CU Physics Department Colloquium

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Spin and Pseudo-Spin in Graphene

Graphene, a single atomic layer of graphite, has been provided physicists opportunities to explore an interesting analogy to the relativistic quantum mechanics. The unique electronic band structure of graphene lattice yields a linear energy dispersion relation where the Fermi velocity replaces the role of the speed of light and pseudo spin degree of freedom for the orbital wavefunction replaces the role of real spin in usual Dirac Fermion spectrum. The exotic quantum transport behavior discovered in these materials, such as unusual half-integer quantum Hall effect and Klein tunneling effect, are a direct consequence of the pseudo-spin rotation in graphene. Interacting systems with internal symmetries will tend to break those symmetries in order to lower their energy. In graphene, the strong Coulomb interactions and approximate spin-pseudo spin symmetry are predicted to lead to a varietyof quantum Hall ferromagnetic ground states and excitations which manifest as integer quantum Hall plateaus appearing within a graphene. In this presentation I will discuss various experimental evidence support the importance of spin and pseudo-spin structures in graphene at the strongquantum limit.

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