

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 : 23/10/2013

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Adresse / address: 4 place Jussieu, Tour 12-13, 75005 Paris			
Lieu du stage / internship place: idem			

Titre du stage / internship title: *Casimir physics and quantum friction*

Résumé / summary

Vacuum field fluctuations exert radiation pressure forces on any scatterer placed in empty space. For two mirrors at rest in vacuum, this effect has been known for a long time as the static Casimir force [1].

It is also known that a dynamical Casimir force exists for a mirror moving in vacuum, which corresponds to the radiation of photons through non-adiabatic processes [2]. Because of energy conservation the mirror's motion is damped out by a dissipative radiation reaction force.

A quantum friction force also arises because of dissipation in the moving object. The dynamical Casimir effect and quantum friction are striking theoretical predictions arising from motion in quantum vacuum. The project aims at a better understanding of these effects for realistic geometries. In particular we propose to study the photon production via the dynamical Casimir effect / quantum friction arising from a nanostructured plate moving in vacuum. From previous studies it may be hoped that the photon production will be enhanced with the help of surface plasmons living on the nanostructure [3].

Our group has a long-standing experience in calculating vacuum induced phenomena within the scattering approach [4], which will also be applied to the problem at hand. In order to approach the problem gradually the internship will consist of a study of different physical systems, such as a single plate, a single nanostructure, a single atom moving in vacuum and determining the conditions for obtaining radiation of photons via the dynamical Casimir effect / quantum friction.

The project can be followed by a PhD thesis in which we plan to calculate explicitly the emitted radiation for different systems, in particular for the moving nanostructure.

[1] H. B. G. Casimir, Proc. K. Ned. Akad. Wet. 51, 793 (1948)

[2] S. A. Fulling and P. C. W. Davies, Proc. Roy. Soc. London 348A, 393 (1976)

[3] R. Guérout et. al., Phys. Rev. B 85, 180301(R) (2012)

[4] A. Lambrecht, M.-T. Jaekel, and S. Reynaud, Phys. Rev. Lett., 77, 615 (1996)

A. Lambrecht et al. New Journal of Physics 8, 243 (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: ED Physique Ile de France

Lasers et matière	x	Lumière, Matière : Mesures Extrêmes	x
Optique de la science à la technologie		Plasmas : de l'espace au laboratoire	

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