Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

The ($T = 0$) Phase Diagram of the RKKY model[1] DONALD PRIOUR, JR., SANKAR DAS SARMA, University of Maryland — We consider magnetic moments (e.g. Mn ions in $Ga_{1-x}Mn_xAs$) coupled via the indirect exchange RKKY interaction. We obtain via Monte Carlo the $T = 0$ phase diagram as a function of Mn density n_i and the relative carrier (hole) concentration n_c/n_i. As evidenced by a diverging correlation length and the magnetic susceptibility, the boundary between the ferromagnetic (FM) and paramagnetic (PM) phases constitutes a line of zero temperature critical points with behavior very similar to that of a percolation transition. In particular, ferromagnetic clusters increase in size and ultimately coalesce to span the system as the phase boundary is approached from the PM side. In the dilute limit, we find that bulk ferromagnetism vanishes for $n_c/n_i > 0.1$. We also incorporate the local antiferromagnetic super-exchange coupling between nearest neighbor magnetic impurities, eliminating ferromagnetism above a Mn density threshold $n_i^{\rm crit}$. We discuss the impact of a finite carrier mean free path l, which we include as a damping factor in the RKKY range function. Among our findings for an l on the order of the lattice constant a is an expansion of the ferromagnetic region in the phase diagram, though with a suppression of the Curie Temperature T_c. We determine the values of n_i,n_c, and l which maximize T_c.

[1]Work supported by US-ONR and LPS

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Date submitted: 29 Nov 2005 Electronic form version 1.4