

Chez Pierre

Presents ...

Wednesday, February 12, 2014

12:00pm

MIT Room 4-331



Special Chez Pierre Seminar

Martin Mourigal

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“Interacting quasiparticles in quantum and frustrated magnets”

A fascinating manifestation of collective quantum phenomena in condensed matter is the emergence of elementary excitations – or quasiparticles – carrying quantum numbers that are fractions of those of a non-interacting system. Low-dimensional and frustrated magnetic materials, built from localized spins $1/2$, display a diversity of such many-body phenomena. Moreover, they allow detailed experimental investigations, quantitative comparisons with theoretical predictions, and often surprise with counter-intuitive properties that are difficult to predict.

In this talk, I will present neutron scattering experiments that provide access to the dynamic spin correlations of one-dimensional (1D), square-lattice and triangular-lattice Heisenberg antiferromagnets. These results highlight the importance of understanding quantum fluctuations and interactions to describe the spin dynamics of some of the most fundamental models in magnetism. Starting from the 1D limit, I will first illustrate the concept of deconfined fractional spin excitations – or spinons – through their observation as pairs and quartets in single-crystals of copper sulphate [1]. Then, I will present on-going progresses made in the search for fractional spin excitations in bulk quasi-two-dimensional materials with and without magnetic frustration.

Throughout my talk, I shall stress the importance of combined efforts between materials discovery and preparation, thermo-magnetic characterisation, advanced spectroscopy, and theory, in the quest for new quantum states of matter.

[1] “Fractional spinon excitations in the quantum Heisenberg antiferromagnetic chain”, M. Mourigal, M. Enderle, A. Klöpperpieper, J.-S. Caux, A. Stunault, H. M. Rønnow, *Nature Physics* 9, 435-441 (2013).