Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Emergence of quantum spin Hall and "half-topological" states at Graphene/TMDC heterostructures[1] DENIS KOCHAN, MARTIN GMITRA, PETRA HÖGL, JAROSLAV FABIAN, University of Regensburg — We discuss orbital and spin-orbital proximity effects emerging in graphene deposited on a monolayer transition-metal dichalcogenides (TMDCs: MoS2, MoSe2, WS2, WSe2) and analyze the impact on spin transport in such graphene/TMDC heterostructures. First-principles investigations show that graphene on MoS2, MoSe2, and WS2 has a topologically trivial band structure, while graphene on WSe2 exhibits inverted bands. The essential low energy physics can be well described by a symmetry inspired realistic tight-binding Hamiltonian. We predict topologically protected helical edge states for graphene zigzag nanoribbons on WSe2, demonstrating the emergence of the quantum spin Hall effect. Our model also features "half-topological states", which are protected against time-reversal disorder on one edge only. Unlike in pristine graphene, the proximity spin-orbit coupling in graphene on TMDCs is significant (orders of meV), making the predicted effect testable experimentally. References: M. Gmitra, D. Kochan, P. Högl, J. Fabian; Trivial and inverted Dirac bands, and emergence of quantum spin Hall states in graphene on transition-metal dichalcogenides, arXiv:1510.00166

[1]This research was supported by DFG SFB 689, GRK 1570 and by the EU Seventh Framework Programme under Grant Agreement No. 604391 Graphene Flagship.

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Date submitted: 04 Nov 2015 Electronic form version 1.4