

Postdoctoral and R&D positions at SPINTEC to work on unconventional computing and smart communication applications

CONTEXT

In the frame of different French and European collaborative research projects, addressing spintronic innovations for a more frugal, agile and sustainable digital technology, SPINTEC has **several postdoctoral and R&D openings for a duration of up to 24 months**. The work will be carried out within the RF Spintronics and Artificial Intelligence teams of SPINTEC, in close collaboration with other PhD students and postdoctoral fellows as well as researchers from the different research teams of SPINTEC.

The candidate will carry out and coordinate in full autonomy the materials stack design and characterization, the nanofabrication and the electrical characterization of the spintronic nano-devices in relation with the specific research goals. These target probabilistic and unconventional computing as well as smart communication applications based on state-of-the-art magnetic tunnel junctions coupled into interacting networks. The ultimate goal will be to develop small scale demonstrators with improved performances and reduced power consumption. This requires mastering well the material properties as well as the underlying physics concepts to push the frontiers of the different application areas.

POSITION

The mission of the candidate can be twofold depending on the candidate's further career plan: either with **emphasis on materials development and device nanofabrication** or with **emphasis on device characterization based on advanced and more complex high frequency measurement techniques** and circuits.

For the **device fabrication**, the candidate will use our state-of-the-art sputtering systems as well as established nanofabrication processes based on our clean room facilities including electronic, laser, Deep Ultraviolet (DUV) & Ultra-violet (UV) lithography, resist chemistry, material deposition by evaporation, sputtering, Atomic Layer Deposition (ALD), Ion Beam Etching (IBE), Reactive Ion Etching (RIE) and Chemical Mechanical Polishing (CMP). The challenge here is to adapt the process to build complex networks of interconnected devices and to develop devices on top of CMOS circuits. The candidate will carry out standard inspection and characterizations throughout the processes using optical and electron microscopy, profilometry and ellipsometry techniques. The materials characterization prior to nanofabrication includes VSM, MOKE and FMR. After nanofabrication, devices will be tested on wafer level as well as individually to assess their performance quality and provide feedback to the materials and nanofabrication process. Priority will be given to candidates bringing in previous clean room experience.

The **device characterization** targets different application areas, based on two types of magnetic tunnel junctions: (i) stochastic magnetic tunnel junctions, where the free layer properties are tuned such that its magnetization orientation switches stochastically due to thermal activation between two equilibrium states. The stochastic switching can be tuned by field and spin polarized currents and will be influenced by mutual coupling, with the goal to build up artificial neural networks. Novel algorithmic approaches will be tested to train the network; (ii) spin torque nano-oscillators that convert a DC signal into a microwave voltage signal. In conjunction with their non-linear dynamical properties these devices are ideal for the development of unbiased random bit streams needed in probabilistic computing and secure communication applications.

To apply, please send a CV and motivation letter to:

EBELS Ursula (ursula.ebels@cea.fr) and Philippe Talatchian (philippe.talatchian@cea.fr)

SPINTEC

SPINTEC is one of the leading spintronics research laboratories in the world. It's mission is to act as a bridge between academic research and technological applications in the field of spintronics, which is both a very rich source of new condensed-matter-magnetism physics, and recognized today as one of the major innovation routes for future microelectronics industries, information and communication technologies, sensing technology and bio-applications. As such, we are at the cross-road of nanosciences and technology, conducting our activities in collaboration with academic and industrial partners from all around the world. As such, the laboratory's markers are not only high-rank publications and communications in international conferences, but also the creation of a consistent patent portfolio and the implementation of relevant functional demonstrators and device nanofabrication. The laboratory has launched four start-ups in the last 15 years, with a few others in the pipes. This synergy has placed SPINTEC at the forefront of spintronics research, with a crucial contribution to the discovery of new key fundamental effects. These underpin the emergence in the industry of spintronic memories called MRAM, on which the laboratory holds key patents.

The research activity of SPINTEC covers the whole spectrum from theory to demonstrators, including the development of innovative functional materials, the experimental validation of novel concepts in physics, up to the realization of test structures. Academic research concerns spinorbitronics, spintronics in 2D materials, spin-torque driven magnetization dynamics and magnonics, antiferromagnetic spintronics, and exotic spin textures. The application-oriented topics are: magnetic random-access memories, artificial intelligence, microwave components, design of spin-based integrated circuits, sensors, and biotechnology. For more information check out our website www.spintec.fr.

Grenoble is a cosmopolitan city at the heart of the French Alps. One out of five people living there works in the field of research, innovation or higher education. In addition, Grenoble offers various cultural and sportive opportunities all year round.

