NEAR FIELD OBSERVATION OF SURFACE PLASMONS GENERATED ELECTRICALLY

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Surface plasmons are electromagnetic waves originating from electrons and light oscillations at metallic surfaces. These electromagnetic waves which propagate in a direction parallel to the metal/dielectric interface can be used to detect molecular species in functionalized biosensors.
There are three main techniques for the excitation of surface plasmons. The first technique uses a prism and total internal reflection, the second one involves scattering from a topological defect like small holes in a thin film and the third technique makes use of periodic corrugations in the metal's surface.
In situ generation of surface plasmons using an active device would clearly be advantageous.
We will present near-field measurements highlighting a new method for the generation of surface plasmons via a quantum cascade laser (QCL), operating in the mid infrared (= 7,7µm), whose metallic top cladding has been periodically structured with a gold grating [1].
We give a direct proof of surface plasmons generation by measuring with an apertureless near-field scanning optical microscope (NSOM) the presence of an intense, evanescent electric field above the metal grating upon electrical injection into the device.
Our efforts are currently devoted to launching those surface plasmons into a passive waveguide.

*[1] A. Bousseksou, R. Colombelli, A. Babuty, Y. De Wilde, Y. Chassagneux, C. Sirtori, G. Patriarche, G. Beaudoin, I. Sagnes. Optics Express, **17**, (2009), 9391-9400.*

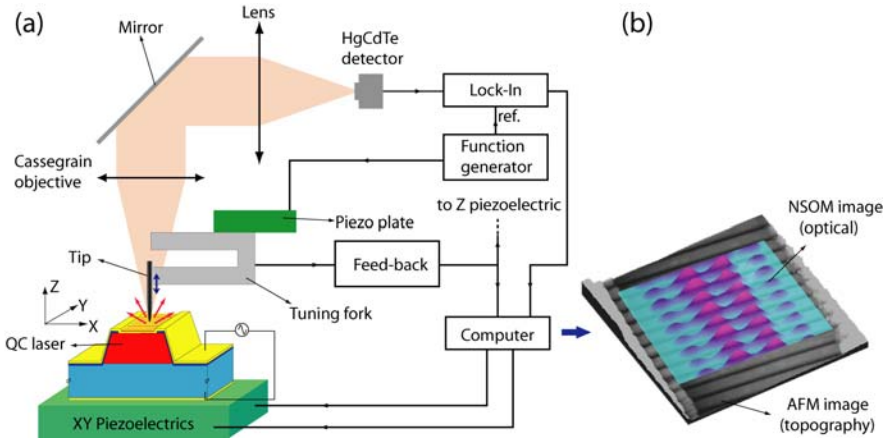

Figure 1: (a) Schematic of the apertureless near field optical microscope setup using a tungsten atomic force microscope tip to scatter the near-field at the surface of a quantum cascade laser with metallic grating. (b) Three dimensional experimental images obtained with this set-up, showing surface plasmons on the metallic fingers of the grating.