Anomalous Hall Effect in ferromagnetic graphene

Yafis Barlas, Jing Shi, Roger K. Lake

University of California at Riverside, Department of Physics and Astronomy, Riverside, USA
yafisb@gmail.com

Abstract

Recent advancements in device transfer techniques have enabled transfer of graphene on ferromagnetic substrates, which leads to a proximity induced ferromagnetism of the graphene sheet [1]. The presence of ferromagnetic exchange along with Rashba spin-orbit coupling leads to an energy gap at the Dirac points [2]. When the Fermi energy is pinned in the gap this system exhibits a quantized anomalous Hall with Chern number 2. I will show that when the Fermi energy is not in the gap the system exhibits un-quantized anomalous Hall effect (AHE) due to an intrinsic (band structure effect) and an extrinsic (disorder induced effect) contribution. The AHE contributions due to the intrinsic and extrinsic mechanisms will be calculated in semi-classical Boltzmann transport. The ability to gate tune the two-dimensional carrier density of the graphene sheet allows for a more detailed study of the anomalous Hall than that previously available in ferromagnetic semi-conductors. I will compare our theoretical results with most recent experimental data.

References

[1] Zhiyong Wang, Chi Tang, Raymond Sachs, Yafis Barlas, Jing Shi, *Proximity-induced ferromagnetism in graphene revealed by anomalous Hall effect,* cond-mat/1412.1521 (to be published in PRL).
[2] Z. Qiao, H. Jiang, X. Li, Y. Yao and Q. Niu, Phys. Rev. B 85, 115439 (2012).