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Thermodynamics of Ising Spins on the Triangular Kagome Lattice[1] YEN LEE LOH, DAOXIN YAO, ERICA W. CARLSON, Purdue University — In the compounds $Cu_9X_2(cpa)_6 \cdot xH_2O$ (cpa=2-carboxypentonic acid; X=F,Cl,Br), the Cu spins form a fascinating and unique pattern called a triangular kagome lattice (TKL). We present a detailed study of Ising spins on such a lattice using exact methods and Monte Carlo simulation. We calculate the free energy, internal energy, specific heat, entropy, sublattice magnetizations, and susceptibility, and we find a rich phase diagram as a function of coupling constants, temperature, and applied magnetic field. In the frustrated regime at $T = 0$, the system effectively decouples into independent degrees of freedom, giving residual entropy $s_0 = \frac{1}{9} \ln 72$ per spin and correlation length $\xi = 0$ – an interesting contrast with the triangular and kagome lattice Ising models. Applying a field induces a critical phase (related to the honeycomb lattice dimer model) that has irrational entropy 0.0359 per spin and $1/r^2$ correlations that should be detectable by neutron scattering.

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