

# Physikalisches Kolloquium



**Thursday, 14.12.2023, 16:15, HS 100**

Reception with coffee & cookies 16:00

(For university staff: please bring your own cup for sustainability reasons)

**Prof. Dr. Hartmut Löwen**, Theoretical Physics II: Soft Matter  
Heinrich-Heine-Universität Düsseldorf:

## *Self-propelled particles*

### Abstract

Ordinary materials are "passive" in the sense that their constituents are typically made by inert particles which are subjected to thermal fluctuations, internal interactions and external fields but do not move on their own. Living systems, like schools of fish, swarms of birds, pedestrians and swimming microbes are called "active matter" since they are composed of self-propelled particles. Active matter is intrinsically in nonequilibrium and exhibits a plethora of novel phenomena as revealed by a recent combined effort of statistical theory, computer simulation and real-space experiments. After an introduction on biological and artificial self-propelled particles [1], the talk will focus on modelling of active Brownian particles and collective phenomena like motility-induced phase separation. Finally effects of inertia and the formation of active complexes will be discussed including an inertial delay [2], the coexistence of two states with different temperatures [2], an active refrigerator [3] and entropions in active crystals [4].

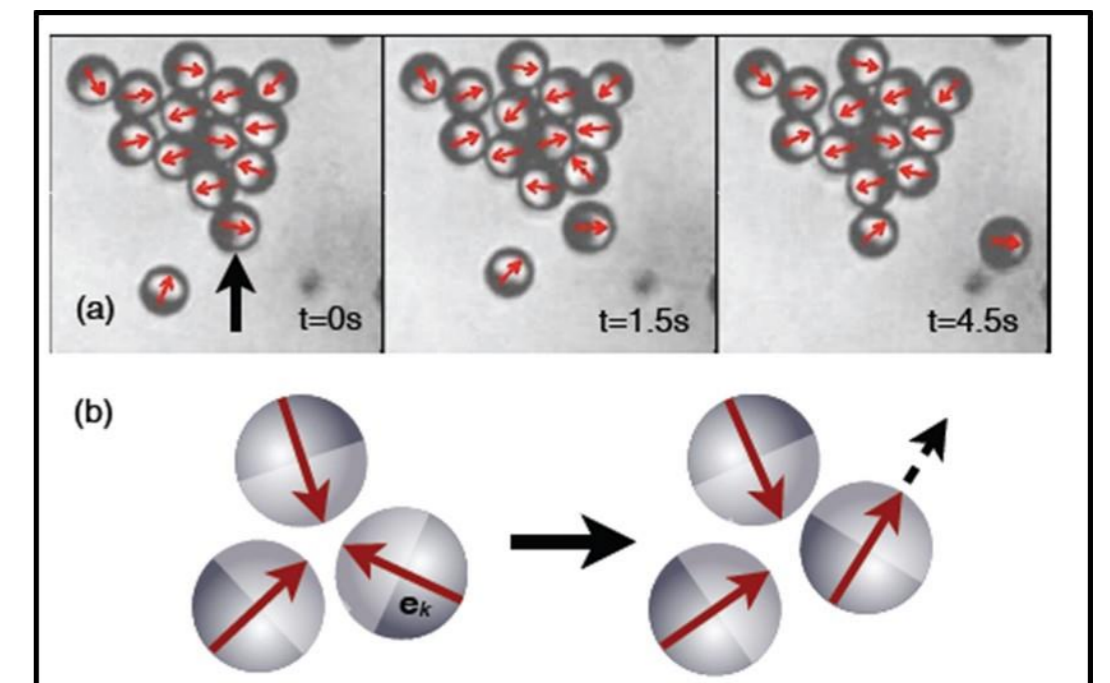
[1] For a review, see: C. Bechinger, R. di Leonardo, H. Löwen, C. Reichhardt, G. Volpe, G. Volpe, Active particles in complex and crowded environments, *Reviews of Modern Physics* 88, 045006 (2016).

[2] C. Scholz, S. Jahanshahi, A. Ldov, H. Löwen, Inertial delay of self-propelled particles, *Nature Communications* 9, 5156 (1-9) (2018).

[3] S. Mandal, B. Liebchen, H. Löwen, Motility-induced temperature differences in coexisting phases, *Phys. Rev. Letters* 123, 228001 (2019).

[4] L. Hecht, S. Mandal, H. Löwen, B. Liebchen, Active refrigerators powered by inertia, *Phys. Rev. Letters* 129, 178001 (2022).

[5] L. Caprini, U. M. B. Marconi, A. Puglisi, H. Löwen, *J. Chem. Phys.* 159, 041102 (2023).



All of you interested in physics are cordially invited!