Spin transport in 2D nanocrystals

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The rise of spintronics has provided huge momentum to magnetic thin films studies, both from the basic and applied points of view. Motivated by the perspective to overcome power, performance, and architectural bottlenecks of CMOS-based devices, spin-based devices have been listed as one of the major contenders for technologies beyond CMOS in the International Technology Road Map. These high expectations are accompanied by new challenges related to the industrial needs for downscaling. Hence, there is need to explore and understand new intrinsic and transport properties of sub-100 nm nanostructured magnetic materials, together with the key role played by the contact interfaces in the overall device properties.

Nanoparticles offer exciting opportunities for technologies at the interfaces between chemistry, physics and biology. When a magnetic material is made extremely small, below the 100nm limit, it may acquire a single magnetic domain structure attractive for electronics applications. Ultimately, the emergence of quantum phenomena at such reduced length scale may provide new properties to nanoparticles thin films, among which an enhanced sensitivity promising for detection and data storage as we recently demonstrated in our group in hybrid organic/inorganic nanoparticle networks and nanocrystals assemblies [1][2][3].

The objective of the PhD student will be to study the spin and charge electronic transport properties of unique II-VI and IV-VI metal chalcogenide based 2D semiconducting nanocrystals of epitaxial quality. He/she will also explore the spin transport properties of 2D/0D layered nanocrystals of perovskite manganites (LSMO) with expected record spin polarization, already confirmed by preliminary first results in our group. The PhD student will benefit of two on-going collaborations with French partners, both being international recognized experts in their field, with already very stimulating first results with our group [1]. Depending of the candidate skills and interests, computer modelling of the nanocrystals electronic properties will be performed in collaboration with colleagues of the theoretical group of IPCMS, in order to get a deeper fundamental insight into the properties of the nanocrystals investigated experimentally during this PhD project.

The successful *candidate will have a pronounced interest for experimental physics,* with ideally a first experience in nanofabrication in cleanroom environment, and/or electrical and magnetic measurements at low temperatures. Good knowledge of solid state physics and spintronics are necessary, and some experience in modelling is desirable but not mandatory. Good English writing and speaking skills are highly appreciated. The student will evolve within the *Nanodevice group* of IPCMS [4], in an international team, and will have the opportunity to interact with several Researchers, Master students and PhD students.

References :
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[2] J.-F. Dayen, E. Devid, M.V. Kamalakar, (…) B. Doudin, S. J. van der Molen,
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[3] M. Pauly, J.-F. Dayen, D. Golubev, J.-B. Beaufrand, B. P. Pichon, B. Doudin, S. Bégin-Colin,
Small 8, 108–115 (2012)
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