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Low frequency vibrational modes and particle rearrangements in colloidal glasses[1]

KE CHEN, University of Pennsylvania

We investigate the correlation between low frequency vibrational modes and fragile regions in two dimensional binary colloidal glasses, consisting of thermosensitive microgel particles. The sample packing fraction is tuned by small changes in temperature. The particles remain in their equilibrium positions in jammed states, and rearrangements are observed during temperature changes when packing fraction is changing. Using the particle displacement covariance matrix, we extract the intrinsic vibrational modes of the "shadow" colloidal network (i.e., with same geometric configuration and interactions but absent damping). Spatial correlations are observed between low frequency quasi-localized modes and rearranging clusters. The low frequency modes are found to contribute much more to particle rearrangement than high frequency modes. The number of rearranging clusters, as well as the size of particle rearrangements, increases as the system approaches jamming transition.

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