

Project title: Layered magnetic structures with tuneable anisotropy and interfacial Dzyaloshinskii-Moriya interaction studied by ab-initio simulations (theoretical project)

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Webpage of group: <http://www.ifpan.edu.pl/sdvs/pl/on3.4.html>

Background: Most of bulk materials showing magnetic ordering can be considered in terms of Heisenberg-like exchange interactions, being of electrostatic nature. The electrons of the neighbouring atoms interact each other directly, respecting the Pauli exclusion principle that determines their allowed quantum states. Such materials exhibit spontaneous magnetisation in the absence of magnetic field and are called ferromagnets. A different and more complex spin alignment can be observed in ultrathin magnetic layered structures due to the presence of enhanced perpendicular magnetic anisotropy (PMA) and Dzyaloshinskii-Moriya interaction (DMI). DMI can emerge at interfaces between ferromagnetic (FM) and heavy metal (HM) slabs owing to broken mirror symmetry. Currently, the artificial layered structures with appropriate configuration are very intensively investigated as they offer wide tuning possibility of desired magnetic properties. In layered FM/HM systems desired magnetic configuration can be achieved by optimization of relation between PMA and DMI. Our group possesses a deep and enhanced experience, gained during the last twenty years, in PMA research in such type structures, containing ultrathin Co component layers.

Aim: The PhD student will perform relativistic ab-initio calculations using codes appropriate to study the interface effects between layered magnetic structures. We will extract microscopic effective parameters, such as anisotropy, magnetic exchange and Dzyaloshinskii-Moriya interaction and use them to elucidate the role of various mechanisms and the stability of the several magnetic phases. Furthermore, there will be a strong connection between the theoretical studies and experimental teams. This project will be realized in collaboration (consortium) with Laboratory of Magnetism at the Department of Physics of Magnetism, University of Białystok (Poland).

Requirements: MSc in Physics is required. To perform the numerical simulations we will use modern supercomputers. The project requires a willingness to learn numerical skills which we will gladly help you with. Proficiency in spoken and written English is required. Prior experience in Density functional theory is highly desired.

Funding: Scholarship: grant funding of 5000 PLN per month, before subtracting obligatory employer and employee social security contributions (~15%), for 48 months. Afterwards: standard Polish PhD scholarship about 3240 PLN per month (750 EUR per month). Additional bonus to the salary is provided for every publication in medium-high rank journals.

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Deadline:

Please contact us writing as object of the email "Layered magnetic structures - Ph.D. application - theoretical project". We will consider applications until 29 December 2020. Interview for the short-listed candidates will start immediately after the previous date.