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Unstable colloidal rollers: a new kind of fingering instability MICHELLE DRISCOLL, BLAISE DELMOTTE, MENA YOUSSEF, STEFANO SACANNA, ALEKSANDAR DONEV, PAUL CHAIKIN, New York Univ NYU — When colloidal particles are rotated adjacent to nearby floor, strong advective flows are generated around them, even quite far away. When a group of these microrollers is driven, the strong hydrodynamic coupling between particles leads to formation of new structures: an initially uniform front of microrollers evolves first into a shock-like structure, which then quickly becomes unstable, emitting fingers of a well-defined wavelength. Our experiments and simulations confirm that this instability is quite different than typical fingering instabilities, where size scale selection is a consequence of competing stresses. Here, this instability arises only due to hydrodynamic interactions, and it is controlled by a single geometric parameter, the particle-floor height. Our measurements of the growth rate in both experiments and simulations agree with results from our continuum model. This instability is a direct consequence of the inward flows created by the interactions between the particles and the nearby solid surface.

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