# Concentration gradient mediated interactions between active droplets

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Autophoretic swimmers are subject to an interaction with each other that is due to overlap of the chemical gradients that surround them and drive their motion. It is believed to be similar to the interaction between micro-organisms, which also form and respond to solute gradients [1]. This type of interaction is also interesting because it involves the solvent, so it can be non-reciprocal [2]. Even though many particles and micro-organisms interact in this way, very few quantitative studies are available. The main obstacle is that this interaction is often coupled to self-propulsion making it impossible to study the two effects separately. We show that isotropic swimmers, geometrically symmetric active particles, only swim beyond a cutoff particle size and fuel concentration, providing a window of opportunity to study the solute mediated interaction without the complication of swimming. Using optical tweezers we quantified the force between isotropic swimmers due to this solute mediated interaction and show that the force scales with inter-particle distance as $1/r^2$, as is expected for a diffusion dominated process. We propose a functional form for the interaction, based on analogy with electrostatics, that accurately describes our data. This model is in principle applicable to all solute gradient induced interactions and can aid in understanding the behavior of micro-swimmers as well as more complicated biological systems.

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2. Soto, R. & Golestanian, R. Self-assembly of catalytically active colloidal molecules: Tailoring activity through surface chemistry. *Phys. Rev. Lett.* **112,** 1–5 (2014).