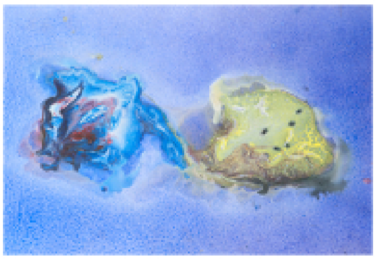

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Chiral Symmetry Breaking and the Quantum Hall Effect in Monolayer Graphene

Thursday 11 September 2014 16:30 (30 minutes)

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. In this talk I will argue that these states possibly arise from interaction induced chiral symmetry breaking orders on the honeycomb lattice, such as Neel antiferromagnetism and charge-density-wave order. In particular, I will show 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 $|\nu| = 1$ chiral symmetry breaking easy-axis antiferromagnetism and charge-density-wave orders coexist. I present self-consistent calculations of the magnetic field dependence of the activation gap for the $\nu = 0$ and $|\nu| = 1$ states and establish excellent agreement with recent experimental results. Our proposed scenario therefore may provide a strong experimental evidence of condensed matter realization of spontaneous chiral symmetry breaking phenomena, which has also occupied a central stage of high energy physics for long time.

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