

Spécialité de Master « Optique, Matière, Plasmas »

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

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition :

Responsable du stage / internship supervisor:			
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Site Internet / web site:	http://www.lkb.ens.fr/-Themes-de-recherche,74-?lang=en		
Adresse / address:	4 place Jussieu, Tour 12-13, 75005 Paris		
Lieu du stage / internship place:	idem		

Titre du stage / internship title: *Quantum thermodynamics in 1D model system*

Résumé / summary

Thermodynamics allows the study of equilibrium properties of macroscopic objects. Its application to quantum systems requires careful reconsideration of the relevant processes as on the quantum scale thermal fluctuations coexist with quantum fluctuations, which even become predominant at $T=0$.

The Casimir effect, that is the attractive force arising between two plates in quantum vacuum due to vacuum fluctuations, shows remarkable features concerning thermodynamic properties. In particular, the Casimir interaction entropy may become negative for mirrors made of dissipative materials [1] and in non trivial geometries such as the plane-sphere geometry [2].

We propose an internship to study the negative Casimir entropy in 1-D model systems within the framework of quantum thermodynamics. The 1-D systems are more easily theoretically analyzed than the 3-D counterparts while they may now be implemented in experiments, for instance in circuit QED [3], in opto-mechanical and electromechanical systems [4,5].

[1] G.L. Ingold et al., PRE 80 (2009) 041113.

[2] A. Canaguier-Durand et al., PRL 104 (2010) 040403 ; PRA 85 (2012) 052501.

[3] C.M. Wilson et al., Nature 479 (2011) 376.

[4] T. Palomaki et al., Science 342 (2013) 710.

[5] R.W. Andrews et al., Nature Phys. 10 (2014), 321.

The scattering approach used to calculate the Casimir interaction is based on the methods of quantum optics. The 1-D systems considered in the study are emerging technologies, which now allow for direct comparison with simple theoretical models. The project implies analytical calculations as well as numerical simulations.

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

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

Si oui, financement de thèse envisagé/ financial support for the PhD:

Lasers, Optique, Matière	x	Lumière, Matière, Interactions	x
Plasmas : de l'espace au laboratoire			

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