Session 21bC

Quantum Phase Transitions in the Orthogonal Dimer System $SrCu_2(BO_3)_2$ 21bC1

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$SrCu_2(BO_3)_2$, a realization of Shastry-Sutherland model, is predicted to become an antiferromagnetic ordered state when exchange constants are varied. To obtain the phase diagram experimentally, magnetic susceptibility was measured under pressure up to 11 kbar. The temperature of maximum susceptibility decreases with pressure, suggesting that the system is still gapped but at least approaching the phase boundary. Next, we demonstrate from NMR that a 1/8-plateau phase which exists at around 28 T is not a consequence of simple order of excited triplets but of Friedel-like oscillations of the spin polarization in a giant unit cell. This is the first observation of the superstructure in the plateau phase.

Protectorate in a geometrically frustrated magnet 21bC2

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Despite progress in both theoretical and experimental physics of geometrical frustration, nature of their ground states is yet to be fully understood. In this talk, I would like to address this issue by discussing our recent inelastic neutron scattering data obtained from $ZnCr_2O_4$ where Cr^{3+} ions form a corner-sharing tetrahedra (or pyrochlore) with uniform antiferromagnetic nearest neighbor interactions. We have discovered that novel *composite* spin degrees of freedom emerge from the frustrated interactions in the spin liquid phase of $ZnCr_2O_4$. Instead of fluctuating individually, groups of six spins self-organize into weakly interacting antiferromagnetic hexagonal loops whose spin directors govern the low temperature dynamics. The hexagon directors are decoupled from each other and hence their reorientations embody the long-sought local zero energy modes for the pyrochlore lattice.

21bC3 Spin-Ice and Other Frustrated Magnets on the Pyrochlore Lattice

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The recent identification of the dysprosium titanate compound $Dy_2Ti_2O_7$ as a “Spin-Ice”, i.e. the spin analog of regular entropic ice of Pauling, has created considerable excitement. The ability to manipulate spins using magnetic fields gives a unique advantage over regular ice in these systems, and has been used to study the recovery of entropy. Predicted magnetization plateaus have been observed, testing the underlying model consisting of a competition between short ranged super exchange, and long ranged dipolar interactions between spins. I discuss other compounds that are possibly spin ice like: $Ho_2Ti_2O_7$, and the two stannates $Ho_2Sn_2O_7$, $Dy_2Sn_2O_7$ and a Heisenberg system $Gd_2Ti_2O_7$ exhibiting a set of magnetic field driven phase transitions. These transitions are explored within a simple meanfield theory with anisotropic exchange derived from dipolar interactions.