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Active Mesogenic Droplets: Impact of Liquid Crystallinity and Collective Behavior¹

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Droplets of common mesogenic compounds show a self-propelled motion when immersed in aqueous solutions containing ionic surfactants at concentrations well above the critical micelle concentration. After introducing some general properties of this type of artificial microswimmer, we focus on two topics: the influence of liquid crystallinity on the swimming behavior and the collective behavior of ensembles of a larger number of droplets. The mesogenic properties are not essential for the basic mechanism of self-propulsion, nevertheless they considerably influence the swimming behavior of the droplets. For instance, the shape of the trajectories strongly depends on whether the droplets are in the nematic or isotropic state. The droplet swimmers are also ideally suited for the study of collective behavior: Microfluidics enables the generation of large numbers of identical swimmers and we can tune their buoyancy. We report on the collective behavior in three-dimensional environments.

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