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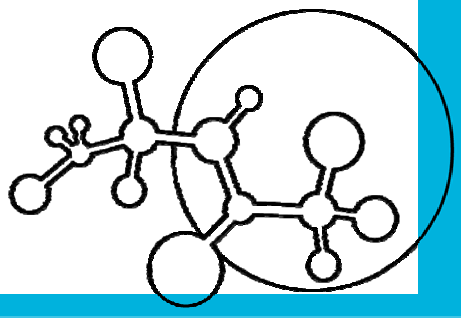

Quantum Efficiency Seminar and Colloquium

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Photon echo for quantum memory applications

Mapping a quantum state of light into an atomic system is fundamentally interesting and may have a strong impact in the context of quantum communication and information processing [1]. Atomic vapors have been extensively used to store non-classical states of light. The protocols exploit a direct excitation of the ground states spin coherence (as the archetypal Electromagnetically Induced Transparency does [2]) elegantly avoiding the optically excited state.

I'll consider a drastically different situation where the optical coherences are transiently excited. The first step is then a simple absorption process in two-level atoms. The last step should be the reversal of the absorption process to retrieve the incoming signal and complete the memory protocol. I'll show that the situation is similar to a two-pulse photon-echo (2PE) experiment. This widely used spectroscopic tool can indeed be turned into an efficient memory protocol.

The 2PE cannot be used candidly because it intrinsically generates noise [3]. It is still a strong source of inspiration to conceive noise-less protocols based on the same initial situation [4].

I'll finally present our recent proposal [5]. It revisits the 2PE and renders it noise-less in principle with a straightforward modification.

I'll finally show that the photon-echo type protocols are perfectly adapted to rare-earth doped solids. Experimental results obtained in Tm:YAG will be presented [5].

My talk is intended for a broad audience and will be hopefully pedagogical.

[1] http://quantumrepeaters.eu/
[2] A.I. Lvovsky, B.C. Sanders, W. Tittel, Nature Photonics, 3, 12, 706-714, (2009).
[3] J. Ruggiero, J.-L. Le Gouët, Ch. Simon, and T. Chanelière, Phys. Rev. A, 79:053851, (2009).
[4] W. Tittel, M. Afzelius, R. Cone, T. Chanelière, S. Kröll, S. Moiseev, and M. Sellars, Laser Photonics Rev. 4, 244–67 (2010).
[5] V. Damon, M. Bonarota, A. Louchet-Chauvet, T. Chanelière, J.-L. Le Gouët, arXiv:1104.4875 (2011).

Date: **Tuesday, May 17th, 2011 4:15 pm**

Location: **FRIAS Seminar Room, Albertstr. 19, Freiburg**

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