# Master 2 Internship

**Title:** Investigate the self-propulsion of nanoparticles using time-correlated spectroscopy and fast tracking.

**Type:** **experimental**


**Supervisor(s):** Antoine Aubret (CR CNRS) and Yoann De Figueiredo (PhD student).

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**PhD funding (if any):**

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**Project:**

In Nature, living organisms are driven from the bottom-up: molecular motors drive cells, which in turn organize at larger scale. Inspired by such complexity, active systems have been widely studied in the lab using microscopic colloids. However, the non equilibrium dynamics of nanomotors remains elusive, despite their potential to design novel hierarchical materials. Such study has been hindered by challenges inherent to the nanoscale: the lack of spatial resolution and the presence of strong thermal noise. In this context, we have built an optical setup that couples fast imaging and optical correlation techniques to probe the dynamics of nano-objects. We use asymmetric particles able to self-propel following their heating by light. Our setup allows us to control and investigate the dynamics of nano-objects (10–100 nm) on a wide range of timescales, from ~0.1µs to ~1s, and to locate the different excitation regimes where self-propulsion becomes significant vs thermal noise [Figure 1]. Within this scope, the goal of this experimental internship is to study the dynamics of dilute active fluids made of nanoparticles of various sizes and shapes.

In general, this project will lead to new and decisive experiments in the field of active matter, generically studying the effects of downscaling to the nanoscale. This is a highly interdisciplinary project, involving concepts of soft matter, optofluidics, colloidal science, nano-optics and statistical physics.

*Figure 1: (A) TEM image of Self-propelled nanoparticles* [3]. *Inset : Self-propulsion mechanism. (B) Experimental setup. Inset: Optical heating setup.*