



MASTER IN PHOTONICS – PHOTONICS BCN EUROPHOTONICS-POESII MASTER COURSE

PROPOSAL FOR A MASTER THESIS

Dates: April - September 2017

Laboratory : Quantum Optics Theory

Institution: ICFO – The Institute of Photonic Sciences

City, Country : Castelldefels, Barcelona, Spain

Title of the master thesis: The gravitational Casimir effect in different geometries

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Summary of the subject (maximum 1 page) :

One of the most remarkable consequences of the non-zero vacuum energy predicted by quantum field theory, is the Casimir effect. In its most basic form, the Casimir effect is the attraction between two perfectly reflecting surfaces as a result of the restriction of allowed modes in the vacuum between them. Real bodies however are not perfectly reflecting, and the generalisation of these ideal boundary conditions to more realistic ones have been derived for the electromagnetic (EM) field, resulting in the Lifshitz formula at zero temperature. The EM field of course, is not the only field that produces the Casimir effect; in theory all fields of the quantum vacuum contribute to the Casimir effect.

The gravitonic contribution to the Casimir effect has recently been derived by Quach [1]. In this work a general framework to derive the gravitational Casimir effect is provided, but up to date has only been applied to the simple case of two infinite parallel planes at zero temperature. In this project the student will use this framework to calculate the gravitational Casimir effect for other, more sophisticated geometries e.g. planar-ball, ball-ball, ball-shell, etc. In addition the student will derive the finite temperature gravitational Casimir effect, using conventional thermal correction techniques. This work will lay the foundations for the understanding of the gravitational Casimir effect for realistic bodies in different geometries.

[1] J. Q. Quach, "Gravitational Casimir Effect". *Physical Review Letters* **114**, 081104 (2015).

Keywords : Casimir effect, quantum gravity, quantum field theory

Additional information :

* Required skills :

* Miscellaneous :