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Abelian and Non-Abelian Height Models R. ZACH LAMBERTY, STEFANOS PAPANIKOLAOU, CHRIS HENLEY, Cornell University — We present Monte Carlo simulations on a new class of lattice models in which the degrees of freedom are elements of an abelian or non-abelian finite group G, placed on directed edges of a two-dimensional lattice. The group product around any plaquette is constrained to be the group identity, as in a discrete gauge model, but in contrast a "height model" only allows a certain subset of group elements to appear on edges. These models often realize a classical form of topological order, in that the ensemble breaks up into sectors labeled by loop products (group products taken around topologically non-trivial loops). Our implementation uses a non-local Monte Carlo update, whereby a pair of topological defects is created and later recombined after one diffuses; this allows the simulation to visit different topological sector. We measured two quantities as diagnostics of topological order (i) The relative probabilities of different sectors, which were found to converge to unity with increasing system size L. (ii) The probability distribution of the separation R of a defect pair, which should approach a constant (be deconfined). Both results show exponential decay as a function of L or R, as expected for a liquid-like phase having only topological order. As a check, we measured the same two quantities in a model equivalent to the 6-vertex model, known to be a critical state, and confirmed the algebraic decay in that case.

R. Zach Lamberty
Cornell University

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