

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 : Casimir forces from quantum fluctuations of an optical fluid
Résumé / summary This project is theoretical
<p>Light can couple to matter in various ways, but one of the most fascinating mechanism is the Casimir effect. The latter corresponds to a dispersion force between neutral materials placed in vacuum. This force is triggered by the quantum fluctuations of the quantized electromagnetic field [1].</p> <p>During the internship, the student will study the Casimir-like force between two materials immersed in an optical electromagnetic field where photons can interact with each other. Such a “quantum fluid of light” can be produced by propagating a quasi-monochromatic paraxial laser beam of light in a nonlinear Kerr medium [2]. In this setup, the force is due to the isotropic quantum fluctuations that arise on top of the classical laser mode.</p> <p>More specifically, we will consider two dielectric plates immersed within a laser field that propagates in the direction parallel to the plane of the plates and we will analyze the Casimir force using a scattering formalism [3]. In such a setup, the laser field itself does not exert any radiation force on the plates, unlike the quantum fluctuations on top of it. In a first step, only the limit of a weakly interacting photon gas, easy to produce experimentally as well as to describe theoretically, will be considered.</p> <p>The project will also involve a collaboration with the team “Quantum Fluctuations and Relativity” at LKB. It can be pursued in a Ph.D, during which the more challenging, strongly interacting regime of the photon gas could be explored.</p>
[1] A. Lambrecht, <i>The Casimir effect : a force from nothing</i> , Physics World 15 , 29 (2002)
[2] 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).
[3] S. Reynaud, A. Canaguier-Durand, R. Messina, A. Lambrecht, P.A. Maia Neto, <i>The scattering approach to the Casimir force</i> , Int. J. Mod. Phys. A 25 , 2201 (2010).

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