Master 2 Internship

Title: (Hydro)Dynamics of Self-Propelling Particles

Supervisor: Juho Lintuvuori https://www.loma.cnrs.fr/juho-lintuvuori/

Contact: juho.lintuvuori@u-bordeaux.fr

Project: *Active systems can be considered as a collection of objects that self-propel by absorbing energy from their surroundings or from an internal reservoir e.g. swimming bacteria, artificial active Janus colloids, or active granular materials. Examples of these from LOMA include dry active materials on macroscale, e.g. toy robots (Fig. 1a-d) or hydrodynamics of spherical swimmers in micrometer length-scale (Fig. 1e,f).*

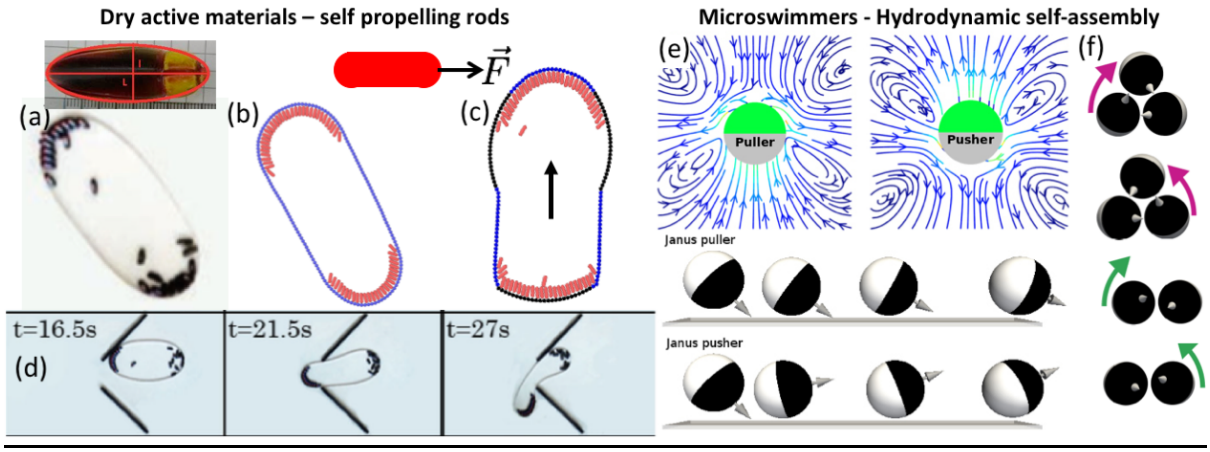

Fig. 1 **Examples of active particle systems studied in LOMA**: (a-d) Dry active materials can be realised (a,d) experimentally using small rod-like robots (toy "cafards") and (b,c) theoretically by Langevin dynamics. (a,b) When confined into flexible arena, the particles accumulate to highest curvature region. (c) A directed motion can be realised by designing the container containing flexible (blue) and rigid (black) segments. (d) The flexible container allows the system to squeeze through small gaps (a, d from Deblais *et al.* PRL 2018). (e) Artificial swimmers can be realized by active Janus particles. (e,f) Hydrodynamics interactions can lead to trapping and to (f) self-assembly of microswimmers near surfaces (Shen *et al.* EPJ E (2018) & arXiv (2018)).

Possible projects include, but are not limited to **(i)** structure and dynamics of confined dry active rods: specific questions include the interplay between the particle/container fluctuations and collective dynamics as well as quantifying (the effects) of an active pressure. **(ii)** Hydrodynamics of microswimmers near surfaces and/or under external fields: specific questions include rotational motion using surface flows and employing liquid crystal topology to direct microswimmers. More specific project will be agreed upon contact with the candidate.

The project(s) are computational and would suit **candidates who are interested in simulations out-of-equilibrium soft materials**. The project(s) offer a rich research environment including a strong cross fertilisation between simulations/theory/experiments, as well as the possibility to gain an experience various simulation techniques (e.g. lattice Boltzmann or Langevin dynamics).

*Remuneration of the internship from an existing IdEx Bordeaux grant might be available.