SPINTEC is opening a two years post-doctoral position on modelling of all optical switching using light carrying orbital momentum

The manipulation of magnetization by ps or fs light pulses has become a very exciting topic nowadays opening routes towards ultrafast magnetization control. To date, most of the light-spin interaction studies made use of spin angular momentum carried by the light (Fig.1(a)), either for control or probing. The proposed position is part of an ANR project in which we consider a yet unexplored opportunity, offered by the tremendous recent progress in the shaping of exotic light beams in 3D in the visible and XUV. For instance, ultrashort light beams carrying orbital angular momentum (OAM) (Fig.1(b)), which corresponds to featuring a helical wave front, are available today in the Vis-IR and XUV spectral ranges. Theory predicts that structured materials have different optical properties for beams of opposite OAM, yielding novel forms of helicoidal dichroisms (HD) (different from the regular circular dichroism), but applications remain scant and specific. Likewise, the inverse effect, i.e. the capability of a beam carrying OAM to modify the magnetization of a material, is still a completely open question. The overall objective of the ANR project is to set a universal framework describing the interaction of structured light and magnetic materials, in particular those with non-uniform structures.

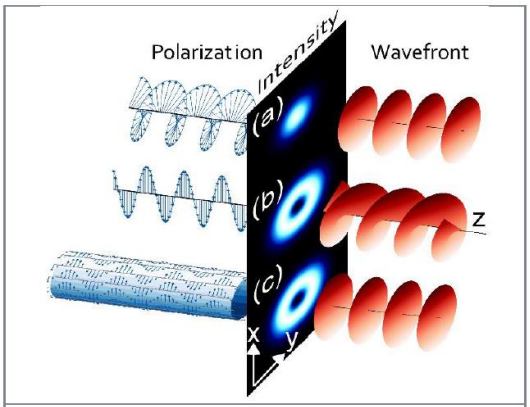

Fig. 1: Examples of simply structured light beams, with (a) spin angular momentum, (b) orbital angular momentum, and (c) azimuthal polarization. Z is the propagation axis. Blue arrows are the polarization vectors (electric field), blue maps represent the intensity in a given transverse plane, and the wavefronts are shown in orange.

In this frame, the post-doctoral position open at SPINTEC will be focused on the modelling of the ultrafast magnetization dynamics induced by helicoidally polarized light. For the moment, the underlying physics needs to be developed. Effects such as heating dynamics (3 temperature model) and torque exerted by light with OAM on magnetization will have to be included in Landau-Lifshitz-Gilbert (or Bloch) equation describing the magnetization dynamics. Simulations will then be carried out and confronted to the experimental results from our partners (CEA-Saclay/Lidyl, SOLEIL, LCF Palaiseau, INSP Paris) with the purpose to get a complete picture of this particular interaction between magnetization and light carrying OAM. The post-doc is expected to have a good ability in coding, good experience in micromagnetic simulations, and enjoy team work at SPINTEC (www.spintec.fr).

Applicant should send their CV including publications list and at least one letter of recommendation to :

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