Spin-orbit-coupling and topology in 2D: topological insulators, Rashba interfaces, TMD, etc

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The recent years have seen the emergence of novel phenomena induced in 2D electronic systems by spin-orbit coupling (SOC), symmetry breaking and topology effects [1]. For example, the locking between spin and momentum in the 2D states at topological insulator, Rashba or oxide interfaces gives rise to efficient conversions between spin and charge currents, in such a way that the implementation of such 2DEGs in spintronic devices is currently investigated for several types of applications. Similar effects have also be obtained with 2D materials such as the TMDs. As well, in nano-magnetism, quasi-2D SOC interactions at interfaces and topological effects stabilize magnetic skyrmions, which has led to the development of a very active new field of research.

I will present a review of the novel phenomena induced by SOC and topology in different types of 2D systems before describing recent attempts to obtain similar effects by the introduction of SOC interactions in graphene-based heterostructures.

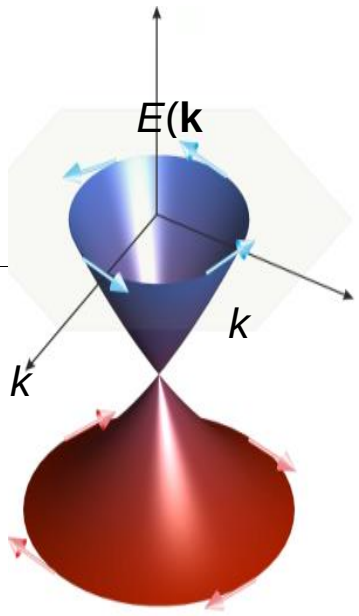

Figure 1: Dirac cone of the surface/interface states of a topological insulator with helical spin polarization of Fermi contour.

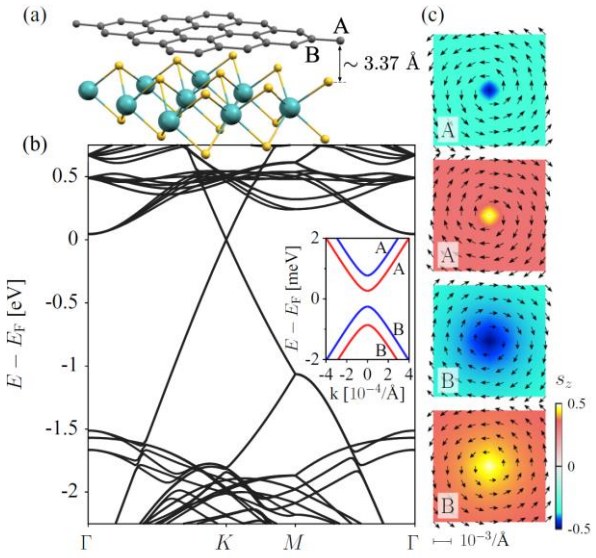

Figure 2: Dispersion curves and helical spin polarizations for MoS_2/graphene heterostructures (from Gmitra et al, PR B 92, 155403 (2015).

References

[1] For a recent review see: A. Soumyanarayanan, N. Reyren, A. Fert and C. Panagopoulos, Nature **539**, 509 (2016).