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Using molecular transistors to study the Kondo effect in the presence of ferromagnetism[1]

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I will describe a technique to study spin-polarized electron transport through nm-sized molecular transistors. We create nm-sized gaps in nanofabricated ferromagnetic wires by electromigration, into which organic molecules can be incorporated. We can tailor the shapes of the ferromagnetic electrodes using electron-beam lithography so that the relative magnetization orientation can be switched from parallel to antiparallel. We use this technique to make contact to C_{60} molecules using nickel electrodes. We are able to observe signatures of the Kondo effect in low- resistance devices. The ferromagnetism in the electrodes splits the Kondo resonance, resulting in two symmetric peaks in the differential conductance as a function of bias voltage. This splitting is decreased (even to zero) when the electrode magnetizations switch from parallel to antiparallel. Our measurements are in good agreement with theories that predict an exchange splitting of the Kondo resonance. The Kondo effect leads to values of magnetoresistance that are several times larger than the Julliere value.

[1]Collaborators: R.C. Bialczak, J. Martinek, J.E. Grose, L.A.K. Donev, P.L. McEuen, D.C. Ralph.