Capturing self-propelled particles in a moving trap

Andreas Kaiser [1], *Katarina Popowa* [1], *Henricus H. Wensink* [2], *Hartmut Löwen* [1]

[1]Institut für Theoretische Physik II: Weiche Materie, Heinrich-Heine-Universität Düsseldorf, Universitätsstraße 1, D-40225 Düsseldorf, Germany

[2]Laboratoire de Physique des Solides, Université Paris-Sud & CNRS, Bâtiment 510, 91405 Orsay Cedex, France

Catching fish with a fishing net is typically done by either dragging the net through the quiescent water or by placing a stationary basket trap into a flowing river. We transfer these ideas of fishing to micron-sized self-motile particles, which move actively in a solvent at low Reynolds number, using computer simulations of a two-dimensional system of self-propelled rods.

A static wedge-like confinement has been shown to a very efficient trap for active particles by computer simulations [1].

We extend our model and drag the obstacle through the system. Theoretical prediction as well as numerical results for the realization of a trapping will be given for the single swimmer case. Furthermore the collective trapping efficiency is studied as a function of the apex angle α of the trap ($0 < \alpha \leq \pi$), the swimmer density and the drag speed v. There are three emerging states corresponding to *no trapping*, *partial trapping* and *complete trapping*. We map out that the full trapping state diagram can be explained by the effects already showing up for the single particle case.

1. A. Kaiser, H. H. Wensink, and H. Löwen, *Phys. Rev. Letters*, **108**, 268307 (2012).