Nonequilibrium Thermodynamics of exciton-polariton fluids in Semiconductor Microcavities

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In semiconductor optical microcavities in the so-called 'strong-coupling regime', the elementary excitations are cavity-photons strongly dressed by an electronic transitions called excitons. These excitations, usually referred to as polaritons, behave pretty much like interacting photons. While their photonic nature provides them with a non-zero but still very light effective mass, their excitonic component provides a mean for mutual interaction. As a result, polaritons behave pretty much like a non-equilibrium (NE) quantum fluid of light.

In this talk, I will present recent experimental results, in which we investigate the heat flux - and its effect on the system- occurring between a heat source at thermal equilibrium (lattice phonons) and a non-equilibrium fluid of polaritons. The first part will be dedicated to the demonstration of a polariton-based heat pump. In a second part, the influence of heat on the spatial coherence properties of a NE polariton condensate will be shown throughout the crossover between the driven-dissipative and the thermalized regime. Finally, a few preliminary measurements will be shown on the excitation spectrum of a thermally-excited spinor polariton superfluid.