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Defect-Mediated Spin Relaxation and Dephasing in Graphene

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This talk will describe a series of transport measurements that disentangle mechanisms of spin and orbital phase relaxation in graphene. The measurements are based on well-known quantum interference phenomena–weak localization and universal conductance fluctuations. We show that a careful analysis of the in-plane magnetic field and temperature dependences of these effects can separately quantify spin-orbit and magnetic scattering rates; this technique works especially well in graphene due to its single-atom thickness. Spin relaxation in exfoliated graphene on SiO_2 is found to be dominated by magnetic scattering (scattering off of magnetic defects), with a smaller contribution from spin-orbit interaction. A similar measurement performed in graphene on SiC suggests that both magnetic scattering and spin-orbit interaction are a factor of 10 stronger than in exfoliated graphene.