Phase diagrams and ground state properties of the anisotropic Kondo lattice model

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We study the properties of the magnetic Kondo lattice model with anisotropic exchange interactions J_{XY} and J_Z. We have performed a detailed analysis of the phase diagrams and ground state characteristics of this model for d-dimensional hypercubic lattices and arbitrary, positive and negative J_{XY} and J_Z. In our study we have used an extended mean-field approximation, analogous to that used in the treatments of the isotropic Kondo model [1].
In this report we mainly focus on the case of half-filled electron band and restrict discussion to the pure phases. In Fig. 1 we show the ground state phase diagram of the model at half-filling plotted as a function of $J_{XY}/2D$ and $J_Z/2D$ for rectangular density of states for electrons (2D is the bandwidth). Denotations: K: Kondo singlet state, AF_{XY}: planar AF, IAF_Z: Néel-1 (Ising AF with parallel sublattice magnetizations of spins and electrons), $IIAF_Z$: Néel-2 (Ising AF with antiparallel sublattice magnetizations).

The diagram of Fig. 1 is in good qualitative agreement with the ground state diagram for d = 1 case derived by Shibata *et al.* [2] using mapping to effective models in the strong coupling regimes combined with the numerical methods.

Note that with increasing $J_Z/2D$ for fixed $J_{XY}/2D$ the system can exhibit the sequences of transitions:

$IAF_Z \rightarrow AF_{XY} \rightarrow IIAF_Z \rightarrow K$, if $J_{XY}/2D < (J_{XY}/2D)_c$,
$IAF_Z \rightarrow AF_{XY} \rightarrow K$, if $J_{XY}/2D > (J_{XY}/2D)_c$.

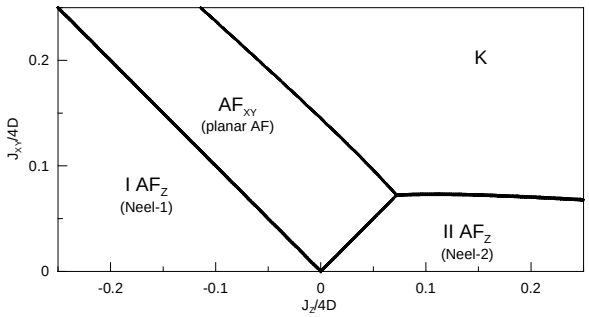

Fig. 1. Ground state phase diagram of the anisotropic Kondo lattice model at half-filling, plotted as a function of $J_{XY}/2D$ and $J_Z/2D$, for rectangular DOS.

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