Van der Waals spintronics with magnetic 2D crystals

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Abstract

It has been recently discovery that layered ferromagnetic compound, such as CrI_3, can be delaminated into 2D crystals that retain magnetic order down to the monolayer limit. This opens the venue both for interesting fundamental research [1] in quantum materials and exploration of new applications. In this talk I will present two types of Van der Waals device architecture that combine magnetic and non-magnetic 2D crystals. First, I will discuss the origin of the very large magnetoresistance observed in a tunnel junction with a spin-filter ferromagnetic barrier and graphite electrodes [2]. Second, I will propose a new in-plane spin valve where a graphene bilayer is sandwiched between two insulating ferromagnets[3]. Using both model Hamiltonians and DFT calculations we find that, when their spin orientation is antiparallel, a gap opens up at the Dirac point of the graphene bilayer.

Figures

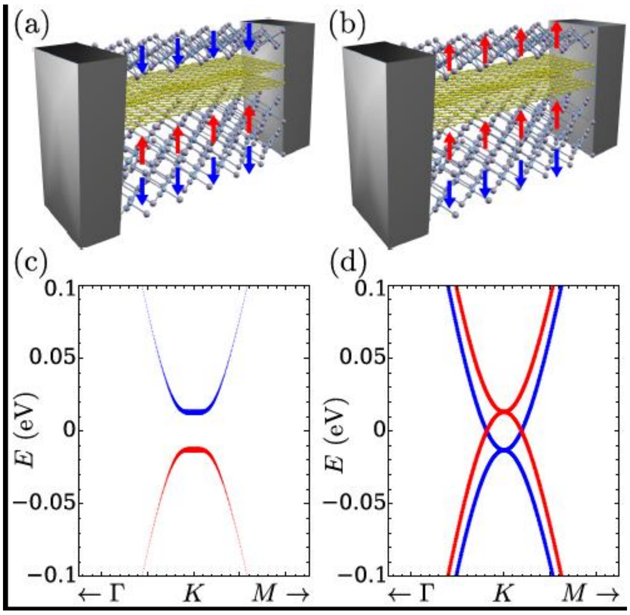

Figure 1: Scheme for current in plane graphene bilayer spin valve (See reference 3). A band-gap opens in the graphene bilayer when the spin orientation of the magnetic layers is antiparallel

References

[1] J. L. Lado and J. Fernández-Rossier, 2DMaterials **4** (2017) 035002
[2] D. R. Klein, D. MacNeill, J. L. Lado, D., E. Navarro-Moratalla, K. Watanabe, T.Taniguchi, S., P. Canfield, J Fernández-Rossier, Pablo Jarillo-Herrero. Arxiv:1810075
[3] C. Cardoso, D. Soriano, N. García, J. Fernández-Rossier, in preparation