Centre DE Nanosciences & DE Nanotechnologies

C2N General Seminar

Friday March 8th 2019 - 10h 00

Amphitheater of C2N

Building artificial quantum materials with light

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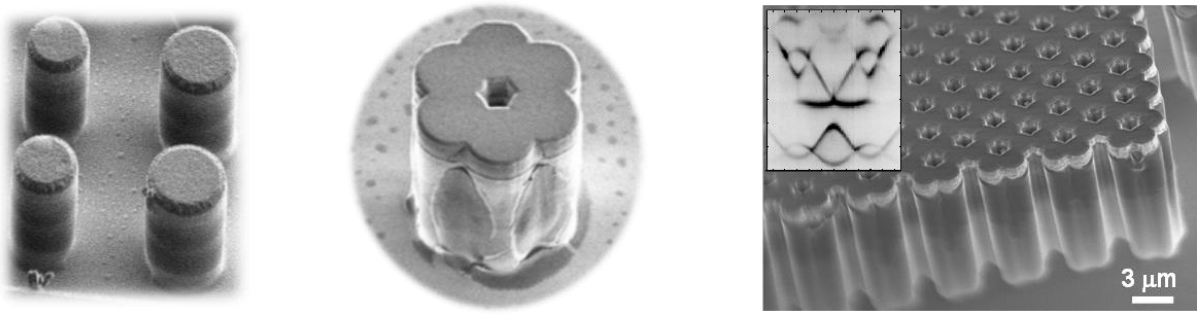
Engineering strong interactions between optical photons is a great challenge for quantum science and technology. One envisioned application is the realization of synthetic quantum materials as a tool to harness and investigate quantum-correlated systems.

Polaritonics, based on the strong coupling of photons to atomic or electronic excitations in an optical resonator, have proved to be a particularly versatile platform to engineer diverse photonic materials. However, it has also been shown that going into the quantum regime requires polariton-polariton interactions that are an order of magnitude stronger than what is currently achieved in state-of-the-art samples.

I will present two approaches that are being developed to tackle this challenge. I will first describe experiments performed at ETH Zürich demonstrating that polariton-polariton interactions can be significantly enhanced by embedding a high-mobility 2D electron system in an optical cavity: an order of magnitude enhancement over the interactions is obtained when the electrons of the 2DES are initially in a fractional quantum Hall state. I will then discuss perspectives related to the development of new active materials exhibiting excitons with a permanent dipole, an approach which is potentially compatible with polariton lattices developed at C2N.



SEM images photonic materials built at C2N

Sylvain Ravets *realized his PhD jointly between the Laboratoire Charles Fabry (Institut d'Optique, Palaiseau) and the Joint Quantum Institute (University of Maryland & NIST, Washington DC), where he worked on quantum engineering using individual neutral atoms. In 2015, he joined the quantum photonics group of ETH Zürich as a postdoctoral researcher, where he worked on the physics of exciton polaritons in the quantum Hall regime. In 2018, he joined the photonics department of C2N – GOSS group – as a CNRS researcher, where is currently interested in the development of new synthetic quantum materials in arrays of semiconductors microcavities.*

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