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RKKY interaction in transition-metal dichalcogenide nanoflakes[1]
OSCAR AVALOS-OVANDO, DIEGO MASTROGIUSEPPE, SERGIO ULLOA, Ohio University — Transition metal dichalcogenides (TMDs) are layered crystals with unique electronic and optical properties, and are promising candidates for a new generation of semiconductor-based devices, mainly when exfoliated to one or a few layers. The process of exfoliation often produces nanoscale samples –flakes– with different shapes and boundaries. These flakes might have applications as quantum dots with novel characteristics. One interesting topic relates to the presence of magnetic impurities and their interaction. In combination with strong spin-orbit coupling and valley degrees of freedom, TMDs might have a great impact in the field of spintronics. Using an effective low-energy two-orbital tight-binding model, we study the Ruderman-Kittel-Kasuya-Yosida (RKKY) interaction between two magnetic impurities in 2D TMD nanoflakes. We consider different geometries and terminations, analyzing the effect of the sample size. Our results show the behavior of the interaction for impurities sitting at different positions in the flake, and its possible tunability with the electron/hole concentration. The magnetic impurities can be intrinsic to the sample production process or can be introduced extrinsically. Our results can be tested with local probes, such as spin-polarized STM.

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