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Unjamming and jamming transitions of granular avalanches JIE ZHANG, ZIWEI WANG, Shanghai Jiaotong University — Study of the jamming transitions of granular materials has become an active field of research in recent years. A closely related inverse process is the unjamming transition, where granular systems may suddenly lose rigidity and start to flow freely. Understanding such a process is of crucial implication towards the understanding of natural disasters such as snow avalanches, landslides and earthquakes. Recent work by Banigan and colleagues (Nature Physics 2013) has provided a new perspective in the study of unjamming and jamming transitions by applying nonlinear dynamical methods. To test their proposition experimentally, we have designed a rotating drum filled with bidisperse photo-elastic disks to create particle avalanches. In unjamming transition, Lyapunov vector and velocity fields are indeed strongly correlated in spatial domain, whereas in jamming transition no such a strong correlation is observed. The Lyapunov exponents are positive in unjamming transition and negative in jamming transition. In addition, the total stress variation, kinetic energy, and non-affine motion of particles all show strong correlations in the time domain during avalanches. Their spatial correlations have also been analyzed.

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