Title: Semiconductor microcavities, from quantum optics to quantum fluids

In semi-conductor microcavities with embedded quantum wells, optical excitations can create exciton-polaritons which are mixed light-matter quasi-particles arising from the strong coupling between photons and excitons. Polaritons are bosons that have very interesting properties. Their excitonic component results in strong polariton-polariton interactions giving rise to high non-linearities. Owing to these non-linearities we have been able to demonstrate nonlinear and quantum optical effects as well as spin control and spin switching, that can be promising for quantum information. Polariton lasing was also observed recently in microcavity pillars.
On the other hand, the very low mass of the polaritons ($\sim 10^{-4}$ times that of the electron, inherited from their photonic component) enables a bosonic condensation at rather high temperatures. We have shown that exciton–polaritons in semiconductor microcavities behave as a novel quantum fluid, with properties such as superfluidity, Cerenkov patterns, vortices and solitons.

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