An electrical surface plasmon nanosource

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Surface plasmons are extensively studied for their ability to confine electromagnetic fields in sub-wavelength volumes and for their use in miniaturized waveguides. Using the inelastic tunneling electrons of a scanning tunneling microscope (STM) is a unique, local, low energy, and electrical method for exciting both localized and propagating surface plasmons on metal films and nanostructures. The ability to precisely position the excitation source and the absence of any excitation background light are essential properties for many experiments.

In our setup, the STM is coupled to an inverted optical microscope and the resulting emitted light is collected through the glass substrate. Recently, we have used this technique to electrically excite and study the guided modes of a hybrid waveguide formed by an organic nanofiber on a gold substrate[1]. Using this sample, we have also investigated the scattering of propagating surface plasmons into photons by the fiber end (see Fig. 1 a). This local STM-plasmon source may also be used to excite a plasmonic lens, thus producing a radially polarized beam of light of low divergence[2].

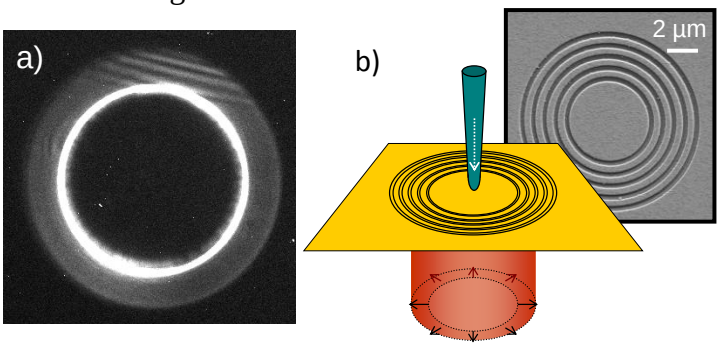

Fig. 1*: Two examples of experiments using a local, electrical STM plasmon source: a) interference fringes resulting from the scattering of surface plasmons into light at the end of an organic nanofiber (Fourier plane image); b) a radially polarized beam of light is produced when a "plasmonic lens" (consisting of circular grooves in a thick gold film) is locally excited with a plasmon nanosource.*

Bibliography

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2. Cao, S. *et al.* Cylindrical vector beams of light from an electrically excited plasmonic lens. *Appl. Phys. Lett.* **105,** 111103 (2014).