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Heavy adatoms and Anderson localization in graphene JOSE H. GARCIA AGUILAR, Instituto de Fisica, Universidade Federal do Rio de Janeiro, RJ, Brazil, BRUNO UCHOA, Department of Physics and Astronomy, University of Oklahoma, OK, USA, LUCIAN COVACI, Department Fysica, Universiteit Antwerpen, Groenenborgerlaan, Antwerpen, Belgium, TATIANA G. RAPPOPORT, Instituto de Fisica, Universidade Federal do Rio de Janeiro, Brazil — We analyze electronic localization in a graphene layer doped with adatoms sitting in the center of the honeycomb hexagon, as happens with the heaviest adatoms. In this configuration, the hybridization between the adatom orbitals and its neighboring carbon atoms mediate hopping processes that connect all six vertices of the honeycomb hexagon around the impurity. The amplitudes of the hopping depend on the symmetry of the orbital that hybridizes with graphene, leading to an orbital-dependent "plaquette disorder". To capture the physics of localization, we propose an effective graphene-only Hamiltonian that preserves the associated orbital symmetries and conduct a scaling analysis of the local density of states (LDOS) for large system sizes. We show that adatoms that form a zero-energy resonant state lead to Anderson localization in the vicinity of the Dirac point. Among those, we show that there is a symmetry class of adatoms for which Anderson localization is suppressed, leading to an exotic quantum critical metallic state with large charge puddles, that localizes only at the Dirac point.

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