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Tensor renormalization group study of the 2d O(3) model

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We study the two-dimensional O(3) model on the lattice using the Tensor Renormalization Group (TRG) approach, with the goal of understanding asymptotic scaling at both the large volume, and large beta limit. Harmonic analysis on the Boltzmann weight introduces a sign problem into the partition function, which makes the model difficult to study with the Worm Algorithm. The TRG is insensitive to the sign problem because it relies on projections onto eigenstates of positive matrices. Thermodynamic quantities are calculated for finite volumes, as well as the infinite volume limit, and compare well with Monte Carlo results. Prospects of parallelizing the TRG method to enable large scale calculations, which would aid in the computation of correlation functions, are briefly discussed, along with our progress on implementing these algorithms on the Blue Gene/Q.

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