

## **INTERNSHIP PROPOSAL**

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Thesis possibility after internship: YES

Funding: YES

If YES, which type of funding: ANR

### **Reconfigurable active matter in 3d**

Active systems exhibit fascinating pattern formation, and collective dynamics not seen in conventional materials. A key consequence of our improving understand of active matter the potential for the application to biological systems, from collective behaviour in fish to insect swarms, such as, as these in general are active due to processing of energy.

Yet to make progress in understanding active matter, simple, controllable and well-characterized systems play a key role and among these are active micron-sized particles (colloids). Here the interactions between the particles are well-understood and machine learning methods facilitate long—standing challenges with coordinate tracking [1]. In particular, colloidal particles assemble in to a variety of structures, which can be interpreted with statistical mechanics [2]. However almost all work with active colloids has used (quasi) 2d systems.

We have developed a 3d active colloidal system of dipolar particles which are active in the xy plane and which have already produced two new phases [3]. This project proposes to investigate further the behaviour of this exotic, and yet well-controlled system. The project may be carried out in experiment, or in computer simulation as we have also developed a simulation model of the same system [4].

[1] Mauleon Amieva et al Sci. Adv. 9 eadf5144 (2023).

[2] Royall et al ArXiv 2305.02452 (2023).

[3] Sakaï N and Royall CP, ArXiv 2010.03925 (2020).

[4] Moore FJ et al , J. Chem. Phys. 158 104907 (2023).

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

Condensed Matter Physics: YES/NO      Soft Matter and Biological Physics: YES/NO  
Quantum Physics: YES/NO                      Theoretical Physics: YES/NO