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The role of hydrodynamics and confinement on the collective behavior of active emulsions SHASHI THUTUPALLI, DELPHINE GEYER, HOWARD STONE, Princeton Univ — Active droplets i.e. emulsion droplets which exhibit self-propelled motion are of tremendous interest in understanding the collective dynamics of systems far from thermal equilibrium. A particularly appealing feature of these active droplet systems is that the coupling between the individuals is well-controlled and mediated by purely physical effects such as steric interactions and hydrodynamics. We create such active droplet systems using liquid crystalline emulsions in aqueous phases stabilized by surfactants. The propulsion of the individual droplets is fully 3 dimensional and occurs via a spontaneously broken symmetry (unlike colloidal swimmers which are often asymmetric by design) which is sustained via dissipation of chemical energy. Here, we show that hydrodynamics and geometry play a crucial role in the emergent self-organization of the active droplets. In particular, we describe the pair-correlations emerging in a population of active droplets confined in Hele-Shaw geometry. We further demonstrate that these interactions result in the formation of stable travelling bands in reduced confinement and self-organize into crystalline vortices at a single interface.

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