2 years Post-Doc Position in the SPIN Team

at the Institut Jean Lamour (IJL), Nancy, France

Super-spintronics

Context and Objectives

Global digital data that is generated annually is now counted in zettabytes, or trillions of billions of bytes, equivalent to delivering hundreds of millions of books of data every second. The amount of data generated continues to grow because of the development of "Internet of Things", "Autonomous Driving", "Artificial Intelligence" etc… If the same technologies continued to be used, all of the current global electricity consumption would be devoted to data storage by 2040.

Spintronics (spin-based electronics) outperforms electronics in many applications, and provides novel functionality. Further possible improvements include the continued reduction of Joule heating, the enhancement of spin signals, their lifetime, and propagation lengths, as well as new spin detection schemes. The post-doc position aims to address these challenges by combining superconductivity and spintronics. In particular, through the generation and propagation of spin-polarized quasi-particles and/or equal spin-triplet Cooper pairs in superconductor-based spintronics devices, the goal is to quench Joule heating, and extend the quantum coherence of spin states. Although the past 15 years have been rich in theoretical predictions, many fundamental and technical issues still hinder the rise of what is now called *superspintronics*. The post-doc will work on original hybrid heterostructures mixing superconductive and magnetic layers in order to reliably and efficiently generate spin-polarized quasi-particles or equal spin-triplet Cooper pairs, as well as new techniques to detect and manipulate both spin-polarized quasi-particles and triplet Cooper pairs, down to the nanometer and picosecond scales. To this end, we will leverage the experience and recent results of the consortium members. This will place the PEPR SPIN community in a favorable position in this emerging field.

Candidate profile

The post-doctoral candidate needs a Ph.D. in Physics or a related field with, if a possible, a concentration in Solid State Physics / Spintronics. Experience in ultra-high vacuum technics for sample growth such as MBE and Sputtering and/or experience the characterization of GHz or THz magnetization dynamic would be appreciated. Expected qualities for the candidate: creativity, autonomy, scientific rigor, the willingness to work in a team. Proficiency in English speaking and writing is required to interact in our international environment; French is optional, although welcomed.

Research environment

The Institute Jean Lamour (IJL) is a joint research unit (UMR 7198) of CNRS and Université de Lorraine. Focused on materials and processes, science and engineering, it covers: materials,

metallurgy, plasmas, surfaces, nanomaterials and electronics. It regroups 183 researchers/lecturers, 91 engineers/technicians/administrative staff, 150 doctoral students and 25 post-doctoral fellows. IJL is located downtown in Nancy (France), a charming and cosmopolitan city at only 1h30 from Paris and Luxembourg by train, where the 50 000 students compose the fifth of the population (https://www.nancy-tourisme.fr/en/experiences).

At IJL, the post-doctoral candidate will be part of the SPIN team (https://www.spin.ijl.cnrs.fr) which has an international recognition in materials design, nanomagnetism and spintronics. The team gathers 15 permanent staff members (CNRS and Faculty) and about 30 PhD students and post-docs from more than 10 nationalities. He/She will specifically collaborate on the daily basis with a CNRS researcher, two professors, and two phD students, as well as collaborate with groups in England and Germany. The position is partly funded by the French PEPR SPIN community which offers many collaboration possibilities.

He/she will work with an engineer to grow his/her samples by Molecular Beam Epitaxy and/or PVD and benefiting from the many in-situ analysis connected to the " UHV TUBE Daum" instrument. IJL also offers cutting edge instruments for complete and high resolution structural analysis (X-ray diffraction, Atomic Force Microscopy, Transmission Electron Microscopy). The post-doc will be in charge of the characterization of static and dynamical spin transport in hybrid stacks including superconductive layer(s) and magnetic layer(s) using SQUIDs, transport measurements, FMR instruments and ultra-fast laser experiments, for temperature and field dependence down to 2K and up to 14T.

TERMS AND TENURE

The duration of the postdoc position is **24 months.**

The target start date for the position is **the spring semester of 2025,** with some flexibility on the exact start date.

HOW TO APPLY

Applicants are requested to submit the following materials:
- A cover letter applying for the position
- Full CV and list of publications
- Recommendation Letters (ideally two)

Deadline for application is ***until the position is filled***. Applicants will be interviewed by an Ad Hoc Commission.

Applications are only accepted through email. All document must be sent to thomas.hauet@univ-lorraine.fr and stephane.mangin@univ-lorraine.fr