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Dynamics of self-propelled colloidal particles in viscoelastic fluids

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The motion of many natural microswimmers, e.g. bacteria and spermatozoa, commonly takes place in viscoelastic fluids and under confinement close to solid walls. The understanding of their swimming mechanisms has triggered a lot of experimental and theoretical work in recent years as well as the development of self-propelled colloidal particles. Although the motion of such synthetic microswimmers in Newtonian fluids has been extensively studied, and they are nowadays a paradigm in non-equilibrium soft matter [1], so far only few investigations have focused on the swimming of microorganisms in viscoelastic fluids [2]. In our work, we experimentally investigate the dynamics of spherical colloidal microswimmers in viscoelastic fluids, which are self-propelled by local demixing of a critical binary polymer mixture induced by laser illumination. Unlike the motion in Newtonian liquids, we observe a pronounced enhancement of rotational diffusion with increasing particle velocity [3], thereby revealing an unexpected breakdown of the Stokes-Einstein relation for the particle orientation. We demonstrate that this non-equilibrium effect originates from the coupling between the directed particle motion, and the slow microstructural relaxation of the surrounding fluid [4]. Furthermore, we show that such a coupling gives rise to a wealth of new non-equilibrium phenomena with no counterpart in Newtonian liquids, e.g. for the particle translational and rotational dynamics close to solid walls, as well as for collective motion in crowded environments.

References

[1] C. Bechinger, R. Di Leonardo, H. Löwen, C. Reichhardt, G. Volpe, and G. Volpe, Rev. Mod. Phys. 88, 045006 (2016).

[2] A. Patteson, A. Gopinath, and P. E. Arratia, Curr. Opin. Colloid Interface Sci., 21, 86 (2016).

[3] J. R. Gomez-Solano, A. Blokhuis, and C. Bechinger, Phys. Rev. Lett. 116, 138301 (2016).

[4] J. R. Gomez-Solano, and C. Bechinger, New J. Physics 17, 103032 (2015).

Primary author: GOMEZ SOLANO, Juan Ruben (Universitaet Stuttgart)

Presenter: GOMEZ SOLANO, Juan Ruben (Universitaet Stuttgart)

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