Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Band Structure and Topological Properties of Graphene in a Superlattice Spin Exchange Field[1] H.A. FERTIG, Indiana University, LUIS BREY, Instituto de Ciencia de Materiales, Spain, A.R. CARVALHO, Universidade Federal Fluminense, Brazil — We analyze the energy spectrum of graphene in the presence of spin-orbit coupling and a unidirectionally periodic Zeeman field, focusing on the stability and location of Dirac points it may support. It is found that the Dirac points at the K and K' points are generically moved to other locations in the Brillouin zone, but that they remain present when the Zeeman field $\vec{\Delta}(x)$ integrates to zero within a unit cell. A large variety of locations for the Dirac points is shown to be possible: when $\vec{\Delta} \parallel \hat{z}$ they are shifted from their original locations along the direction perpendicular to the superlattice axis, while realizations of $\vec{\Delta}(x)$ that rotate periodically move the Dirac points to locations that can reflect the orbit of the rotating electron spin as it moves through a unit cell. When a uniform Zeeman field is applied in addition to a periodic $\vec{\Delta} \parallel \hat{z}$ integrating to zero, the system can be brought into a metallic, Dirac semimetal, or insulating state, depending on the direction of the uniform field. The latter is shown to be an anomalous quantum Hall insulator.

[1]Funded by US-NSF, MEyC-Spain, Capes (Brazil), and US-Israel Binational Science Foundation

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Date submitted: 09 Nov 2016 Electronic form version 1.4