



ERASMUS MUNDUS



## MASTER IN PHOTONICS – PHOTONICS BCN EUROPHOTONICS-POESII MASTER COURSE

### PROPOSAL FOR A MASTER THESIS

Dates: April - September 2017

**Laboratory:** Plasmon Nano-Optics group

**Institution:** ICFO

**City, Country:** Castelldefels (Barcelona)

**Title of the master thesis:**

**Optomechanics in a hybrid Optical/Paul trap**

**Name of the master thesis supervisor:** Andreas Schell and Romain Quidant

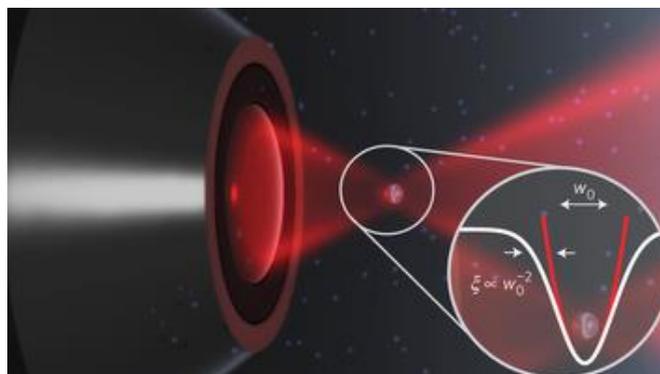
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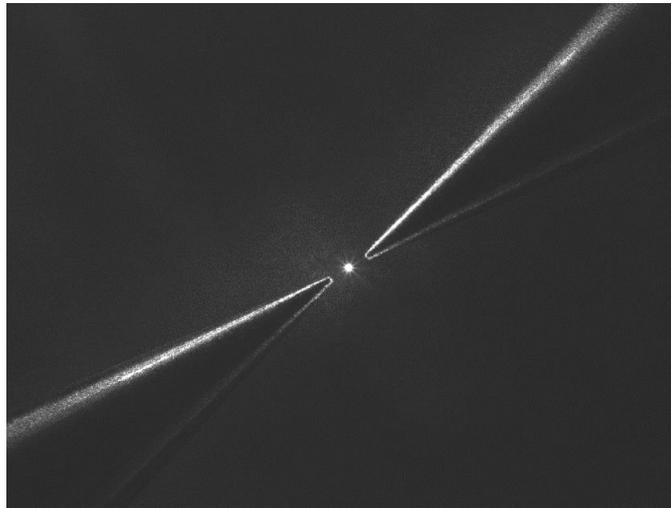
### **Summary of the subject:**

Optical levitation of nano-objects in high vacuum offers great promises in the field optomechanics, with applications to ultra-sensitive metrology, quantum information and study of the classical to quantum transition. However, trapping in vacuum is not straightforward and is currently limited to very low absorbing materials, because of the absence of an efficient heat dissipation mechanism at low pressures.



*Figure 1 Particle trapped in an optical tweezer*

With the aim to extend levitation optomechanics to a wider range of nano-objects (and in particular artificial atoms), we here propose to use an oscillating quadrupolar electric trap, so-called Paul trap, that circumvents heating of the trapped specimen.



*Figure 2 Charged nanoparticle in a Paul trap*

In this project, the student will work towards the integration of a hybrid Optical/Paul trap to achieve unprecedented control of the dynamics of levitating nanoparticles.

The student will be required to work experimentally in the trapping and manipulation mechanisms, and also to perform simulations and understand the dynamics of the trapped particles.

**Keywords: Nanoparticles, Paul trap, Optical tweezers, Numerical simulations**

**Additional information:**

\* Required skills:

- Some experience in programming.

\* Competences that can be acquired through the thesis program/other useful skills:

- Hands-on experience with analog and digital electronic systems
- Familiarity with MATLAB
- Automatization with LabVIEW
- Basic knowledge of differential equations