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Active Particles Powered by Quincke Rotation in a Bulk Fluid<sup>1</sup> DEBASISH DAS, ERIC LAUGA, Department of Applied Mathematics and Theoretical Physics, University of Cambridge — How are groups of living organisms such as flocks of birds, sheep, schools of fish and bacterial colonies able to self-organize and display collective motion? This question has fascinated scientists for decades and has given rise to the new field of 'active matter'. One of the key features of active matter is that it is composed of self-propelled units that move by consuming energy from their surrounding with a direction of self-propulsion typically set by their own anisotropy (shape or function) rather than by an external field. In this work, we show how an electrohydrodynamic instability called Quincke rotation can be exploited to develop an ideal self-propelled particle in a bulk fluid. Dielectric particles suspended in a weakly conducting fluid are known to spontaneously start rotating under the action of a sufficiently strong uniform DC electric field due to Quincke rotation. This rotation can be converted into translation when the particles are placed near a surface providing useful model systems for active matter. Using a combination of numerical simulations and theoretical models, we demonstrate that it is possible to convert the spontaneous Quincke rotation into spontaneous translation even in the absence of surfaces by relying on geometrical asymmetry instead.

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