Abstract Submitted
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Chiral symmetry breaking and integer and fractional quantum Hall effects in monolayer graphene[1] BITAN ROY, University of Maryland, MALCOLM KENNETT, Simon Fraser University — Integer quantization of Hall conductivity near the Dirac points in graphene is unique in the sense that only electron-electron interactions can resolve the four fold valley and spin degeneracy, which in turn gives rise to Hall plateaus at filling $\nu = 0, \pm 1$. In this work, we will argue that generation of chiral symmetry breaking orderings such as anti-ferromagnetic and charge-density-wave orders, provides an excellent variational description of the Hall states at $\nu = 0, \pm 1$. For realistic strength of the sub-critical short-ranged Coulomb interactions, the solutions of the self-consistent gap equations are in very good agreement with the recently observed scaling of the interaction induced gap at $\nu = 0, \pm 1$ with magnetic field as measured with a variety of different techniques. Although Zeeman coupling changes the nature of the broken symmetry phases, it otherwise leads to better agreement with experimental results. A possible explanation of recently observed hierarchy of fractional Hall states within the framework of chiral symmetry breaking ordering inside the zeroth Landau level in graphene will also be highlighted.

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