

Person in charge of the internship: R. Gutierrez-Cuévas, L. Rondin, P. Verlot
e-mails: rodrigo.gutierrez-cuevas@ens-paris-saclay.fr; loic.rondin@ens-paris-saclay.fr;
pierre.verlot@universite-paris-saclay.fr

Multimode opto-ultrasonics with acoustically levitated objects

Description of the scientific project:

Optomechanics investigates the interactions between light and mechanical degrees of freedom. Emerged in the mid-1990's, the field distinguishes by the extreme motion sensitivity, down to the zeptometre range, yielded by a large panel of ultra-sensitive optical readout methods.

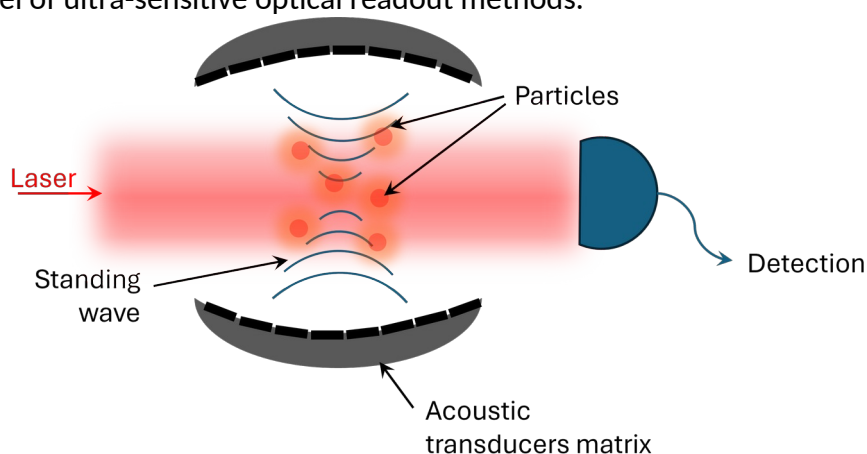


Figure 1 Schematic of the proposed experiment. Microbids are acoustically trapped using acoustic matrix transducers. The motion of the trapped microbids is detected using sensitive laser interferometry. This platform will be used for (a) quantitative investigation of the noise dynamics of acoustically trapped particles (both at the individual and collective level), (b) addressing the structure of standing acoustic waves generated by the acoustic trap and (c) independent characterization of the transduction efficiency of the acoustic matrices used in the trap.

This internship proposes to extend this paradigm by combining the precise control of light with the complementary control offered by acoustic waves. While optics provides exquisite sensitivity at small scales and high frequencies, acoustic trapping allows manipulation of particles at micrometric scales and lower frequencies, enabling complementary access to spatial and temporal dynamics.

By integrating an acoustic levitation system with an ultra-sensitive optomechanical detection scheme, this approach will enhance measurement sensitivity and provide new opportunities to simultaneously control and monitor multiple particles in the trap. The project will focus on the characterisation and the control of the acoustic field to optimize the trapping and coupling of the levitated particles. Its main goals will be to optimize the measurement sensitivity of the optomechanical systems scheme, as well as gaining control of collective particle motion.

This work will serve as a foundation for future advanced optomechanics experiments and the development of low-noise experimental platforms.

Methods and techniques: Optomechanics; Levitodynamics; Acoustics

Possibility to continue as a PhD student ? YES

PhD grant available ? TBD