Centre DE Nanosciences & DE Nanotechnologies

C2N General Seminar

Friday Septembre 6th 2019 - 10h 00

Amphitheater of C2N

Photon-phonon interaction driven by complexity

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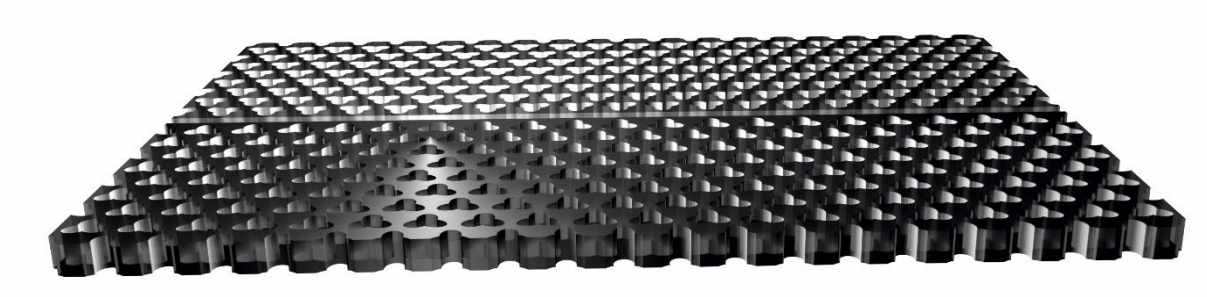
Precision is a virtue in science in general and nanotechnology in particular where carefully fabricated nanometer-scale devices hold great promise in both classical and quantum regimes. Ground-state cooling or phonon amplification require, for example, a sideband resolved photon-phonon coupling where unavoidable imperfections often impose severe performance limits. However, imperfection and disorder are ubiquitous in Nature and emerge with a role particularly important in nanoscale devices.

In this talk, I will explore the limits imposed by imperfection in different nanodevices, but not only. In certain cases, disorder may be invoked to enable new functionalities and can be exploited to enhance the light-matter interaction in different fields of nanotechnology such as quantum photonics, nonlinear photonics, phononics and optomechanics.



Pedro David Garcia Fernandez obtained a Master on solid-state and theoretical physics at the Complutense University of Madrid. Then, he got a PhD on complex Photonics at CSIC (Madrid) at the colloidal photonics group led by Prof. Cefe López in close collaboration with the group of Prof. Diederik Wiersma at LENS, Italy. He spent many years at the Niels Bohr Institute in Copenhagen, studying disorder-induced mesoscopic phenomena in cavity quantum electrodynamics experiments. He is back to Spain, Barcelona, to incorporate the effect of phonons to this picture.

His primary scientific goal is to understand how thermodynamical fluctuations and entropy ultimately lead to complexity in Nanotechology and how this complexity can be used as a resource to obtain a given functionality. Entropy leads to imperfections, disorder and multiple scattering which is in general detrimental for any technology at the nanoscale, both in the classical or the quantum regime. However, disorder and randomness are ubiquitous in nature. In particular, he has focused his attention to on light emission and propagation through complex – disordered – dielectric structures and very recently, he has been triggered by how mechanical vibrations of matter affect and are affected by complexity in Nanotechnological devices. This rather fundamental research topic has important applications in many relevant fields such as energy harvesting, imaging, lasing, quantum optics or information processing.

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