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A Spontaneous Electrokinetic Magnus Effect JAMES SWAN, Massachusetts Institute of Technology, ZACHARY SHERMAN, University of Texas at Austin — h $-abstract-$\pardColloids dispersed in electrolytes and exposed to an electric field produce a locally polarized cloud of ions around them. Above a critical electric field strength, an instability occurs causing these ion clouds to break symmetry leading to spontaneous rotation of particles about an axis orthogonal to the applied field, a phenomenon named Quincke rotation. In this Letter, we characterize a new mode of electrokinetic transport. If the colloids have a net charge, Quincke rotation couples with electrophoretic motion and propels particles in a direction orthogonal to both the applied field and the axis of rotation. This motion is a spontaneous, electrokinetic analogue to the well-known Magnus effect. Typically, motion orthogonal to a field requires anisotropy in particle shape, dielectric properties, or boundary geometry. Here, the electrokinetic Magnus (EKM) effect occurs for spheres with isotropic properties in an unbounded environment, with the Quincke rotation instability providing the broken symmetry needed to drive orthogonal motion. We study the EKM effect using explicit ion, Brownian dynamics simulations and develop a simple, continuum, analytic electrokinetic theory, which are in agreement. We also explain how nonlinearities in the theoretical description of the ions affect Quincke rotation and the EKM effect.\pard-/abstract-\

James Swan
Massachusetts Institute of Technology MIT

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