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An Extended Dynamical Cluster Approximation for Local-Moment Systems KARLIS MIKELSONS, University of Cincinnati, Oak Ridge National Laboratory, THOMAS MAIER, RANDY FISHMAN, Oak Ridge National Laboratory, MARK JARRELL, University of Cincinnati — We introduce an Extended Dynamical Cluster Approximation for studying local moment systems, such as Heisenberg and Ising models. Below T_c, self-consistency is imposed both for the order parameter and the correlation function. Exact enumeration and Monte-Carlo methods are used to solve the local moment problem on a cluster with coarse-grained effective interactions. Even if the original exchange interactions are short-ranged, the effective interactions are long-ranged. For a single site cluster this method is equivalent to the EDMFT. As the size of the cluster is increased, the fluctuations are systematically included into this approximation. We apply this method to the one-, two- and three-dimensional Ising models. We develop scaling analysis by increasing the cluster size to find the T_c. Unlike other expansions about the mean-field theory, our technique converges quite rapidly to the exact solutions, which are known analytically in one and two dimensions and to great accuracy from numerical work in three dimensions. Long- ranged interactions can easily be included in this method, i. e., for studying glassy systems.

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