

## Post-doctoral offer at LPS (LUTECE team)

### Biaxial Strain Control of Electronic Properties of Quantum Materials

**Duration** : 18 mois (plein temps)

**Starting** : janvier 2023

**Link for application** : <https://emploi.cnrs.fr/Offres/CDD/UMR8502-VINJAC-001/Default.aspx>

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#### Missions

In the last years, the LUTECE team of the Laboratoire de Physique des Solides (LPS) has been developing a biaxial strain device working at cryogenic temperatures for the study new phases of correlated electron systems under biaxial strain. This particularly makes sense for naturally layered samples such as graphite (down to graphene), transition metal dichalcogenides (TMDs), some cuprates, etc. The aim is to explore the phase diagram of such quantum materials (QM) under strain, and as a function of temperature in the 4-400K range.

The device is compatible with wide-angle x-ray diffraction, both at LPS and at large-scale instruments, like synchrotrons (particularly the DIFFABS beamline of SOLEIL synchrotron), but also at XFELs. This allows to probe lattice deformations, but also all other periodic modulations in the crystal, under biaxial strain. In that sense, we are particularly interested in new electronic periodicity like charge-density-wave (CDW) modulations that appear in many QM, and in particular their relation to superconductivity (SC). Any structural modification is expected to change the conditions for the appearance of CDW and SC, change transition temperatures etc. The device is also compatible with electrical transport and optical measurements.

The applicant will develop a scientific program around this device, focused on a family of compounds of his/her choice amongst the family of compounds cited before. This will include characterization of the device in new operation conditions, use of x-ray diffraction measurements under applied biaxial strain at LPS, as well as transport and optical measurements, to follow electronic transitions such as CDW and SC. The applicant will also write proposals for synchrotron/XFEL beamtime, perform these experimental campaigns, analyze the data and write associated articles.

**Activities**

- Use and develop the cryogenic biaxial strain device
- Perform x-ray diffraction, transport and/or optical measurements
- Participate to large-scale instrument experiments
- Analyze data, and synthesize them for dissemination (scientific articles, conferences)
- Participate to regular meetings of the project, as well as conferences

**Skills**

The applicant should hold a PhD degree in material science or condensed matter physics, and particularly, experience in x-ray diffraction and associated data treatment methods. Knowledge about mechanical deformation of materials and/or transport measurements and/or use of cryogenic fluids will be appreciated. Experience in large-scale instruments will also be an asset.

This project is part of an international consortium, so team work capabilities are necessary to interact with other group members and good communication skills to present results in regular meetings.

**Context of work**

The applicant will work in the LUTECE team of LPS, a joint CNRS/Paris-Saclay University laboratory in Orsay, France ([www.lps.u-psud.fr](http://www.lps.u-psud.fr)). This group is interested in the link between atomic and electronic structure of condensed matter systems, using x-ray diffraction and spectroscopic methods (<https://equip2.lps.u-psud.fr/lutece>). Most experiments/developments of this project will be performed in the laboratory but frequent experiments at large-scale instruments are foreseen.

This project is part of an international ANR project, and implies interaction with the international team through regular meetings.

**Constraints and risks**

The project requires the use of x-rays, cryogenic fluids and large-scale instruments. The working environment fulfills all protection requirements. Dedicated formation will be provided if necessary.