P.02 Orientational order and motility in active droplets

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Spatially confined active matter exhibits fascinating collective behaviour, for instance internally generated flows in, and macroscopic self-propelled motion of active fluid droplets. Both seem to be associated with a particular long-range orientational order of the active particles in the droplet.

Our aim is to understand which type of orientational order enables the transmission of local activity onto large scales and leads to directed movement of the drop. We consider a three dimensional drop of active matter that has a fixed, flat shape and is located on a plane surface. We impose different orientational fields with topological defects and calculate the resulting flow fields inside the drop analytically by solving the Stokes equation, which contains an active stress. For certain cases we show that an asymmetry in the imposed orientation field is inherited by the flow and enables motility in the case of appropriate boundary conditions at the contact surface.

One example of an active droplet is a cell extract, that is a solution of active cytoskeletal compartments confined by the cell membrane. Thus, understanding the interplay of orientational order and directed macroscopic movement could reveal new insights into the basic mechanisms of cell motility.