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Graphene/Cobalt interface for spin-orbitronics

A major challenge for future spintronics is to develop suitable spin transport channels with superior properties such as long spin lifetime and propagation length. Graphene can meet these requirements, even at room temperature [1]. However, the development of all-graphene spintronic devices requires that, in addition to its passive capability to transmit spins over long distances, other active properties are incorporated to graphene. The generation of long range magnetic order and spin filtering in graphene have been recently achieved by molecular functionalization [2,3] as well as by the introduction of giant spin-orbit coupling (SOC) in the electronic bands of graphene [4]. On the other side, taking advantage of the fast motion of perpendicular magnetic anisotropy (PMA) chiral spin textures, i.e., Néel-type domain walls (DWs) and magnetic skyrmions, can satisfy the demands for high-density data storage, low power consumption and high processing speed [5].
Here, we report on high quality, epitaxial Graphene/Co(111)/Pt(111) stacks grown on (111)-oriented oxide crystals, characterized by STM, LEED, STEM, Kerr Magnetometry, XMCD and Kerr Microscopy, that exhibit enhanced PMA for Co layers up to 4 nm thick and left-handed Néel-type chiral DWs stabilized by interfacial Dzyaloshinskii-Moriya interaction (DMI) localized at both graphene/Co and Co/Pt interfaces with opposite sign [6]. While the DMI at Co/Pt side is due to the intrinsic SOC [7], the sizeable DMI experimentally found at the gr/Co interface has Rashba origin (Figure 1) [6]. The active magnetic texture is protected by the graphene monolayer and stable at 300 K in air, and, since it is grown on an insulating substrate, amenable to transport measurements [8].

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Figures

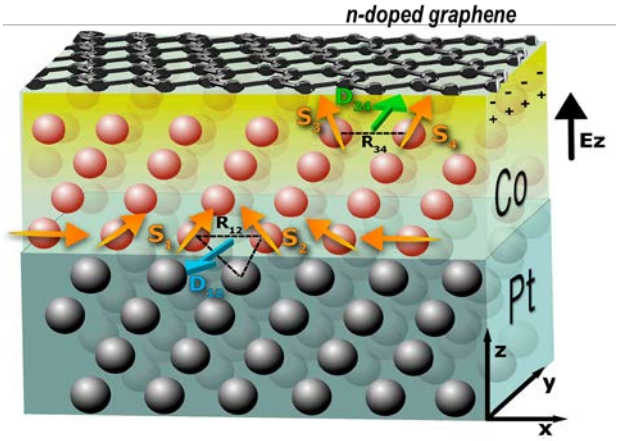

Figure 1: Sketch of the interplay between Spin-Orbit Coupling-induced Dzyaloshinskii Moriya Interaction (DMI) at the Co/Pt and opposite Rashba-type DMI at the gr/Co interfaces [6].