Superfluidity, vortices and dark solitons in Exciton-Polariton condensates

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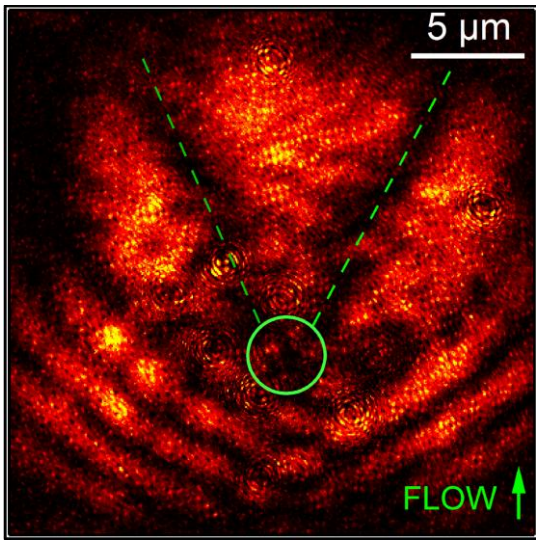
Polaritons are half-light half matter quasiparticles resulting from the strong coupling of photons confined in a microcavity with excitons confined in a quantum well. Polariton condensates may be created both spontaneously through a "*standard*" phase transition towards a Bose Einstein condensate, or be resonantly driven with a well-defined initial phase, speed and spatial distribution.

Thanks to the photonic component of polaritons, the properties of the quantum fluid may be accessed very directly, with in particular the possibility of detailed interferometric studies. This allows for example to probe the long-range coherence properties of a quantum fluid with unprecedented ease. This also allows testing superfluid properties with great precision in space and time.

I will describe the static and dynamics of superfluid flow in polariton condensates, obtained with a picosecond time resolution, in different configurations, with in particular their phase configuration. I will show in particular the dynamics of the creation of dark solitons and quantized vortex pairs.

This work has been performed at EPFL by a dream team of Postdocs, PhD students and collaborators: K. Lagoudakis, G. Nardin, T. Paraiso, G. Grosso, F. Manni, Y Léger, S. Trebaol, M. Portella Oberli, F. Morier-Genoud and the help of our theorists friends V, Savona, M. Wouters and T. Liew.



Observation of the dark soliton created by the interaction of a supersonic flow of polaritons with an obstacle.