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Artificial Microfluidic Squirmers SHASHI THUTUPALLI, M.P.I. for Dynamics and Self Organisation, Gottingen, Germany, RALF SEEMANN, Physics Faculty, University of Saarlandes, Saarbrucken, Germany, STEPHAN HERMINGHAUS, M.P.I. for Dynamics and Self Organisation, Gottingen, Germany — While there is a growing consensus on the propulsion mechanisms of swimmers at low Reynolds' numbers, many questions remain open regarding the hydrodynamic effects on such swimmers, in particular the coupling between swimmers. Here we present experiments on artificial swimmers, where hydrodynamics is seen to be responsible for a wide range of collective behavior and interactions. Using droplet microfluidics with a surfactant laden continuous oil phase, we create monodisperse aqueous droplets containing chemicals that produce a steady source of Bromine ions. The surfactant (mono-olein) reacts at the droplet interface with the Bromine produced within the droplets, and a dynamic instability leads to gradients of interfacial tension at the droplet interface. These gradients set up Marangoni flows propelling the droplets, in a manner similar to the classical squirmer model of swimming. The flow around the swimmers as well as its effect on the droplet motion are measured using particle image velocimetry (PIV). The PIV analysis reveals the far field flows generated by the swimmers in the surrounding liquid, leading to the emergence of bound states and oriented clusters. We discuss the interaction mechanisms and compare it to previous theoretical work and simulations.

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