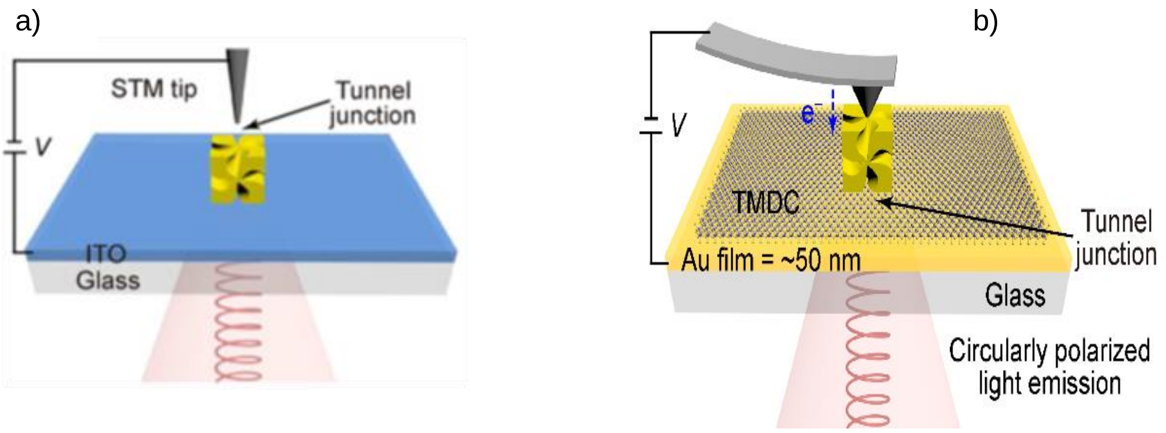
Post-doc position available (funding already acquired)

Controlling the polarization of light with chiral plasmonic nanostructures

In this project we will (1) locally and electrically excite chiral plasmonic nanoparticles and (2) to use them to enhance the chiral properties of a new class of two-dimensional (2D) semiconductors called *transition metal dichalcogenides* (TMDCs), which are key for a new branch of physics and technology called *valleytronics*.

Chiral structures, whose initial and mirror structural images cannot be superimposed, interact differently with left-handed and right-handed circularly polarized light. This is called the "chiroptical response". Most often, the chiroptical response of semiconductor materials is very weak. Gold plasmonic nanoparticles, which can concentrate light in sub-wavelength volumes, have a relatively strong chiroptical response. The goal of this project is thus to enhance the chiroptical response of a 2D semiconductor using chiral plasmonic nanoparticles. In particular, the polarization of the semiconductor luminescence will be controlled with the "handedness" of the nanoparticle.

The chiroptical response of materials and structures is most often studied by optical means, yet in a future optoelectronic nanodevice, a local electronic excitation is necessary. Working with this long-term goal in mind, we will investigate for the first time the *electrical* excitation of a chiral nanoparticle using the tunneling current from a *scanning tunneling microscope* (see part a) of the figure below). We will also investigate chiral light-matter interactions of a 2D semiconductor in an electrically excited plasmonic cavity (see part b) of the figure).



During this postdoc, the successful applicant will acquire experience in (i) scanning tunneling microscopy and atomic force microscopy (imaging of the chiral structures and excitation), (ii) optical microscopy (detection and analysis of the emitted light) and (iii) the theory of plasmonics and two-dimensional semiconductors ("valleytronics"). The successful applicant will have a physics background or equivalent, and will have experience in experimental optics and/or nanoscience. Good communication skills in English OR French are required. Note that for a motivated candidate, the project may also include numerical modeling.

Contact:

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For more information about our work:
https://www.youtube.com/watch?v=nqqpkWicR2k (in French)
https://www.youtube.com/watch?v=bZAs1W25_dQ (in French)
http://www.ismo.u-psud.fr/spip.php?rubrique199 (available in French and English)