Abstract submitted to the
RESEARCH WORKSHOP ON SPIN, CHARGE, AND ENERGY CURRENTS IN NOVEL MATERIALS
October 1 - 7, 2017 Hvar, Croatia

Spin-orbit proximity effects in graphene on TMDCs[1]

Jaroslav Fabian
Department of Physics, University of Regensburg, 93040 Regensburg, Germany Submitted : 31-06-2017
Keywords : spintronics, graphene, proximity effects

Graphene and novel 2d materials offer new perspectives for spintronics [1]. Since graphene itself has no band gap, its spintronic applications will be limited as a highly efficient spin transfer channel. Instead, heterostructures of graphene and two-dimensional transition-metal dichalcogenides (TMDC) are emerging as systems in which both orbital and spin properties can be controlled by gating, thus offering a materials basis for spintronic applications. We have proposed that graphene on TMDCs can be used in optospintronics [2], since the direct gap of TMDCs allows optical spin orientation, with the successive transfer of spin into graphene. But these van der Waals stacks also yield interesting fundamental physics. We have recently shown that graphene on WSe2 exhibits an inverted band structure, which leads to protected pseudohelical edge states in graphene nanoribbons on WSe2 [3, 4], with a bulk spin-orbit gap of about 1 meV, which is giant when compared to 24 micro eV in pristine graphene. Even more fascinating is bilayer graphene on TMDCs, as the spin properties of this material can be controlled by gate voltage, creating a platform for spin-orbit valves and spin transistors [5].

[1] W. Han, R. Kawakami, M. Gmitra, and J. Fabian, Nature Nanotechnology **9**, 794 (2014).
[2] M. Gmitra and J. Fabian, Phys. Rev. B **92**, 155403 (2015).
[3] M. Gmitra, D. Kochan, P. Hogl, and J. Fabian, Phys. Rev. B **93**, 155104 (2015).
[4] T. Frank, P. Hogl, M. Gmitra, D. Kochan, and J. Fabian, arxiv.1797.02124
[5] M. Gmitra and J. Fabian, arxiv.1706.06149

[1]This work was supported by SFB 689, SFB 1277, and Graphene Flagship