Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Dynamic phases of active matter systems with quenched disorder CYNTHIA J. OLSON REICHHARDT, Los Alamos National Laboratory, CSANAD SÁNDOR, ANDRAS LIBÁL, Babes-Bolyai University, CHARLES REICHHARDT, Los Alamos National Laboratory — Depinning and nonequilibrium transitions within sliding states in systems driven over quenched disorder arise across many size scales, ranging from nanoscale atomic friction, mesoscale flux motion in type-II superconductors, microscale colloidal motion in disordered substrates, and geological scale plate tectonics. We show that active matter or self-propelled particles interacting with quenched disorder under an external drive represent a new class of system that exhibits pinning-depinning phenomena, plastic flow phases, and nonequilibrium sliding transitions correlated with distinct velocity-force curve signatures. For strong particle-substrate interactions, a homogeneous pinned liquid phase forms that depins plastically into a uniform disordered phase and then dynamically transitions into a moving stripe coexisting with a pinned liquid and then into a moving phase separated state at higher drives. We numerically map the dynamical phase diagrams as a function of external drive, substrate interaction strength, and self-propulsion correlation length. These phases can be observed for active matter moving through random disorder. Our results indicate that intrinsically nonequilibrium systems can exhibit additional nonequilibrium transitions when subjected to an external drive.

Cynthia Reichhardt
Los Alamos National Laboratory

Date submitted: 09 Nov 2016 Electronic form version 1.4