Host University: Université Paris-Sud

Field (drop-down list): Natural sciences, mathematics and statistics

Specified field, subject: Physics

Research project title: An optical nanosource based on the strong coupling of surface plasmons and excitons

Possible starting month(s): Sep ☒ Oct ☒ Nov ☒ Dec ☒ Jan ☒ Fev ☒ Mar ☒ Apr ☒ May ☒ Jun ☒ Jul ☒ Aug ☒

Possible duration in months: 1 ☒ 2 ☒ 3 ☒ 4 ☒ 5 ☒ 6 ☒ 7 ☒ 8 ☒ 9 ☒ 10 ☒ 11 ☒ 12 ☒

Alternatively, exact starting and end date: from date to date

Suitable for students in: ☒ Bachelor level ☐ Master level

Prerequisites: Physics background; a desire to do experiments; good communication skills in English (or French).

Restrictions:

Description (maximum 2,000 characters):

Just as individual atoms can exchange electrons and thus create “hybridized” molecular states of different energies, a surface plasmon and a semiconductor nanocrystal can create new states of matter by exchanging photons. A surface plasmon is an electromagnetic wave coupled to a collective oscillation of the free electrons in a metal. On the other hand, when a semiconducting nanocrystal is excited (e.g., with a laser), a delocalized electron-hole pair known as an exciton is created. It is the strong coupling of these two entities (plasmon and exciton) that is expected to lead to new electronic states of light and matter exhibiting new properties such as enhanced coherence.

The goal of this internship is to fabricate and demonstrate the operation of novel one dimensional (1D) hybrid optical nanosources based on the strong coupling of plasmons and excitons. Such a nanosource will combine plasmonic
and excitonic nanostructures in a nanowire geometry and will be driven either optically or electrically.

During this internship, the student will investigate the electrical and optical excitation of the hybrid plasmon-exciton nanosource. The student will acquire experience in (i) atomic force microscopy (imaging and manipulation of the gold nanotube filled with semiconductor nanocrystals) (ii) optical excitation (i.e., laser) and optical microscopy (for the optical excitation and detection of the light emitted from the nanosource) and (iii) scanning tunneling microscopy (for the electrical excitation).

**Faculty and/or Department:**
UFR de Sciences, Département de Physique
http://www.sciences.u-psud.fr

**Contact person, including position:**
Séverine Fogel, Head of International Relations

**Contact email:**
severine.fogel@u-psud.fr

**Deadline for nomination to reach host university:**
2 months before the starting date

**Notification of admission given by the end of:**
Within 3 weeks

**Additional information:**
Starting date and length of internship may be flexible.