Abstract Submitted
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Mechanical response of a colloidal glass undergoing repeated local perturbation[1] TIM STILL, YE XU, Department of Physics and Astronomy, University of Pennsylvania, Philadelphia PA 19104, USA, KEVIN APTOWICZ, Department of Physics, West Chester University, West Chester, PA 19383, USA, ARJUN YODH, Department of Physics and Astronomy, University of Pennsylvania, Philadelphia PA 19104, USA — If an amorphous solid is deformed beyond a certain threshold, it undergoes rearrangements on a microscopic level. Often these rearrangements are irreversible and the glassy material finds a new minimum in the energy landscape. However, if the glass is repeatedly perturbed with a moderate cyclical deformation, the mechanical response of the glass can evolve from irreversible to reversible. In our experiments, we utilize colloidal particles with strong thermophoretic properties and local laser heating to generate singular and periodic local non-homogeneous perturbations in quasi-two-dimensional colloidal glasses. The individual particles are soft and deformable, and the elasticity of the material induces mechanical recovery when laser heating ceases. Optical microscopy and particle tracking allow us to follow the path of each individual particle and determine the reversibility and affinity of the mechanical response on a single particle level. This enables us to investigate the microscopic mechanisms of energy dissipation in model glasses and sheds light on the onset of mechanical failure in disordered materials.

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