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Dynamic Regimes for Driven Colloidal Particles on a Periodic Substrate at Commensurate and Incommensurate Fillings DANIELLE MCDERMOTT, University of Notre Dame, JEFFERY AMELANG, California Institute of Technology, CYNTHIA REICHHARDT, CHARLES REICHHARDT, Los Alamos National Laboratory — We numerically examine colloidal particles driven over a muffin tin substrate. Previous studies of this model identified a variety of commensurate and incommensurate static phases in which topological defects can form domain walls, ordered stripes, superlattices, or disordered patchy regimes as a function of the filling fraction. Here we show that the addition of an external drive to these static phases can produce distinct dynamical responses. At incommensurate fillings the flow occurs in the form of localized pulses or solitons correlated with topological defect structures. Transitions between different modes of motion can occur as a function of increasing drive. We measure the average particle velocity for specific ranges of external drive and show that changes in the velocity response correlate with changes in the topological defect arrangements. We also demonstrate that in the different dynamic phases, the particles have distinct trajectories and velocity distributions. Dynamic transitions between ordered and disordered flows exhibit hysteresis, while in strongly disordered regimes there is no hysteresis and the velocity-force curves are smooth. When stripe patterns are present, transport can occur at an angle to the driving direction.

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