UNIVERSITY OF CRETE
DEPARTMENT OF PHYSICS

CRETE CENTER FOR
QUANTUM COMPLEXITY
AND NANOTECHNOLOGY

ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday, 20 November 2014

17:00 -18:00

3rd Floor Seminar Room

"Long-lived nuclear spin states: Overcoming relaxation and dissipation of quantum systems in the real world"

Prof. Malcolm Levitt
University of Southampton

Abstract

In solution NMR, clusters of coupled nuclear spins may support states that have lifetimes much longer than the conventional relaxation time T1 which describes the interaction of the spin system with the fluctuating thermal environment. In general, such states are called long-lived states (LLS): in the special case of spin-1/2 pairs, the LLS corresponds to singlet order (a population imbalance between the spin-zero singlet state, and the spin-1 triplet manifold). The phenomenon of LLS is of fundamental interest in quantum information science and in molecular spectroscopy, and also suggests many new possibilities in NMR and MRI, including the study of slow motional and chemical processes, and the transport of nuclear hyperpolarization. I will discuss some of the following topics:

- the conditions under which long-lived states exist
- how long-lived states are accessed
- how long-lived states are maintained
- relaxation mechanisms and theory of long-lived states
- hyperpolarized long-lived states
- new results showing long-lived state lifetimes of almost 1 hour in ambient conditions

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[3] G. Pileio *et al.*, J. Am. Chem. Soc. 130, 12582-12583 (2008).
[4] M. Carravetta *et al.*, Phys. Rev. Lett. 92, 153003 (2004).