**Spintronics based on 2D ferromagnetic materials and Van der Waals heterostructures**

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Introduction. **Van der Waals (vdW) ferromagnetic materials are rapidly establishing themselves as effective building blocks for next generation spintronic devices. When layered with non-magnetic vdW materials, such as graphene and/or topological insulators, vdW heterostructures can be assembled (with no requirement for lattice matching) to provide otherwise unattainable device structures and functionalities.**

Aims. To explore various spintronic devices based on Van der Waals heterostructures.

Methods. Van der Waals stacking, electron and spin transport

Results. We report a hitherto rarely seen antisymmetric magnetoresistance (MR) effect in van der Waals heterostructured Fe3GeTe2/graphite/Fe3GeTe2 devices. Unlike conventional giant magnetoresistance (GMR) which is characterized by two resistance states, the MR in these vdW heterostructures features distinct high, intermediate and low resistance states. This unique characteristic is suggestive of underlying physical mechanisms that differ from those observed before. After theoretical calculations, the three resistance behavior was attributed to a spin momentum locking induced spin polarized current at the graphite/FGT interface.We also report the spin orbit torque devices based on vdW heterostructures.

Discussion. Our work reveals that ferromagnetic heterostructures assembled from vdW materials can exhibit substantially different properties to those exhibited by similar heterostructures grown in vacuum. Hence, it highlights the potential for new physics and new spintronic applications to be discovered using vdW heterostructures.

Conclusion. Various spintronic devices with unseen properties can be fabricated based on vdW heterosturcure.

**References**

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