



ΣΕΜΙΝΑΡΙΟ ΚΕΝΤΡΟΥ ΚΒΑΝΤΙΚΗΣ ΠΟΛΥΠΛΟΚΟΤΗΤΑΣ & NANOTEΧΝΟΛΟΓΙΑΣ/
CCQCN SEMINAR

Tuesday, 29 April 2014

11:00-12:00

3rd Floor Seminar Room

Towards a quantum interface between optical and microwave photons

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Abstract

Future quantum networks will interconnect many quantum systems of diverse physical nature. Photons are ideal carriers of quantum information over long distances because they can be efficiently sent through low loss optical fibers. On the other hand, fast and scalable quantum gates can be implemented in solid-state system, e.g. architectures involving superconducting circuits. Thus, interfacing photonic and solid-state qubits within a hybrid quantum architecture offers a promising route towards large scale distributed quantum computing. Ensembles of optically active spins are promising candidates for realizing such a quantum media converter. Among these, spin ensembles consisting of rare earth erbium (Er³⁺) ions doped into a Y₂SiO₅ crystal matrix play a special role due to the 1.54 μm optical transition of Er³⁺, which exactly matches the low loss Telecom C-band of optical fiber communication. We are working on realizing such a coherent quantum converter. I will present our results on strong coherent coupling of superconducting resonators to erbium spins in Y₂SiO₅ [1] and optical spectroscopy of these crystals at millikelvin temperatures. Finally, I will discuss our recent results of Er doped into the YAP crystal matrix, which requires much lower magnetic fields [2].

[1] S. Probst, H. Rotzinger, S. Wünsch, P. Jung, M. Jerger, M. Siegel, A. V. Ustinov, and P. A. Bushev, Phys. Rev. Lett. **110**, 157001 (2013)

[2] A. Tkalec, S. Probst, D. Rieger, H. Rotzinger, S. Wünsch, N. Kukharchyk, A. D. Wieck, M. Siegel, A. V. Ustinov, P. Bushev, arXiv:1402.5242 (2014)

