



ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

***PHYSICS COLLOQUIUM***Thursday, 18 February 2010  
17:00-18:003<sup>rd</sup> Floor Seminar Room***"Exploring Exotic Quantum Phases in Model Magnets"***

Dr Christian Rüegg

London Centre for Nanotechnology and Department of Physics and  
Astronomy, University College London

## Abstract

Quantum spins in magnets show a cornucopia of complex quantum phases at low temperatures including for example Bose-Einstein Condensates, spin Luttinger-liquids, and supersolids [1]. Direct control of the magnetic exchange interactions and fluctuations by application of hydrostatic pressure [2] or magnetic field [3-5] allows us to study these phases in real materials and by a number of experimental techniques. Here, quasi-one-dimensional arrays of quantum spin ladders are particularly exciting because they show a rich phase diagram in temperature and magnetic field. In the seminar I will present our most recent work, in which we have been able to explore quantum disordered, quantum critical, spin Luttinger-liquid, BEC, and classically saturated regimes and their thermodynamics and characteristic excitations in novel metal-organic compounds [3-5]. The results will be discussed in the context of developments and future perspectives in neutron spectroscopy, crystal growth of novel custom-built materials, and challenges in quantum many-body theory.

- [1] T. Giamarchi, Ch. Rüegg, O. Tchernyshyov, *Nature Physics* **4**, 198 (2008).
- [2] Ch. Rüegg *et al.*, *Phys. Rev. Lett.* **100**, 205701 (2008).
- [3] Ch. Rüegg *et al.*, *Phys. Rev. Lett.* **101**, 247202 (2008).
- [4] B. Thielemann *et al.*, *Phys. Rev. B* **79**, 020408(R) (2009).
- [5] B. Thielemann *et al.*, *Phys. Rev. Lett.* **102**, 107204 (2009).