

CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE

Mercredi 7 décembre 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

Quantum memory for light in rare-earth doped crystals

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The term "quantum memory" is now widely used in the literature. It means everything and nothing at the same time because it applies to very different domains and systems. We can give a minimal definition: it is device capable of converting a flying qubit which carries the information to a static qubit which keeps it. The reversed processed is most of the time desirable. Behind such a broad definition, everyone can identify himself.

I will present a special kind of quantum memory in which a photon is stored in a rare-earth doped crystal. We can justify this choice in a very pragmatic manner: (i) photons are robust and rapid carriers of quantum information, (ii) rare-earth doped crystals as solids are well known for their photo-luminescent properties. More fundamentally, we can see this perspective as a modern branch of atomic physics considering the interaction of a single photon with a macroscopic sample.

I will develop two protocols we are working on. One is based on "slow light" by spectral hole burning (SHB) [1] and the other is directly inspired by the photon-echo technique [2]. The goal is not only to present our research solely, but rather to have insight in the domain. Our protocol of "slow light" is actually very close to Electromagnetically induced transparency storage (EIT) in atomic vapors. I will emphasize the similarities of EIT and SHB, both belonging to a wider class of protocols that I called dispersive. On the other hand, the photon-echo was a source of inspiration for a series of protocols which are directly based on absorption as opposed to dispersion. My goal is actually to give a global view of light storage protocols by treating these two examples that I consider as archetypal.

[1] Lauro R, Chanelière T & Le Gouët J.-L. 2009, Phys. Rev. A, 79, 053801.

[2] Damon V, Bonarota M, Louchet-Chauvet A, Chanelière T & Le Gouët J.-L 2011, New Journal of Physics, 13, 093031.

A coffee break will be served at 11h00. The seminar will be given in English.