17 April 2026

Dual-PhD offer

Tohoku University + Université de Lorraine

Manipulation of magnetism with picosecond current pulses

General information

Workplace: Nancy, France
Type of contract: PhD contract, dual-degree Univ. of Lorraine (France) + Tohoku Univ. (Japan)
Period: October 2026 – October 2029 (few month flexibility)
Proportion of work: Full time
Desired level of education: Master's in physics, material science, electronics or optics

Missions / Activities

Join a pioneering joint-PhD project focused on using **picosecond-wide electrical current pulses** to control magnetization in novel magnetic heterostructures. Building on groundbreaking work at IJL [1] and Tohoku University [2,3], you will explore:
-Antiferromagnetic materials (e.g., Mn_3Sn) for ultrafast memory and computing applications.
-Size-dependent effects in ferro-, ferri-, and antiferromagnets, addressing scalability and efficiency in next-gen spintronic devices.
-Alternate spin-orbit torque geometries (x-, y-, z-types) in the picosecond regime, aiming to enhance speed and efficiency in magnetic memory technology.

This project combines cutting-edge pulse generation and advanced magnetic characterization, from the two groups at the University of Lorraine (France) and Tohoku University (Japan). The student will be trained on a femtosecond laser bench, and learn extensively about aspects such as spintronics, ultrafast optics, electronics material growth and sample fabrication. During his PhD he will establish a new collaborative research line between the two universities, and will spend time in both labs.

References

[1] K. Jhuria, … and J. Gorchon *Nat. Elec*. 2020, E. Díaz, … and J. Gorchon *Nat. Nano*. 2025
[2] J. Han, … and S. Fukami *Nat. Phys*. 2024, Y. Takeuchi, … and S. Fukami *Science* 2025
[3] Fukami et al., *Nat. Nano.,* 11, 621–625 (2016)

Keywords:
magnetism, terahertz, spintronics, antiferromagnetism, ultrafast optics, high-frequency electronics

Work context

The PhD student will work under the supervision of Dr. Jon Gorchon within the SPIN Team research group at Institut Jean Lamour whose topics range from the development of innovative materials for implementation in spin electronics devices, to the development of magnetic sensors and the fundamental study of physical phenomena related to magnetism.
The project will be in tight collaboration with the group of Pr. Shunsuke Fukami (co-advisor), from Tohoku University (Sendai, Japan). The student will have to spend time (about 12 months) and follow courses at Tohoku University in order to validate the dual degree.

Skills

Knowledge of electromagnetism and solid-state physics, including optics, magnetism and electronic transport properties is essential. Experience with electronics and optics instrumentation, sample growth and/or clean-room would be ideal.
Knowledge of English (oral and written) is important and knowledge of French or Japanese would be an advantage.
As an enthusiastic researcher you are always trying to understand and learn, you enjoy working in an international team, and have a taste for both experimental and theoretical work.
You are ready to spend around about 12 months in Japan within the duration of the PhD project.

About Institut Jean Lamour

The Institute Jean Lamour (IJL) is a joint research unit 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.
Partnerships exist with 150 companies and our research groups collaborate with more than 30 countries throughout the world.
Its exceptional instrumental platforms are spread over 4 sites; the main one is located on Artem campus in Nancy.

Application

Applicants are invited to submit:
- Curriculum Vitae
- Letter of motivation
- Academic grades for the last couple years
- Scan of passport
- Recommendation letters or contacts (if possible)

Applications will be accepted until 16th of May 2026. Interviews will be carried during the month of May. A decision should be made end of May/early June.

Applicants should have finished their master's degree before the beginning of the expected PhD start date. A diploma will be required to sign the contract.

Send the application to:
J. Gorchon (CNRS researcher): jon.gorchon@univ-lorraine.fr