Internship offered in M2
2018-2019

Responsible for internship

Name: Lhuillier Emmanuel (INSP)
Abdelkarim Ouerghi (C2N)

Location:
INSP - 4 place Jussieu, 75005 Paris

Group: Chemical Physics and Dynamics of Surfaces

E-mail: el@insp.upmc.fr et abdelkarim.ouerghi@c2n.upsaclay.fr

Tel: +33 (0)1 44 27 82 37

Group website: http://www.insp.upmc.fr/-Lhuillier-Emmanuel-.html

Internship topic: **Electronic properties of polar two-dimensional transition metal dichalcogenides**

Since the successful exfoliation of graphene by Novoselov *et al.* in 2004, growing research attention has been focused on two-dimensional materials. In particular transition metal dichalcogenide (TMD) monolayer MX_2 (M = Mo, W; X =S, Se, Te), due to their intrinsic band gap of about 1.1-1.9 eV, are considered good candidate for the channel materials in field effect transistors (FETs), as well as promising materials for optoelectronics.
In addition, inversion symmetry breaking together with giant spin-orbit coupling (SOC) originating from the *d* orbitals of the metal atoms in TMD monolayers induces the large spin splitting from 150 meV to nearly 500 meV at the corners of the two-dimensional hexagonal Brillouin zone (K points). Different from MX_2 monolayer, polar MXY (M= Mo, W; X ≠ Y = S,Se,Te) monolayer can show additional Rashba spin splitting around the Γ point of the BZ zone due to the intrinsic out-of-plane electric field induced by the mirror symmetry breaking. Rasbha SOC has achieved growing research interest due to its great significance in spin FETs. Then, the polar two-dimensional MXY systems represent a new important class of materials that will promote the progress of the spin FET.

The candidate will be involved from the fabrication of the device to the investigation of optoelectronic properties of polar two-dimensional transition metal dichalcogenides. Finally, the electronic properties characterized by ARPES will be correlated to the transport properties in collaboration with C2N Laboratory. The internship, as well as the possible following PhD will involved both laboratory: C2N for electronic structure and device fabrication. INSP for transport measurement.

A good background in solid state physic is required.

Techniques involved: Optoelectronic, Clean Room, Optical lithography, ARPES (Soleil Synchrotron)

Type of internship: theorical X, experimental, mixed
Paid internship: Yes
Can this internship be continued for a PhD? Yes
If yes, type of PhD funding envisaged is: