

INTERNSHIP PROPOSAL

Laboratory name: Institut des NanoSciences de Paris

CNRS identification code: UMR 7588

Internship director'surname: Agnès Maître / Juliette Lignières

e-mail: agnes.maitre@insp.jussieu.fr

Phone number: 0144274217

Web page: [quantum nanophotonics](http://quantumnanophotonics)

Internship location: Sorbonne université, Jussieu, 22-32, 5th floor

Thesis possibility after internship: YES

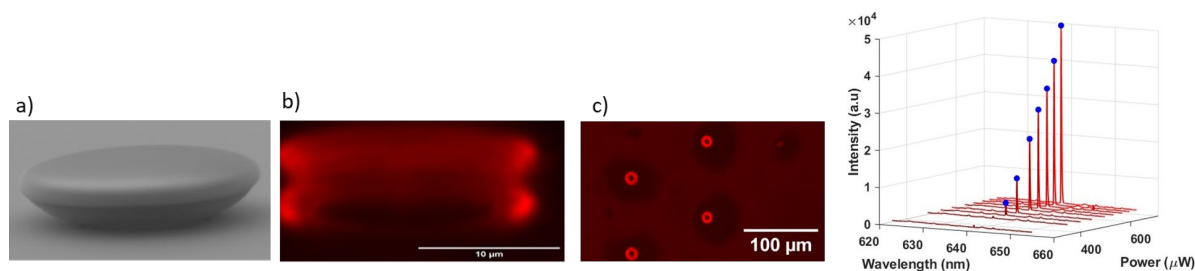
Funding: YES If YES, which type of funding: doctoral school

Excitonic whispering gallery mode laser in high pumping regime

Keywords: laser, quantum dot, whispering gallery mode, exciton

In nanophotonics and quantum technologies, photon sources are a resource which can be integrated into a chip. Cylindrical dielectric microdisks make excellent resonators in which optical gallery modes can propagate at the air/dielectric interface.

Using optical lithography, we have fabricated gallery-mode resonators on which we have deposited fluorescent nano-emitters, colloidal quantum dots. These are CdS/CdSe/CdS semiconductors in a spherical core/shell/shell configuration. Of nanometric dimensions, their fluorescence wavelength depends on their size. They can emit single photons, are resistant to photobleaching and are bright under strong excitation. We have deposited these quantum dots in high concentration on microdisks, in order to achieve a sufficient gain. We were therefore able to create gallery modes excitonic microlasers. [1,2].



a) microdisk optical cavity c b) Fluorescent gallery mode (side view split by substrate reflection) c) Gallery mode (top view) d) Laser mode and fluorescence spectra

The aim of this internship will be to study these gallery-mode lasers, as a function of their size, shape or when two cavities are coupled. In particular, we will be interested in the behavior of these lasers far from the threshold, when the excitation laser is intense. Under these conditions, the resonant gallery mode intensity is high. If its coupling to the excitons is sufficiently strong, emission will be modified by exciton-photon interaction. We will study these strong coupling configurations in relation to theoretical predictions.

[1] C. Kersuzan et al, *ACS Photonics*, 11(4), 1715-1723 (2024)

: M1 and M2

Condensed Matter Physics: YES Quantum Physics: YES

Quantum Engineering: YES