



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:

Collective effect in arrays of levitated nanoparticles

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

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Summary of the subject:

The trapping of single ions became possible after the invention of the Paul trap, allowing for the possibility to study and perform, for the first time, quantum mechanics experiments with single quantum objects. The original trap design evolved into a handful of different geometries, one of the most successful being the linear trap. This led to the first proposals of quantum computers with entangled ions via spin qubits.

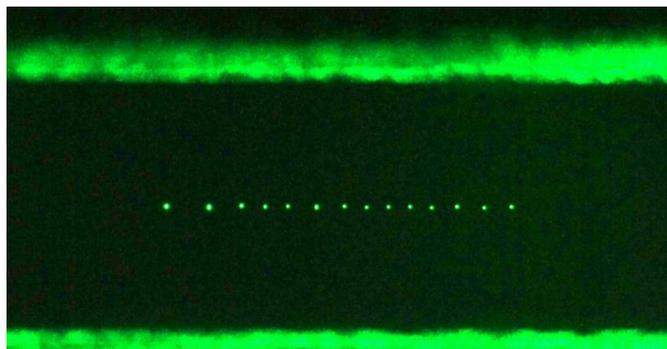


Figure 1 Charged microparticles trapped in a linear trap

The prospect of storing chains of ions in the same trap gave rise to more sophisticated forms of cooling, like the cooling of different species of ions at the same time.

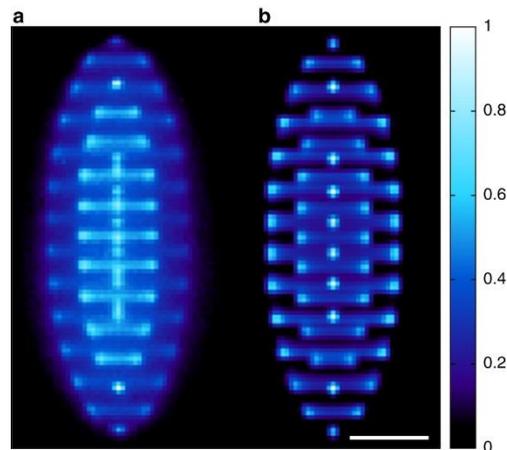


Figure 2 Chain of ions forming a Wigner crystal

In this project, the student will work on the study of collective effects of trapped charged nanoparticles, in a mesoscale between the macroscopic and the quantum world. The student will be required to work experimentally in the trapping mechanisms and techniques, 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