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Active Matter Chaos DAVID A. EGOLF, Dept. of Physics and Institute for Soft Matter Synthesis and Metrology, Georgetown University, EDWARD J. BANIGAN, Dept. of Physics & Astronomy, Northwestern University, CHARLES DAWSON, Dept. of Physics, Georgetown University & Harvey Mudd College — Recently, researchers demonstrated that a model of soft, polydisperse, non-aligning, self-propelled particles in two dimensions exhibits a transition from a liquid-like state to a "frozen" glassy state as the density is increased or the propulsion speed is decreased. Here we analyze the two states and the transition between them using nonlinear dynamical techniques. We find that the largest Lyapunov exponent indicates that the transition is a dynamical transition from a chaotic liquid state to a non-chaotic glassy state and that this transition is characterized by dynamical time and length scales that diverge as power laws. Near the transition, we also find that cooperative rearrangements of particles are anticipated by an increase in the finite-time exponent and a localization of the Lyapunov vector to the particles that will be involved in the rearrangement. Our results, in conjunction with similar previous results for granular matter, suggest the broad applicability of nonlinear dynamical techniques for exploring glassy and jamming transitions in a variety of media.

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