorescence induced by the plasmon resonances of noble metal nanoparticles has attracted wide interest during the last decade. The enhancement effect could be demonstrated for linear emission [1] as well as for two-photon induced fluorescence [2]. However, most studies were carried out in diluted nanoparticle suspensions [3] or on metal islands [4]. More recently, studies on more defined systems have been carried out, such as metal-core particles coated with spacer molecules and fluorescent dyes [5].
Here, we report a high local enhancement of two-photon induced fluorescence in close proximity of elliptic gold nanostructures produced by colloidal lithography. The signal is confined to a very small localized volume and it dominates strongly over the background and, thus, allows detailed investigations of small sample volumes. Moreover, the use of a well-defined system geometry guarantees a high reproducibility. A two-photon approach is used in order to excite both the plasmon resonance of the nanostructure (for gold, typically λ = 800 nm) and the fluorophore (for common dyes, typically λ = 400 nm) simultaneously. This also leads to a highly increased sensitivity of the measurement compared to an equivalent one-photon experiment.



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