Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

The effect of disorder and short-range correlations on ferromagnetism in dilute magnetic semiconductors B. MORITZ, University North Dakota, University of Cincinnati, K. MIKELSONS, University of Cincinnati, Oak Ridge National Lab, J. MORENO, University of North Dakota, M. JARRELL, University of Cincinnati, R. S. FISHMAN, Oak Ridge National Lab — We use the Dynamical Cluster Approximation (DCA) and double exchange model, coupling spin one-half holes to magnetic impurities, to study the ferromagnetic transition in semiconductors doped with transition metal magnetic ions. Our approach includes the effect of local dynamics as well as short-range correlations between the magnetic impurities. We systematically incorporate the effect of disorder in the impurity positional configurations with a new algorithm, based on the DCA, specific to dilute systems. This new algorithm serves as a replacement for the Traveling Cluster Approximation and Coherent Potential Approximation. We focus on the appearance of the impurity band and the development of the magnetization for a range of coupling strengths and hole and impurity concentrations. In addition, we discuss the effect of impurity clustering on the hole mobility and the ferromagnetic transition temperature. We conclude that the successful design of spintronic nanostructures based on ferromagnetic semiconductors must include an understanding and careful analysis of disorder and spatial correlations.

Juana Moreno
University of North Dakota

Date submitted: 30 Nov 2005 Electronic form version 1.4