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Jamming to Clogging Transitions for Systems with Obstacle Arrays CHARLES REICHHARDT, CYNTHIA REICHHARDT, Los Alamos National Laboratory, ZOHAR NUSSINOV, Washington University — Jamming can occur in systems consisting of collections of particles when the response of the system changes from a fluidlike state that can easily flow to a state that acts like a solid. For a loose collection of grains, jamming can occur as a function of density, where the grains readily flow at low densities but with increasing density undergo a transition to a jammed state at point J. Liu and Nagel have proposed that there may be a universal jamming phase diagram as a function of density, load, or temperature that may also include the glass transition. Here we propose that the density of fixed obstacles or quenched disorder can be considered as a new axis for the jamming phase diagram, since the disorder causes the system to jam at densities below point J. For a small number of obstacles, the system exhibits jamming behavior; however, for higher disorder density, there is a crossover to a behavior that we term clogging rather than jamming since the stuck states are highly heterogeneous, fragile, and exhibit memory effects. Our results imply that clogging is a distinct phenomenon from jamming with very different behaviors. These results are of relevance for particle flow in porous media, depinning transitions, and jamming in crowded environments.

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