MAR14-2013-020313

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

Deconfined Quantum Criticality and Phase Transitions in 3D Classical Loop Models

JOHN CHALKER, Physics Department, Oxford University, UK

I will talk about the statistical physics of a family of three-dimensional lattice models for completely-packed loops that have transitions between phases of two types: one in which there are only short loops, and another in which some loops are extended. The models can be viewed as lattice discretisations of CP^{n-1} sigma models in 3D. Alternatively, they can be seen as quantum $SU(n)$ quantum magnets in (2+1)D. In this case, the phase with long loops is a Neel phase, the phase with only short loops is a valence bond phase, and the models are closely related to loop algorithms developed for quantum Monte Carlo simulations. Depending on the design of the model, the short loop phase is either unique (representing a valence bond liquid) or spontaneously breaks a spatial symmetry (representing a valence bond solid). The transition from the Neel phase to the valence bond solid is a candidate deconfined critical point and the loop model gives access to this transition via Monte Carlo simulations. I will present results from large-scale simulations of the transition.

[1] Adam Nahum, J. T. Chalker, P. Serna, M. Ortuno, and A. M. Somoza, Phys. Rev. Lett. **107** 110601 (2011).
[2] Adam Nahum, J. T. Chalker, P. Serna, M. Ortuno, and A. M. Somoza, Phys. Rev. B **88**, 134411 (2013).
[3] Adam Nahum, J. T. Chalker, P. Serna, M. Ortuno, and A. M. Somoza, in preparation.