

Kondo effect in the presence of ferromagnetism

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We study the Kondo effect in a quantum dot (QD), which is coupled to ferromagnetic leads, and analyze its properties. Based on a scaling analysis we first show that a splitting of the Kondo resonance similar to the usual magnetic-field-induced splitting will appear due to exchange interaction with leads. The most important result is that this splitting can be fully compensated by an appropriately tuned external magnetic field and the strong coupling limit of the Kondo effect can be restored. We adapt the NRG method to the case of a QD coupled to ferromagnetic leads. We show that the Kondo effect in the presence of ferromagnetic leads has unique properties such as a strong spin polarization of the density of states at the Fermi level. In addition, we find, surprisingly, that even in the presence of strong spin asymmetry in the QD spectral function at the Fermi level, the ground state of the system has a fully compensated local spin and displays Fermi liquid behavior. We also analyze the nonlinear transport through the QD. We find that for parallel alignment of the lead magnetizations the zero-bias anomaly is split. This splitting can be removed by appropriately tuning of a magnetic field. In the antiparallel configuration of the lead magnetizations and symmetric coupling no splitting occurs. New experimental results for a single C_{60} molecule confirm our theoretical predictions.

9.7 cm

13.4 cm

Subject category :

2. Magnetic Films, Surfaces, Multilayers and Nanostructures

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