

Swarming, Orientation and Quorum Sensing of Synthetic Microswimmers

CLEMENS BECHINGER¹

¹*Fachbereich Physik, Universität Konstanz, Universitätsstr. 10, 78464 Konstanz, Germany*

Presentation type: Invited Speaker

Many motile organisms have developed intriguing steering mechanisms allowing them to orientate and navigate within gravitational, chemical or light fields. Such tactic response strongly facilitates e.g., the search for food, reproduction and/or escape from unfavorable ambient conditions and is therefore an essential aspect of life. Unlike living systems (bacteria, motile cells), where tactic behavior is typically achieved by complex internal signal pathways, it is not obvious how this can be realized with synthetic microswimmers, which have much simpler internal structures. Using light-activated self-propelled particles, we demonstrate that autonomous steering in gravitational fields and light gradients can be achieved without invoking a complex internal machinery but simply by the combination of viscous forces and torques, which naturally arise during self-propulsion in liquids. In addition, we demonstrate, how to realize different types of communication rules between particles and how this affects, e.g. the cluster formation in such systems. Because the interaction between particles can be easily varied (range of interaction, local vs. non-local interactions), this allows us to study the conditions, under which cooperative phenomena such as cluster and swarm formation can be generated in active systems.

References

- [1] Ten Hagen, Borge and Kümmel, Felix and Wittkowski, Raphael and Takagi, Daisuke and Löwen, Hartmut and Bechinger, Clemens, *Nat. Comm.* **5**, 4829 (2014).
- [2] Lozano, Celia and Ten Hagen, Borge and Löwen, Hartmut and Bechinger, Clemens, *Nat. Comm.* **7**, 12828 (2016).