PhD opening – sept 2021

Tuning magnetic anisotropy for magnetoresistive sensors optimisation

Context:

Using nanoscale magnetic thin films and multilayers, and controlling the magnetic anisotropy and the angle between magnetization and electrical current, it is possible to design on-purpose high sensitive magnetic sensors based on the AMR (Anisotropic Magnetic Resistivity) effect. Thanks to a fruitful and long-lasting collaboration between GREYC Research center in CAEN (France) and IMDEA Nanociencia in Madrid (Spain), and as part of the outcomes of the H2020 European project ByAxon (2017-2020 - http://www.byaxon-project.eu/), we have developed magnetic sensors based on single layer $La_{0.7}Sr_{0.3}MnO_3$ (LSMO) oxide thin films, with a magnetic detectivity as low as few 100 $pT/Hz^{1/2}$ in the white noise region (above 100 Hz), and in the order of $1nT/Hz^{1/2}$ at low frequency (1 Hz).

Subject:

The Ph'D work aims at improving and/or tailoring the sensitivity, the detectivity and the spatial resolution of the sensing device by designing new geometries, using combination of materials with both in-plane magnetic anisotropy (IMA) and perpendicular magnetic anisotropy (PMA), adding new features like a flux focuser, and exploiting different combination of materials, like ferromagnet (FM)/heavy-metal (HM) multilayers.

The objectives of the Ph'D work are thus:

- to enhance the detectivity of single layer sensors by tailoring IMA and AMR of epitaxial LSMO thin films fabricated by pulsed laser deposition (PLD)
- to study size effect and spatial resolution
- to fabricate multilayer systems based onto Co/Pt with tailored PMA and spin-orbit driven magneto-transport response
- to design and realize a new device geometry incorporating a flux focuser to improve the MR sensitivity of the sensors

It is planned that the Ph'D student will stay two periods of 7 to 9 months in each laboratories. In addition to these alternating periods, travels between laboratories during these periods will also be possible for specific purposes, experimental requirements, etc. This work will benefit from complementary expertise from GREYC and IMDEA Nanociencia and complementary facilities, such as temperature controlled magnetoresistance measurement setup, longitudinal MOKE and OBIRCH imaging, low frequency noise measurement setup, near-field microscopy, patterning down to micron size, ion-beam milling) at GREYC, or simultaneous MR and vectorial MOKE measurements as function of XPS-UPS (X-ray or Ultraviolet Photoelectron Spectroscopy) at IMDEA Nanociencia.

Perspectives :

This Ph'D thesis will explore new concepts for magnetic field sensor based on the magneto-resistive response in low dimensional magnetic structures based onto perovskites with on-purpose designed magnetic anisotropy, with clear outputs in the domains of biomedical, low-energy consumption applications such as muscular or neuronal activities detection as already targeted in ByAxon.

The Ph'D work will provide to the candidate a strong experience in sensors design and characterization, as well as expertise in measurements techniques, fabrication of sensors using clean room facilities and Data analysis.

Required competences:

The candidate must have a background in applied physics and electrical engineering. Specific knowledge in magnetism, materials science or instrumentation will be appreciated. Experience or competences as an experimentalist are expected. The candidate should have an independent and efficient working attitude. He/She will participate in the communication of the results in the frame of international meetings, perform experiments by partners and must therefore have a good level in English.

Contract terms:

Location: **GREYC (CNRS UMR6072) – ENSICAEN – Univ. Caen Normandie (France)**

Start: **September 2021** (tentative)

Duration: **36 months**

Closing date for applications: **31/05/2021**

Net salary: **about 1400 €/month**

The selection of the candidate will follow a continuous process starting in April process. The candidate may thus be selected before the closing date

Contact:

Please send a CV, a motivation letter and a recommendation letter to

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