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Coherent structures, globally aligned states, and hydrodynamic traffic jams in confined active suspensions DAVID SAINTILLAN, ADRIEN LEFAUVE, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — Strongly confined active liquids are subject to unique hydrodynamic interactions due to momentum screening and lubricated friction by the confining walls. Using numerical simulations based on a minimal model for swimmer dynamics and interactions, we demonstrate that two-dimensional dilute suspensions of fore-aft asymmetric polar swimmers in a Hele-Shaw geometry can exhibit a rich variety of collective behaviors depending on particle shape and density, including: coherent polarized density waves with global alignment, stationary aster-shaped clusters, persistent counter-rotating vortices, density shocks and rarefaction waves. We also substantiate these various phenomena using a linear stability analysis and a nonlinear traffic flow model, both derived from a mean-field kinetic theory.

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