Abstract Submitted
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The Chaotic Dynamics of Jamming[1] DAVID A. EGOLF, Department of Physics, Georgetown University, EDWARD J. BANIGAN, Dept. of Physics and Astronomy, Univ. of Pennsylvania, MATTHEW K. ILLICH, DERICK J. STACE-NAUGHTON, Department of Physics, Georgetown University — Despite the appearance of simplicity, much of the behavior of granular materials remains mysterious. One intriguing puzzle is the dynamical mechanism underlying the "jamming" transition, in which disordered grains become rigid at high density. By applying nonlinear dynamical techniques to simulated 2D shear cells, we reveal the mechanisms of jamming and find they conflict with the prevailing picture of growing cooperative regions. Additionally, at the density corresponding to random close packing, we find a dynamical transition from chaotic to non-chaotic states accompanied by diverging dynamical length and time scales. Furthermore, we find that the dominant cooperative dynamical modes are strongly correlated with particle rearrangements and become increasingly unstable before stress jumps, providing a way to predict the times and locations of these earthquake-like stress-release events.

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