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Spin impurities and interactions in graphene

JOSHUA FOLK, University of British Columbia

Graphene was once hailed as the material of the future for spintronics applications, both classical and quantum, with the potential for extremely high coherence while offering the chance to tailor spin interactions for efficient spin control. Very quickly, experimental data put a damper on these high hopes. Measurement after measurement has indicated that graphene, in practice, is not the dream material for spintronics that it should, in principle, be: it is hard or impossible to generate long spin coherence times, while at the same time it is much more difficult than anticipated to engineer interactions for deterministic spin control. The difficulty of spintronics in graphene has the silver lining of offering a fascinating testbed for understanding how spins interact in what should be a "simple" physical system. This talk will describe a set of experiments that uncover, in graphene, many of the effects that have highlighted spin physics in metals for the last several decades, from Kondo effect to RKKY interaction to dephasing from local moments. Where the local moments come from, and how to control them, are questions that we are just turning to now.