Using Random Boundary Conditions to simulate disordered quantum spin models in 2D-systems

Abel Yuste*[1] and Anna Sanpera*[2,3]

[1]Universitat Autònoma de Barcelona (UAB) – UAB Campus 08193 Bellaterra (BARCELONA) SPAIN, Spain

[2]Institució Catalana d'Estudis Avançats (ICREA) – Spain

[3]Universitat Autònoma de Barcelona (UAB) – Spain

Abstract

Disordered quantum antiferromagnets in two-dimensional compounds have been a focus of interest in the last years due to their exotic properties. However, with very few exceptions, the ground states of the corresponding Hamiltonians are notoriously difficult to simulate making their characterization and detection very elusive, both, theoretically and experimentally. Here we propose a method to signal quantum disordered antiferromagnets by doing exact diagonalization (ED) in small lattice clusters using random boundary conditions and averaging the observables of interest over the different disorder realizations. To this aim we study the Heisenberg spin-1/2 model in an anisotropic triangular lattice (SATL), where the competition between frustration and quantum fluctuations might lead to some spin liquid phases (SL) as predicted from different methods ranging from spin wave mean field theory to 2D-DMRG or PEPS. Our method reproduces accurately the ordered phases expected in the model, signals disordered phases by the presence of a large number of quasi degenerate ground states and presents a relatively weak dependence on finite size effects.

*Speaker