

EUROPHOTONICS MASTER

PROPOSAL FOR A MASTER THESIS

Dates: April 1st, 2018 – September 30th, 2018

Laboratory: Institut Fresnel
City, Country: Marseille, France

Title of the Master Thesis: Optical Spectroscopy of Single Particles in Levitation

Name of the tutors of the Internship: Nicolas Bonod and Johann Berthelot

Email address: nicolas.bonod@fresnel.fr

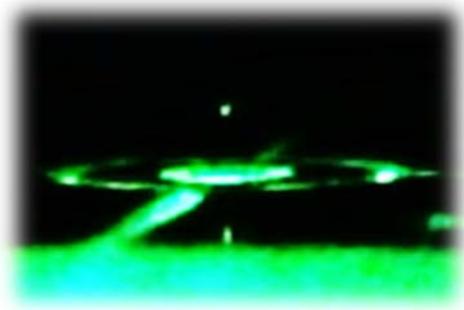
Phone number: 0491282835

Mail address: Institut Fresnel, Domaine Universitaire de Saint Jérôme, 13397 Marseille, France

Summary of the subject (maximum 1 page):

Subwavelength sized particles can resonantly interact with light. In particular, metallic particles (e.g. gold or silver) can feature localized surface plasmons while high refractive index particles (e.g. Si, Ge,...) can feature Mie resonances. The resonant light scattering can be probed by illuminating individual particles with a white lamp and by collecting the light scattered by the object in the forward or the backward direction. The analysis of the scattered light permits to retrieve the optical resonances of the particles. However, in classical spectroscopy, particles are deposited on a substrate before being illuminated which modifies their optical responses.

In this master internship, we will use a levitation set-up built recently in the lab relying on the use of radio-frequency Paul traps. The system is composed of an electro spray coupled with a linear Paul trap made of 4 electrodes allowing to electrically charge and guide the particles towards a second Paul trap. This last one is planar (ie, all electrodes are in the same plane) and is mounted on a translation robotic arm and piezo system. The trapped particle, in levitation above the planar Paul trap can be manipulated in 3D thanks to the automatized arm and be transported up to the optical confocal microscope.



The optical properties of the particle in levitation can therefore be probed by illuminating the particle with different sources (white light, lasers) and by analysing the backscattered light with a photospectrometer.

During this master internship, the master student will have the opportunity to manipulate a unique set-up combining optical microscopy and levitation. He/she will be supervised by Nicolas Bonod (CNRS researcher) and Johann Berthelot (European Marie Curie fellow).

Keywords: Levitation, Resonant light Scattering, Optical Spectroscopy, Plasmonics

Additional information:

- * Required skills: LabView, Matlab, Experimental optics
- * Salary: 550€/month
- * Miscellaneous: