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Numerical studies of Spin Liquid Phases

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After discussing the early 90' classification of the different phases of Quantum Antiferromagnets, I will explain why exact diagonalizations have been a useful tool in the quest of Quantum Spin Liquids. Contrary to superficial thinking, signatures of symmetry breakings appear very clearly in exact spectra of small samples of quantum spins. Spin Liquids are states which do not break any simple symmetry: neither spin-rotational symmetry nor lattice symmetry. They are characterized by topological degeneracies (which may be helpful for the realization of quantum bits, with very low rates of decoherence), and generically gapful excitations. The first supposed-to be Quantum Spin Liquid has been discovered in 1998 by Misguich and coll. in the frustrated 4-spin ring exchange model on the triangular lattice. Following this first break-through, simpler models exhibiting well defined Quantum Spin Liquids have been produced. After a rapid review of these cases, I will show some results that may be characteristic of new Quantum Critical Phase Transitions between non colinear Néel magnets