Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage

Date de la proposition : 5/1/2017

Responsable du stage	*internship supervisor*:		
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Code d'identification :	Organisme : CNRS, UPMC, ENS		
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Lieu du stage / *internship place*: Jussieu			

Propagation of a polariton condensate in an potential optically reconfigurable.

Quantum fluids of light

Historically, most work in many body-physics (theoretical and experimental) are dealing with massive material particules (atoms, electrons...). However, we know since the early days of quantum mechanics, that photons in a box can be interpreted as a massless Bose gas of non-interacting particules and this interpretation leads to a correct calculation of the black-body radiation. Recently, it has been realized that under suitable circumstances photons can acquire an effective mass and will behave as a quantum fluid of light with photon-photon interactions. Striking experimental demonstrations of superfluidity and other quantum hydrodynamics effects such as quantized vortices and solitons have been performed using semi-conductor planar micro-cavities. Building on these experiments done by the LKB group, we propose to use a different geometry (propagating light instead of confined) to study quantum fluids of light.

Internship

Quantum wells embedded in microcavities are systems where the interaction between matter (excitons) and the light (photons) exhibits unusual characteristics. In the regime of strong coupling between excitons and the photons, the fields can be described as a pseudo-particle, which is a mixed state of light and matter. These pseudo-particles are called polaritons.

These polaritons are bosons that are confined in a 2D structure (transverse plane of the microcavity). Due to Coulombian interactions, fascinating phenomena such as superfluidity and Bose-Einstein condensation can be observed.

The LKB Quantum Optics group has a recognize expertise in this domain and is looking forward on developing a new experimental setup to study the propagation of polariton superfluids in an optically controlable potential landscape. As we already demonstrated in the group, a defect in the microcavity acts like a potential well and induces the formation of vortices, anti-vortices and solitons. With a non-resonant light source, one can induce artificial defects in the cavity by injecting excitons. We aim at building an experiment in which the transverse beam profile can be set arbitrarily and reconfigure easily. This can be achieved using a Spatial Light Modulator (SLM) in addition with an algorithm that generate a numerical hologram in the Fourier plan.

For more details, please check our website: www.quantumoptics.fr/stage-1/

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : OUI**

Si oui, financement de thèse envisagé/ *financial support for the PhD***: ANR ou Allocation Ministère**

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**