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Instabilities, rheology and spontaneous flows in magnetotactic bacterial suspensions. ROBERTO ALONSO-MATILLA, DAVID SAINTILLAN, UC San Diego — Magnetotactic bacteria are motile prokaryotes, mostly present in marine habitats, that synthesize intracellular magnetic membrane-bounded crystals known as magnetosomes. They behave as self-propelled permanent magnetic dipoles that orient and migrate along the geomagnetic field lines of the Earth. In this work, we analyze the macroscopic transport properties of suspensions of such bacteria in microfluidic devices. When placed in an external magnetic field, these microorganisms feel a net magnetic torque which is transmitted to the surrounding fluid, and can give rise to a net unidirectional fluid flow in a planar channel, with a flow rate and direction that can be controlled by adjusting both the magnitude and orientation of the external field. Using a continuum kinetic model, we provide a physical explanation for the onset of these spontaneous flows. We also study the rheological properties and stability of these suspensions in both an applied shear flow and a pressure-driven flow.

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