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Kondo quantum criticality in graphene BRUNO UCHOA, University of Illinois at Urbana-Champaign, T.G. RAPPOPORT, Universidade Federal do Rio de Janeiro, A.H. CASTRO NETO, Boston University — Graphene fits in a large class of "pseudogap" materials which are allowed to exhibit quantum criticality as a result of the interplay of strong correlations and a vanishing density of states near the Fermi points. In the presence of magnetic impurities, we show there is a symmetry class of localized orbitals which, in combination with quantum interference effects inbuilt in the honeycomb lattice, can lead to a novel class of Kondo quantum criticality in graphene [1]. In this class, graphene effectively screens the local spin as a super-ohmic dissipative environment and the RKKY interaction decays spatially with a fast power-law $\sim 1/R^7$, rather than the standard $1/R^3$ decay expected for Dirac fermions. We also show that unlike metals, the exchange coupling between the localized and itinerant spins can be controlled across the quantum critical region with the application of an external gate voltage. This effect may permit the first experimental observation of quantum criticality in graphene at zero magnetic field, directly with scanning tunneling probes and gating.

[1] B. Uchoa et al., arXiv:1006.2512 (2010)

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