SEMINARIUM Z MAGNETYZMU I NADPRZEWODNICTWA

Uprzejmie zawiadamiamy, że w **środę**

8 marca 2023 r., o godz.10:00

odbędzie się seminarium **on-line (link podany jest na stronie IF PAN)**,

na którym

mgr Amar Fakhredine

(Instytut Fizyki PAN)

wygłosi referat na temat:

"Huge Dzyaloshinskii-Moriya interactions in Re/Co[n]/Pt thin films"

In this work, we study the Dzyaloshinskii-Moriya interaction (DMI) in the modeled Re/Co[n]/Pt chiral multilayered system using DFT calculations and report its interfacial and additive character. DMI is an antisymmetric indirect exchange interaction occurring between two spins $\vec{S}_i$ and $\vec{S}_j$.
It arises also in the systems with broken inversion symmetry e.g. at the interfaces [1], in the presence of spin-orbit coupling. In particular, it is expected in heavy metal/ferromagnet asymmetric layered structures. This interaction is fundamental for the appearance of complex magnetic structures, e.g. skyrmions which are promising for the industry of spintronic applications that offer ultra-small, ultrafast, and low power devices. The control of the DMI strength in multilayered structures allows us to manipulate the different sizes and stability of these magnetic objects [2].
The total DMI strength (d^{tot}[meV]) in the Re/Co[n]/Pt chiral multilayered system was calculated from the difference in energy between clockwise and anticlockwise configurations of the Co magnetic spin spirals which were further used to determine the micromagnetic DMI[3]. The investigated systems were composed of 5 atomic monolayers (ML) of Pt and 5 MLs of Re sandwiching the Co layer with a tuneable thickness ranging from 1 to 6 MLs. The micromagnetic DMI named as D was found as high as 5.78 mJ/m2 for 3 layers of Co which is a considerably large value.
The layer resolved DMI strength at each Co layer shows the highest contributions from the two interfaces of the systems, namely Re/Co and Co/Pt, which add up to produce a huge additive outcome confirming that the DMI is an interfacial effect [4]. This also explains the dependence of the micromagnetic DMI on the number of Co layers since it appears due to the electron hybridization between magnetic moments in the 3d Co atoms and the strong spin-orbit coupling in 5d states of Pt and Re atoms.

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[1] H. Soumyajyoti, S. Meyer, A. Kubetzka, and S. Heinze. Physical Review B 104, no. 18 (2021): L180404.
[2] Morshed, Md Golam, K. H. Khoo, Y. Quessab, J.W. Xu, R. Laskowski, P. V. Balachandran, A. D. Kent, and A. W. Ghosh. Physical Review B 103, no. 17 (2021): 174414.
[3] Yang H., Thiaville A., Rohart S., Fert A. & Chshiev M. Physical Review Letters 115, 267210 (2015).
[4] S. K. Jena, R. Islam, E. Milińska, M. M. Jakubowski, R. Minikayev, S. Lewińska, A. Lynnyk, A. Pietruczik, P. Aleszkiewicz, C. Autieri and A.Wawro. Nanoscale 13, no. 16 (2021): 7685-7693.

Serdecznie zapraszamy

Roman Puźniak
Andrzej Szewczyk
Henryk Szymczak