

Master 2: *International Centre for Fundamental Physics*

INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Gulliver (ESPCI Paris PSL and CNRS) CNRS identification code: 7083 Internship director's surname: Démery e-mail: vincent.demery@espci.psl.eu Web page: https://www.pct.espci.fr/~vdemery/ Internship location: Gulliver (ESPCI Paris PSL and CNRS), 10 rue Vauquelin, 75005 Paris	Phone number: 01 40 79 45 52
Thesis possibility after internship: YES Funding: YES	If YES, which type of funding:

Wakes in active systems

With microrheology, the rheological properties of a medium are inferred from the observation of the motion of a probe particle. In passive microrheology, the probe either diffuses freely or is held in a harmonic trap, while in active microrheology the probe is driven through the medium, giving access to its non-linear response. In the latter case, two main observables are of interest: the drag force exerted by the medium on the probe, and the wake left by the probe behind it. While microrheology has been used for twenty five years in equilibrium systems, much less is known for active systems.

The goal of the internship is to study the wake created by a moving probe in an active system, focusing on the minimal model of Active Brownian Particles (ABP). We have recently unveiled a peculiar behavior of the correlation function in ABP, with the depletion concentrated in self-similar algebraic wings instead of behind the particle [1]. These results suggest a peculiar form of the wake when the probe is driven at the velocity of the self-propelled particles. The evolution of the wake as this characteristic speed is approached from below or above is thus of particular interest. Last, these wakes are reminiscent of the surface waves created by boats, and we will try to draw connections between the two types of wakes.

The internship will involve collaborations with Elie Raphael at Gulliver et Michael Benzaquen at Ladhyx (École Polytechnique).

[1] Algebraic winged pair correlations of dilute active Brownian particles
A. Poncet, O. Bénichou, V. Démery et D. Nishiguchi, *arXiv* 2006.08202.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES
Quantum Physics: YES

Soft Matter and Biological Physics: YES
Theoretical Physics: YES