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Study of the one-band model for colossal magnetoresistive manganites using the Truncated Polynomial Expansion Monte Carlo Method
CENGIZ SEN, National High Magnetic Field Laboratory and Department of Physics, Florida State University, Tallahassee, FL, ELBIO DAGOTTO, Oak Ridge National Laboratory, Oak Ridge, TN and Department of Physics, University of Tennessee, Knoville, TN — The recently proposed Truncated Polynomial Expansion Method (TPEM) for spin-fermion systems is tested using the one-band double exchange model with finite Hund coupling $J_{\rm H}$ in the clean limit. Two dimensional lattices as large as 48×48 are studied, far larger than those that can be handled with standard exact diagonalization (DIAG) techniques for the fermionic sector. Phase diagrams are obtained, showing first-order transitions separating ferromagnetic metallic from insulating states. A huge magnetoresistance is found at low temperatures by including small magnetic fields, in excellent agreement with experiments. By comparing results between the two methods, TPEM and DIAG, on small lattices, and by analyzing the systematic behavior with increasing cluster sizes, it is concluded that the TPEM is accurate to handle realistic manganite models on large systems. Our results pave the way to a frontal computational attack of the colossal magnetoresistance phenomenon using double-exchange like models, on large clusters, and including quenched disorder.

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