Two Kondo Impurity Spin Interactions in Quantum Dots

BARBARA JONES, IBM Almaden Research Center, San Jose, CA, TZEN ONG, Department of Applied Physics, Stanford University, IBM Almaden Research Center, San Jose, CA, DAVID GOLDHABER-GORDON, Department of Physics, Stanford University — The Kondo effect in a single quantum dot, where the localized electron behaves as a magnetic impurity, has been well studied [1]. A recent experiment by C.M. Marcus’s group indicates a possible RKKY-like spin interaction between two quantum dots (QD) in the Coulomb Blockade regime [2]. We have obtained an effective Hamiltonian by carrying out a perturbation expansion (related to the Schrieffer-Wolf transformation) of an Anderson model of the two QD system (including terms representing the tunneling) to fourth order. We obtain the standard Kondo-coupling terms at second order, and we obtain RKKY-like terms at fourth order. We have also kept the scattering terms obtained at second-order, which are usually neglected, in order to study their effects on possible fixed points for the two-QD problem. We discuss the full range of interaction terms obtained at the level of RKKY, and their implications for the low-temperature behavior. 