Unravelling Dzyaloshinskii-moriya interaction and chiral nature of graphene/cobalt interface

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The development of room temperature graphene-based spintronic devices requires that, in addition to its passive capability to transmit spins over long distances and spin lifetime [1], other active properties are incorporated to graphene. Long range magnetic order and spin filtering in graphene can be achieved by molecular functionalization [2,3] as well as by the introduction of giant spin-orbit coupling (SOC) in the electronic bands of graphene by intercalation of adequate metals [4].

Here, we report on high quality, gr/Co(111)/Pt(111) stacks grown epitaxially on MgO(111) crystals, characterized by XPS-UPS, LEED, STEM, Kerr Magnetometry, XMCD and Kerr Microscopy, that exhibit enhanced perpendicular magnetic anisotropy (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, the sizeable DMI experimentally found at the gr/Co interface has Rashba origin [5]. 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 [5].

The discovery of a strong DMI at the Graphene/Cobalt interface is a crucial step to promote 2D materials spinorbitronics based on the electrical control of the transport and manipulation of topologically protected magnetic structures, such as chiral domain walls and skyrmions [6].

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