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Chiral symmetry breaking and the Quantum Hall Effect in monolayer graphene[1] MALCOLM KENNETT, Physics Department, Simon Fraser University, BITAN ROY, Condensed Matter Theory Center, University of Maryland — Monolayer graphene in a strong magnetic field exhibits quantum Hall states at filling fractions $\nu = 0$ and $\nu = \pm 1$ that are not explained within a picture of non-interacting electrons. We propose that these states arise from interaction induced chiral symmetry breaking orders. We argue that when the chemical potential is at the Dirac point, weak onsite repulsion supports an easy-plane antiferromagnet state, which simultaneously gives rise to ferromagnetism oriented parallel to the magnetic field direction, whereas for $|\nu| = 1$ easy-axis antiferromagnetism and charge-density-wave order coexist. We perform self-consistent calculations of the magnetic field dependence of the activation gap for the $\nu = 0$ and $|\nu| = 1$ states and obtain excellent agreement with recent experimental results.

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