Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Rashba Spin Orbit Interaction and Birefringent Electron Optics in Graphene[1] MAHMOUD ASMAR, Ohio University, SERGIO ULLOA, Ohio University and Freie Universität, Berlin — Analogies between geometrical optics and electron trajectories have resulted in a number of interesting proposals for device applications, where material interfaces play a similar role to that of transparent interfaces in physical optics. Optical birefringence in materials arising from crystal anisotropies are manifested as different group velocities for different polarizations of light. By making use of analytical solutions of the Dirac equation, and extending the partial wave component method of scattering to include spin dependent observables, we show that an equivalent phenomenon to optical birefringence in electron optics is feasible in two dimensional graphene. The electronic birefringence arises from the intrinsic graphene structure and requires the presence of Rashba spin-orbit interaction. The different group velocities depend on the chirality of the electronic states, mimicking the light polarization dependence of the group velocities in optical birefringent materials. In circular regions containing large Rashba interaction and reversed charge density (Veselago lenses), we predict the formation of sets of double caustics and cusps, where the spacing between the two different chiral cusps is proportional to the strength of the Rashba interaction in the system.

[1]Supported by NSF MWN/CIAM and NSF PIRE.

Mahmoud Asmar
Ohio University

Date submitted: 11 Dec 2012 Electronic form version 1.4