Dynamics of coupled polariton condensates

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Semiconductor microcavities are an excellent solid state platform for the study of the quantum fluid properties of bosonic condensates. The eigenstates of this system are polaritons, half-light/half-matter quasiparticles arising from the strong coupling between excitons and photons confined in a planar semiconductor microcavity. The very short lifetime of polaritons sets this system out of equilibrium. The steady state is thus no longer set by thermodynamics but by the interplay between pumping, relaxation and decay.

Polaritons can be confined in lower dimensional structures of almost any engineered shape by etching planar microcavities. In this paper we will show how we can manipulate polariton condensates in microstructures and study phenomena like non-linear Josephson oscillations between two coupled condensates, or the spontaneous formation of spin currents in ring-like structures. These features arise from the combination of out-of-equilibrium nature of polariton condensates and the engineered confinement. These results open the way to study two-dimensional lattices with non-trivial geometries.