Abstract Submitted
for the FWS16 Meeting of
The American Physical Society

Landau Level Mixing Effects in the Graphene Fractional Quantum Hall Effect.[1] YONAS GETACHEW, MICHAEL PETERSON, California State University Long Beach — A two-dimensional electron system exposed to a strong perpendicular magnetic field at low temperatures forms a new state of matter that exhibits the fractional quantum Hall effect (FQHE). This phenomenon has been observed in graphene, a naturally occurring two-dimensional electron system. Landau level mixing is intrinsic to graphene and must be taken into account in any realistic theoretical treatment [Phys. Rev. B 87, 245129 (2013)]. Recently, an effective model Hamiltonian including Landau level mixing has been formulated in terms of Haldane pseudopotentials: this model includes emergent three-body interactions in addition to renormalizing the two-body interactions. Furthermore, electrons in graphene have spin and valley degrees of freedom, complicating the physics and making exact diagonalization studies formidable. We discuss a real-space realistic Hamiltonian formalism that can be used in future variational Monte Carlo studies of the graphene FQHE. We benchmark this formalism by comparing the results of the Monte Carlo to exact diagonalization results that utilize the pseudopotential.

[1]This project is supported by the National Science Foundation Grant No. DMR-1508290 and the 2015 CSULB Summer Student Research Assistantship.

Yonas Getachew
California State University Long Beach

Date submitted: 07 Oct 2016 Electronic form version 1.4