UNIVERSITY OF CRETE
DEPARTMENT OF PHYSICS

CRETE CENTER FOR
QUANTUM COMPLEXITY
AND NANOTECHNOLOGY

ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

Thursday, 29 October 2015
17:00 -18:00
3rd Floor Seminar Room

"Towards quantum phononics in biomolecules"

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Abstract

It has been increasingly recognized that coherent electron-vibration coupling affects significantly the characteristics of photo-induced electronic transport in a variety of molecular systems. For instance, it has been shown that infrared light excitation of intramolecular vibrations can radically change the efficiency of electron transfer in donor-acceptor-bridge systems. Furthermore, theoretical and experimental evidence suggests that such interactions can support coherent dynamics of excitations in photosynthetic pigment-protein complexes. All together these studies raise the question of whether the quantum nature of the phonons, or elementary excitations of the vibrations involved in these processes, play a significant role in the photo-induced transport and if so how this can be probed. In this lecture, I will discuss our recent research [1] on signatures of truly quantum behavior of the collective vibrational modes driving excitation energy transfer in prototype light-harvesting complexes. In these prototypes quantum coherent interactions between excitons and vibrations can lead to non-classical phonon number fluctuations that are concomitant with efficient transport. Our work suggests that quantum phononics may be at play in biological systems.

[1] E.J. O'Reilly, A. Olaya-Castro, "**Non-classicality of molecular vibrations activating electronic dynamics at room temperature**" Nature Communications, 5, 3012 (2014)