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Avalanches and di?usion in model bubble rafts near jamming
CRAIG MALONEY, Carnegie Mellon — Energy dissipation distributions and particle displacement statistics are studied in the mean field version of Durian's bubble model. A two dimensional (2D) bi-disperse mixture is simulated at various strain rates, $\dot{\gamma}$, and packing ratios, ϕ, above the close packing limit, ϕ_c. Well above ϕ_c, and at sufficiently low $\dot{\gamma}$, the system responds in a highly intermittent way, reminiscent of other dynamically critical systems with a power law distribution of energy dissipation. As one increases $\dot{\gamma}$ at fixed ϕ or tunes $\phi \to \phi_c$ at fixed $\dot{\gamma}$, the intermittent behavior vanishes. Displacement distributions are non-Fickian at short times but cross to a Fickian regime at a universal strain, $\Delta\gamma_*$, independent of $\dot{\gamma}$ and ϕ. Despite the profound differences in short-time dynamics, at intermediate $\Delta\gamma$ the systems surprisingly exhibit qualitatively similar spatial patterns of deformation, with lines of slip extending across large fractions of the simulation cell. The results raise new questions about the nature of quasistatic shear near ϕ_c and should have important consequences for various kinds of jammed systems.

Craig Maloney
Carnegie Mellon

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