CEA – Saclay, 91191 Gif-sur-Yvette Cedex

Service de Physique de l'Etat Condensé - UMR 3680

SÉMINAIRE

Mercredi 28 mars 2018 à 11h15

Orme des Merisiers SPEC, Salle Itzykson, Bât.774

Pascale SENELLART

Center for Nanoscience and Nanotechnology, CNRS-University Paris Saclay, France

Single-photon generation and manipulation with semiconductor quantum dots

Today, optical quantum technologies are limited both by the low efficiency of heralded single-photon sources and by the probabilistic operation of two-photon gates. Deterministic sources and gates can in principle be obtained making use of the single-photon sensitivity of an atomic transition. In this context, artificial atoms in the form of semiconductor quantum dots have emerged as a promising system to boost optical quantum technologies, offering the potential of integration and scalability. However, this requires an ideal atom-photon interface, where the quantum dot interacts with only a single mode of the optical field and is isolated from any source of decoherence.

In this seminar, I will present our progress along this research line. I will explain how near optimal atom-photon interfaces are obtained by positioning a semiconductor quantum dot in a microcavity [1]. The quantum dot is shown to interact with a single mode of the optical field and is largely protected from all sources of decoherence, including phonons [2,3]. These technological developments have allowed the fabrication of bright solid-state sources of single-photon with single photon purity and indistinguishability exceeding 99\%. The brightness of the sources exceeds by a factor 20 the one of currently used sources [4]. We have also made progresses toward the development of deterministic two-photon gates, with devices performing as nonlinear switches at the single-photon level, converting a coherent pulse into a highly non-classical light wave-packet [5].

References

[1] A. Nowak et al., Nature Communications 5, 3240 (2014)
[2] V. Giesz et al., Nature Communications 7, 11986 (2016)
[3] N. Somaschi, et al. Nature Photonics 10, 340 (2016).
[4] T. Grange et al., Physical Review Letters 118, 253602 (2017)
[5] L. De Santis et al, Nature Nanotechnology 12, 663–667 (2017)

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

Contact : cristian.urbina@cea.fr/cesare.nardini@cea.fr - Tel : +33 1 69 08 74 44/70 72

http://iramis.cea.fr/spec