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Competition between Kondo and indirect exchange at the edges and bulk of graphene, and 2D materials. ANDREW ALLERDT, Northeastern University, GEORGE MARTINS, Oakland University, ADRIAN FEIGUIN, Northeastern University — We study the problem of two magnetic impurities at the surface of graphene, BN, MoS_2, phosphorene, silicene and germanene using exact numerical methods. We map the band structure of these materials onto one dimensional tight-binding chains in the same spirit as Wilson's numerical renormalization group. We use the density matrix renormalization group to solve the problem exactly, keeping all the information about the underlying lattice. Competition between Kondo and Ruderman-Kittel-Kasuya-Yosida (RKKY) interactions is non-trivial, due to strong non-perturbative effects. Depending on the presence of a pseudogap, or gap, we identify an important directionality and position dependence of the correlations. We present scenarios and regimes where impurities prefer to form their own Kondo clouds instead of an RKKY singlet state, or remain as uncoupled local moments. In the particular case of graphene, ferromagnetism is only stable at half-filling. In addition, we study the effects of spin-orbit coupling, and the presence of edge states.

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