



## **MASTER IN PHOTONICS – “PHOTONICS BCN” ERASMUS+ “EUROPHOTONICS”**

### **MASTER THESIS PROPOSAL**

**Dates: April - September 2019**

**Laboratory :** Plasmon Nano-Optics group  
**Institution:** ICFO - The Institute of Photonic Sciences  
**City, Country :** Barcelona, Spain

**Title of the master thesis: Simulation of Planar Paul traps for inertial sensing**

**Name of the master thesis supervisor: Prof. Romain Quidant/ Dr. Nadine Meyer**

**Email address :** nadine.meyer@icfo.eu  
**Phone number :** 0034 935534048  
**Mail address :** Plasmon Nano-optics group  
ICFO – The Institute of Photonic Sciences  
Av. Carl Friedrich Gauss, num. 3  
08860 Castelldefels (Barcelona)  
Catalonia, Spain

**Keywords :** numerical simulation, Paul traps, inertial sensing

**Summary of the subject (maximum 1 page) :**

**In our everyday world the demands on inertial sensors in sensitivity, accuracy, transportability, speed and costs increase nearly by the day. However, the best inertial sensors suffer of their complexity, while other platforms don't reach the desired sensitivities. One promising compromise of complexity and sensitivity is offered by levitated oscillators, e.g. nanoparticles trapped in optical tweezers. With their relatively high mass and relatively simple experimental setups they achieved sensitivities of down to the  $aN/\sqrt{Hz}$  ( $10^{-18} N/\sqrt{Hz}$ ) while still being generally transportable. While most levitation setups use optical tweezers, Paul traps based on electrostatic forces offer a suitable alternative, avoiding high laser powers.**

**In the ion community planar Paul traps are widely available and offer a more compact design and better optical access than standard trap designs.**



UNIVERSITAT POLITÈCNICA  
DE CATALUNYA  
BARCELONATECH

**UAB**  
Universitat Autònoma  
de Barcelona

 UNIVERSITAT DE  
BARCELONA

**ICFO**  
The Institute  
of Photonic  
Sciences

**With the final goal to develop a transportable inertial sensor based on planar Paul traps, this master project will develop an optimised planar Paul trap design for inertial sensing via numerical simulation.**

**The daily work will be mainly computer based with a possible lab experience towards the end of the project. The successful candidate will be fully integrated in the optomechanics sub-group in the Plasmon Nano-optics group to carry out the project but is also expected to show appropriate levels of independence and initiative.**

**Additional information :**

- \* Beneficial skills: programming skills
- \* Miscellaneous: basic level of English