As a promising topologically protected swirling spin configuration, skyrmion is promising for non-volatile data storage with high-density and low-power. A competition among Dzyaloshinskii−Moriya interaction (DMI), Heisenberg interaction, dipolar interactions and Zeeman energy results in different spin states. The interfacial Dzyaloshinskii−Moriya interaction (iDMI) is intimately related to the prospect of superior DW dynamics and the formation of magnetic skyrmion. Ever since it was discovered by Dzyaloshinskii and Moriya in 1958 and 1960 [1, 2], DMI in structures with broken inversion symmetry has attracted significant interest of publics.

The DMI effect can be regarded as an effective field , which takes the form . The and are neighboring spins at site 1 and site 2 and is the corresponding Dzyaloshinskii–Moriya vector. Except for the bulk DMI in bulk chiral magnet, the existence of spin-orbital coupling (SOC) and inversion symmetry breaking at material interfaces will induce an iDMI. Considering the iDMI, can be written as [3] , where both and are unit vectors, pointing to the perpendicular direction of the film surface and pointing from site 1 to site 2. For , the iDMI favours anticlockwise rotations from to . on the contrary, lower energy for clockwise magnetization rotation corresponds to .

There are mainly three types of interfaces which induce strong DMI. The first and most common type is interface between ferromagnetic (FM) layer and heavy metal (HM) layer with strong SOC. The relative position of the 3d states in the magnetic transition metal and the 5d states in the heavy metal is of great importance. The second type is FM/oxide. A large charge transfer and a strong interfacial electric field are induced at oxide interface compensate the small SOC of the atoms at the interface [4–6]. It was also found large DMI at FM/graphene interface on account of Rashba effect.

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