SEMINAIRE ISMO

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Antenna-coupled photoemission from single emitters and single electrons

Optical antennas are devices that convert energy efficiently between propagating and localized radiation. They are realized as metal nanostructures that make use of plasmon resonances to enhance the strength of light-matter interaction at the nanoscale, thus leading to smaller, more efficient optoelectronic devices.

I will briefly cover the history of optical antennas and will review our recent work in the field of antenna enhanced optical interactions within the context of nanoscale microscopy and spectroscopy (SNOM). Specifically, I will discuss the interaction of prototype colloidal antennas with single molecules that serve as prototypical receivers and emitters, and thereby will show that the photoemission can be increased controllably by two orders of magnitude.

In addition, I will highlight the similarities and differences between optical antennas and conventional radiowave antennas. Optical antennas so far have transduced between fields unlike their radio counterparts which transduce between waves and localized currents. I will discuss how SNOM can borrow inspiration from STM to extend its domain of operation to include low-energy electrons as well. I will show that electrons in an STM or an integrated tunnel barrier can excite localized and propagating plasmons (SPPs) in optical antenna structures by inelastic tunneling, without the need of any external radiation. This opens up new opportunities for truly nanoscale ultrafast optoelectronic signal transduction.

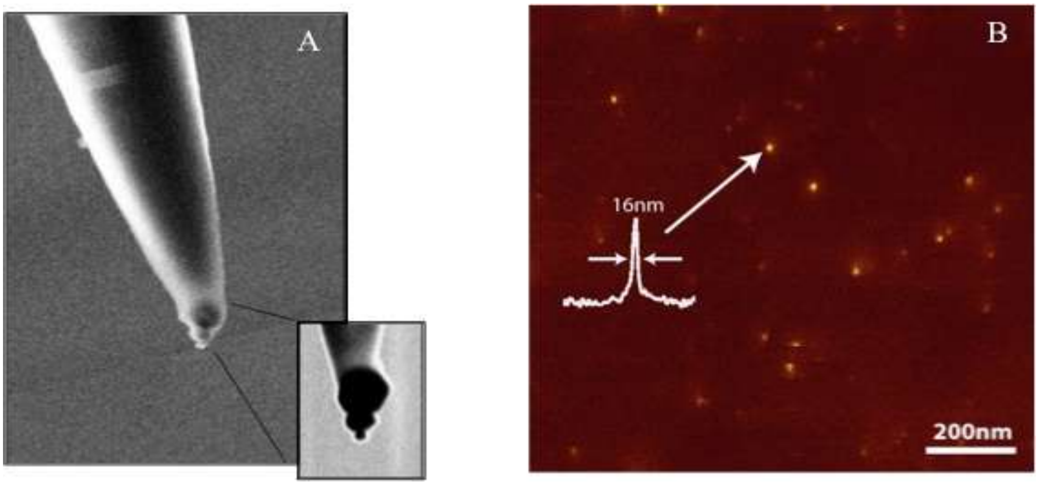

Fig. 1: (A) Electron micrograph of a self-similar trimer antenna comprised of three gold nanoparticles. (B) Fluorescence map of single molecules made using such an antenna showing sub-20 nm resolution

Attention ! Jour et heure inhabituels

Vendredi 5 septembre 2014 à 15h
Bât 210 – Amphi 1 (2ème étage)
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