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Thermodynamics of the AF Heisenberg Model on the Checkerboard Lattice; a Numerical Linked-Cluster Expansion Study[1] EHSAN KHATAMI, MARCOS RIGOL, Georgetown University — Employing numerical linked-cluster expansions (NLCEs) along with exact diagonalizations of finite clusters with periodic boundary condition, we study the energy, specific heat, entropy, and various susceptibilities of the antiferromagnetic (AF) Heisenberg model on the checkerboard lattice. NLCEs, combined with extrapolation techniques, allow us to access temperatures much lower than those accessible to exact diagonalization and other series expansions. We find that the high-temperature peak in specific heat decreases as the frustration increases, consistent with the large amount of unquenched entropy in the region around maximum classical frustration, where the nearest-neighbor and next-nearest-neighbor exchange interactions (J and J', respectively) have the same strength, and with the formation of a second peak at lower temperatures. The staggered susceptibility shows a change of character when J' increases beyond $0.75J$, implying the disappearance of the long-range AF order at zero temperature. For $J' = 4J$, in the limit of weakly-coupled crossed chains, we find large susceptibilities for stripe and Néel order with $\mathbf{Q} = (\pi/2, \pi/2)$ at low temperatures with AF correlations along the chains. Other magnetic and bond orderings, such as a plaquette valence-bond solid and a crossed-dimer order suggested by previous studies, have also been investigated.

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