Post-Doc Position (2 years contract)

A postdoctoral position is available for 2 years in the framework of “the Materials World Network: Novel magnetic materials For spIn torquE physics aNd DeviceS (FRIENDS) described below. Although he or she will work with the IJL partners involved in the FRIENDS project as well as in collaboration with the other partners UCSD and IEF for specific experiments (e.g. FMR measurements and magnetization reversal dynamics). He or she will join the “nanomagnetism & spintronic “ team at IJL (http://www.lpm.u-nancy.fr/nanomag/). His or her main work will consist in growing samples using state-of-the-art MBE and characterize the magnetic and magnetoresistive properties of the materials and structures. He or she will study electrically connected devices to quantify the magnetoresistance effects. Measurement of the spin transfer torque effect in nanodevices will be the final goal. To that last purpose, he or she will benefits of the large pool of electrical measurement set-ups at IJL. The applicant must have a PhD in Physics, materials science or related discipline. A previous experience in the field of magnetism is highly desirable and will be valued.

Summary of the FRIENDS project:

ANR/NSF Project “FRIENDS” focuses on the study of the interactions between spin-polarized current and novel magnetic materials at the nanoscale. Research opportunities include: fundamental issues of spin-injection, spin-manipulation and spin-detection, novel materials, new device architectures, characterization at the nanoscale, fundamental understanding of damping, collective and resonant spin dynamics in confined geometries and in complex composite materials. Investigation of such complex and fascinating phenomena requires the combined efforts of materials synthesis, device fabrication, materials characterization with high spatial and temporal resolution, and theoretical understanding. These fundamental materials issues are at the forefront of our scientific mission and hold the promise to impact a broad range of technologies and the training of students in nanoscience and nanotechnologies.

The main scientific focus of this proposal will be on novel nanostructured magnetic materials for spintronics and, more precisely, for spin transfer torque based memory and spin logic devices. While the general concept of spin transfer torque has been clearly demonstrated the vast majority of research has been on “conventional” transition metal alloys (e.g. permalloy (NiFe) and CoFe). These materials are typically soft magnetic materials where the anisotropy is controlled by the device shape. However, it is clear that such materials are far from optimal for understanding the underlying physics of spin-torque and its application to spin-transfer devices. The aim of the research will be on developing novel magnetic films, wires and nano-elements for which the intrinsic materials parameters such as intrinsic defects, magnetic anisotropy, damping constant, spin polarization and magnetization can be tuned over a large range, controlled and optimized for spin-transfer devices. This will enable testing the basic physics of spin-transfer, including the magnetization dynamics and switching time as well as the threshold currents for current induced excitations, which depend sensitively on the intrinsic materials parameters. This will further allow the materials and device architectures to be optimized for spin-torque applications.

In such a competitive field, the pooling of expertise is essential and an international network of collaborators is required. Such collaborative research provides an opportunity for world-class research and the education of the next generation of materials scientists. Indeed this proposal builds on internationally recognized magnetic materials and spinptorque devices strengths of the participants from IEF (Orsay), IJL (Nancy) and UCSD (San Diego) who have successfully collaborated in the past. The past collaborations have resulted in co-organized workshops, visits between laboratories, students exchange and several high-profile publications. The funding of this proposal will allow a continued and expanded collaboration of this team. As a final objective, this project is expected to develop a strong and active collaboration between leading research labs in the US and France.

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