Dynamics and thermodynamics of the two-chain spin ladder: Theory and experiments in BPCB

By

Prof. Bruce Normand
Renmin University, Beijing

Date: 31 May 2012, Thursday
Time: 4.00pm to 5.00pm
Venue: Hilbert Space (PAP-02-02)
Host: Asst. Prof. Pinaki Sengupta

Abstract
While many properties of the two-chain spin ladder were computed theoretically in the 1990s, experimental studies are catching up only now, because of the organometallic compound \((\text{C}_5\text{H}_{12}\text{N})_2\text{CuBr}_4\) (BPCB). In this quasi-one-dimensional system of unfrustrated ladder units, whose energy scales match laboratory magnetic fields, it is possible to investigate quantum disordered, quantum critical, spin Luttinger-liquid, 3D magnetically ordered and fully saturated phases. This presentation reviews the range of experiments performed on BPCB, and introduces a complete bond-operator theory which describes with quantitative accuracy both thermodynamic properties and dynamical excitations at all fields and temperatures in the gapped regime. The field-tuned spinon continuum in the gapless regime, seen beautifully in experiment, is described with similar accuracy at zero temperature using a Bethe-Ansatz method.

Short Biography
Prof. Bruce Normand received his undergraduate training in physics at the University of Cambridge and completed his Ph.D. in theoretical condensed matter physics at Massachusetts Institute of Technology. His extensive career has spanned many subfields in strongly interacting electronic materials - from high-temperature superconductivity to low-dimensional systems and from frustrated quantum magnetism to quantum phase transitions. His work has also included excursions into molecular nanomagnets, cold atoms and solution physics for biomolecules. Prof. Normand is currently a Professor in the Department of Physics at Renmin University of China in Beijing.

College of Science
Nanyang Technological University
SPMS-04-01, 21 Nanyang link, Singapore 637371
Fax: +65 6515 8229       Tel: +65 6513 8459