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Nonlinear Dynamics Near the Jamming Transition EDWARD J BANIGAN, Dept of Physics and Astronomy; Univ of Pennsylvania, DAVID A EGOLF, Department of Physics, Georgetown University — How dynamical behaviors and static measures are related near the jamming transition remains an open question. In simulations of a two-dimensional sheared granular cell, we have calculated mathematical quantities that characterize the underlying nonlinear dynamics near the jamming transition. We find that the Lyapunov exponents and vectors characterizing the most important dynamical modes correlate well in space and time to localized events that alter the physical characteristics of the system. For example, the Lyapunov exponents and vectors highlight areas in which particles are involved in cooperative rearrangement or the formation or destruction of stress chains. In at least some cases, the behavior of the dynamical quantities appears to indicate future position or stress rearrangements. In addition, we report measurements of a dynamical time scale and a dynamical length scale that diverge as the system jams, suggesting an intriguing connection between the jamming transition and a transition between chaotic and non-chaotic dynamical states.

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