

Spécialité de Master « Optique, Matière, Paris »

Stage de recherche

Proposition de stage

Date de la proposition : 26 octobre 2016

Responsable du stage / internship supervisor:	
Nom / name : Cherroret	Prénom/ first name : Nicolas
Tél : 01 44 27 44 00	Fax :
Courriel / mail : cherroret@lkb.upmc.fr	
Nom du Laboratoire / laboratory name : Laboratoire Kastler Brossel	
Code d'identification : UMR 8552	Organisme : UPMC/CNRS/ENS
Site Internet / web site : http://www.lkb.upmc.fr/	
Adresse / address : Université Pierre et Marie Curie, Case 74, 13-23 2ème étage, 4 place Jussieu, Paris 05	
Lieu du stage / internship place : UPMC	

Titre du stage / internship title : Thermalization of a disordered quantum photonic gas
Résumé / summary This project is theoretical
<p>In the presence of a significant Kerr optical nonlinearity, a many-photon laser beam may behave collectively as a quantum fluid of matter : one speaks of “quantum fluid of light”. A promising optical platform for the study of the physics of quantum fluids of light consists in the propagation of a paraxial beam of quasi-monochromatic light in a Kerr medium. In this case, the propagation equation of the quantum optical field is formally analogous to the Heisenberg evolution equation of a dilute Bose-Einstein condensate after exchanging the roles played by the time and the propagation coordinates [1].</p> <p>During this internship, we propose to study how the phase-space density of such a beam of quantum light evolves when propagating in a spatially disordered medium. Due to photon interactions, this evolution is expected to converge toward a thermalized Bose-Einstein distribution, the properties of which depend on the initial conditions of the system and on the disorder. The dynamics of the thermalization process as well as the properties of the eventual thermal-equilibrium state will be investigated in detail in the limit of weak disorder, using a formalism of quantum kinetic equation [2].</p> <p>The project can be pursued in a Ph.D. A natural continuation of this work could then be the investigation of the regime of strong disorder, where thermalization can be blocked by the newly discovered mechanism of (many-body) Anderson localization [3].</p>
[1] P.-E. Larré and I. Carusotto, <i>Propagation of a quantum fluid of light in a cavityless nonlinear optical medium : General theory and response to quantum quenches</i> , Phys. Rev. A 92 , 043802 (2015). [2] N. Cherroret, T. Karpiuk, B. Grémaud, and C. Miniatura, <i>Thermalization of matter waves in speckle potentials</i> , Phys. Rev. A 92 , 063614 (2015). [3] D. M. Basko, I. L. Aleiner, B. L. Altshuler, <i>Metal-insulator transition in a weakly interacting many electron system with localized single-particle states</i> , Annals of Physics 321 , 1126 (2006).

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 : bourse EDPIF ou autre	
Lumière, Matière, Interactions	Lasers, Optique, Matière