

Congratulations to New ICFO PhD graduate

Dr. Roberto de J. Leon-Montiel graduated with a thesis in ?Quantum-Based Spectroscopy and Efficient Energy Transport with Biomolecules?

September 30, 2014

Dr. Roberto de J. Leon-Montiel received his Master Degree in Optics from the Instituto Nacional de Astrofisica, Optica y Electronica (INAOE) in Mexico. After completing this degree, he joined the Quantum engineering of light research group at ICFO, led by Dr. Juan P. Torres and centered his doctoral work on developing quantum-based spectroscopy techniques as well as investigating to what extent microscopic quantum phenomena could impact on the highly efficient transport behavior of photosynthetic systems. Dr. Leon?s thesis, entitled ?Quantum-Based Spectroscopy and Efficient Energy Transport with Biomolecules? was supervised by Dr. Juan P. Torres.

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Abstract:

For many years, the fields of quantum optics and biology have rarely shared a common path. In quantum optics, most of the concepts and techniques developed over the years stand for systems where only a few degrees of freedom are considered and, more importantly, where the systems under study are assumed to be completely isolated from their surrounding environment. This situation is far from what we can find in nature. Biological complexes are, by definition, warm, wet and noisy systems subjected to environmental fluctuations, where quantum phenomena are unlikely to be observed. Notwithstanding, in recent years, this paradigm has begun to be questioned by several works where quantum-mechanical concepts have been introduced in order to describe the dynamics of important biological processes, such as energy transport in photosynthetic light-harvesting complexes.

The goal of this thesis is twofold. Firstly, we will investigate how ideas and techniques routinely used in quantum optics can be exploited in order to develop new quantum-based spectroscopy techniques and, secondly, we will examine to what extent microscopic quantum phenomena could impact on the efficient transport behavior of photosynthetic light-harvesting complexes. This problem is particularly relevant, because the understanding of the fundamental mechanisms that enable the highly efficient transport of energy in photosynthetic systems could lead us to the design of future quantum-inspired light-harvesting technologies, such as high-efficiency organic solar cells.

Thesis Committee:

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Dr Jean Perina, Joint Laboratory of Optics of Palacky University and Institute of Physics of AS

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Thesis Committee