NanoSaclay

Laboratoire d'Excellence
en Nanosciences et Nanotechnologies

Colloquium Nanophotonique

Shining a (bright) light on the very small

Romain Quidant

ICFO- The Institute of Photonics Sciences

ICREA, Barcelona, Espagne

Extensive research in Nano-optics over the last decade has made possible controlling optical fields on the nanometer scale. In this talk we will present our recent advances in enhanced light-matter interaction on the nanometer scale and their applications to quantum optics.

We first discuss an approach in which light is used to trap and manipulate a single nanodiamond containing a single NV. We demonstrate both translational and angular control of the trapped NV and discuss applications to vectorial magnetometry and mapping of the electromagnetic local density of states [1]. We also demonstrate that the hybrid system formed by a single NV coupled to a gold gap antenna can operate as an efficient and fast optical switch upon non-resonant CW illumination. We show a modulation of the NV fluorescence by more than 80% with time response faster than 100ns that we control through an independent NIR gating laser of a few mW [2].

The second part of the talk presents our latest advances in optomechanics. We optically trap a single nanoparticle in high vacuum and cool its three spatial degrees of freedom by means of active parametric feedback. Using a single laser beam for both trapping and cooling we demonstrate a temperature compression ratio of four orders of magnitude. We discuss the potential of this approach for ground state cooling at room temperature [3] and ultrasensitive force detection [4].

[1] M. Geiselmann, M. L. Juan, J. Renger, J. M. Say, L. J. Brown, F. J. García de Abajo, F. Koppens, R. Quidant, Nature Nanotechnol. 8, 175-179 (2013)

[2] M. Geiselmann, R. Marty, F. J. García de Abajo, R. Quidant, Nature Phys. 9, 785-789 (2013)

[3] J. Gieseler, B. Deutsch, R. Quidant, L. Novotny, Phys. Rev. Lett. 109, 103603 (2012)

[4] J. Gieseler, L. Novotny, R. Quidant , Nature Phys. 9, 806-810 (2013)

AUDITORIUM
Institut d'Optique
2 Av Fresnel, 91127 Palaiseau

Lundi 10 février 2014 à 11h

NanoSaclay