Internship proposal

# QED Fluctuation Interactions

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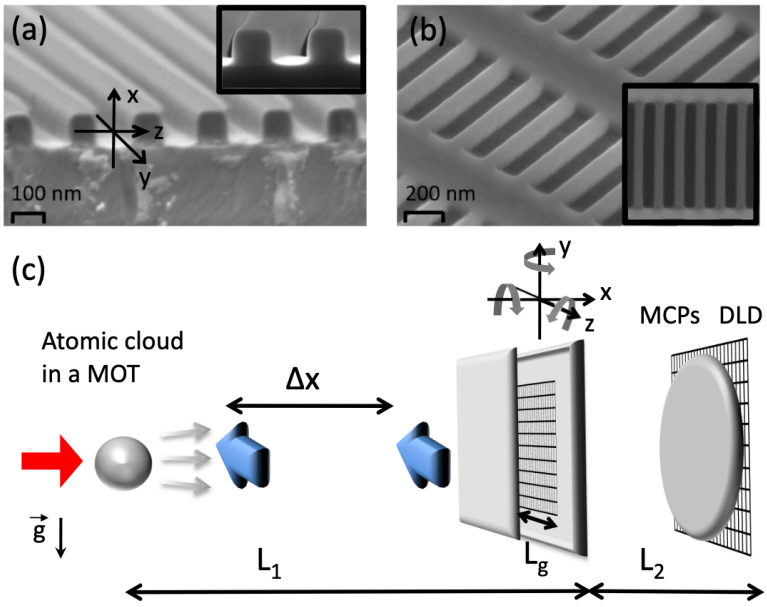
## Overview

Explore the frontier of electromagnetic quantum effects in nano systems. One of the most striking predictions of quantum physics is the interaction of the electromagnetic vacuum with atoms and macroscopic bodies. Spectacular manifestations of this interaction are Casimir forces. Enormous progress in force sensing techniques and the fabrication of nano-structures have highlighted impressively the practical relevance of this quantum effect. This internship concerns the use of new theoretical methods to study the interaction of atoms and molecules with nano-structures.




## What to do

- Learn how neutral particles (atoms, molecules) can interact with macroscopic surfaces due to quantum fluctuations
- Develop approximations to compute these interactions, using a so-called Multiple Scattering Expansion
- Study these forces in experimentally realized nano geometries

**What to gain**

- Learn about the unconventional world of quantum forces and their interesting properties
- Employ advanced theoretical methods to estimate quantum forces, together with leading scientists in the field
- Exposure to forefront research on quantum effects in nano-systems with experimental relevance

**What to know**

We invite applications from students with backgrounds in theoretical physics, statistical physics or atomic physics. A strong interest in both analytical and numerical computations is important. Potential collaboration with experimentalists!

Candidates with a strong interest in a **subsequent PhD** are particularly encouraged to apply.

**Applications**

Interested candidates are asked to submit a CV and a brief motivation letter by email (see above).

**Some relevant literature**


- *Something Can Come of Nothing: Quantum Fluctuations and the Casimir Force*, G. Bimonte, T. Emig, N. Graham, M. Kardar, Annual Reviews of Nuclear and Particle Science 72, 93 (2022)
- *Multiple scattering expansion for dielectric media: Casimir effect*, T. Emig, G. Bimonte, Phys. Rev. Lett. 130, 200401 (2023)
- *Measurement of Casimir-Polder interaction for slow atoms through a material grating*, Julien Lecoffre et al., Preprint http://arxiv.org/abs/2407.14077 (2024)