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: **Automated experiment control in python for levitated nano-oscillators**

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Keywords : **python, labview, FPGA, optical tweezers, nanoparticles**

Summary of the subject (maximum 1 page) :

Where does Quantum mechanics break down? Well proven on the atomic scale, the limits of Quantum Mechanics stay delusive. In order to come closer to answer this question, mesoscopic oscillators offer a unique platform to investigate larger objects in the quantum regime. In our experiment the centre-of-mass motion (CoM) of a levitated nanoparticle is slowed down with the help of a cavity light field (via sideband cooling techniques) with the ultimate goal to bring this particle into its CoM ground state.

For these kind of experiments, it is of upmost importance to control the laboratory experiments at will and with high control. Therefore the aim of this master thesis is to develop and implement a general experiment control based on python, integrating

experiment control and evaluation in one platform. While it is desirable to develop each block (evaluation and experiment control) individually, ultimately they will be designed as an experiment independent platform, easily adaptable to several experiments.

The experiment control needs to control the sequential experiment on a µ-second scale, tuning laser frequencies and optical power via electro-optical equipment on demand. A computational loop will allow to vary different experimental parameters from run to run. The data acquisition will extract power spectral densities and energies from the obtained time traces.

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

Additional information :

* Beneficial skills: programming (python, FPGA), matlab
* Miscellaneous : basic level of English