Dynamic phase transition in confined active matter.

A medium, containing elements capable of moving by themselves, such as nanomotors, is called active. At the intersection of biology and physics, active matter [1], a non-equilibrium medium often chosen to reproduce the behavior of living organisms, is a rapidly evolving research direction. Living matter is, in a simplified manner, a disordered mixture of water, polymers, and nanomotors. This theme involves several rapidly developing areas of physics, such as non-equilibrium statistical physics, the development of nanosciences, the liquid-glass transition, and biological matter. In addition to the fundamental nature of this type of research, applications include drug stabilization, cryopreservation, as well as numerous applications related to nanosciences and biology.

Our research group specializes in simulating the effect of nanomotors on matter at the microscopic scale. We mainly study the fluidization induced by disturbances created in amorphous matter when the nanomotor is activated, as well as the movement of the nanomotor in confined environments (inside nanopores) or in free media. Recently, using numerical simulations, we demonstrated the existence of a phase transition controlled by the temporal parameters of the activated matter [2]. The fundamental origin of this transition, and its connection to the still unresolved liquid-glass transition, remains to be specified.

The objective of the doctoral thesis project will be to continue our study of active matter, starting from a model system and gradually shifting focus towards the more complex issue of activated water as the primary biological material.

The student must demonstrate significant motivation and have proven knowledge in programming and physics; knowledge in statistical physics will be particularly appreciated. However, all applications will be considered.

[1] O. Dauchot, H. Lowen, Journal of Chemical Physics, **151**, 114901 (2019)

[2] V.Teboul, Physical Review E, **108**, 024605 (2023)

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