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Two- and three dimensional frustrated spin systems

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In this presentation I will discuss recent developments on frustrated spin systems in two and three dimension: the orthogonal dimer spin system and the S=1 Pyrochlore system.

The two dimensional Heisenberg model for $SrCu_2(BO_3)_2$ has the exact dimer ground state which was proven by Shastry and Sutherland almost twenty years ago. Almost localized nature of the triplet excitations explains the plateaus observed in the magnetization and unusual dynamical properties of the low lying excitations.

The ground-state properties of the spin-1 antiferromagnetic Heisenberg model on the corner-sharing tetrahedra, pyrochlore lattice, is investigated. By breaking up each spin into a pair of 1/2-spins, the problem is reduced to the equivalent one of the spin-1/2 tetrahedral network in analogy with the valence bond solid state in one dimension. The twofold degeneracy of the spin-singlets of a tetrahedron is lifted by a Jahn-Teller mechanism, leading to a cubic to tetragonal structural transition. It is proposed that the present mechanism is responsible for the phase transition observed in the spin-1 spinel compound ZnV_2O_4 and MgV_2O_4.