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Dynamic Heterogeneity and the Colloidal Glass Transition in Confinement[1]

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We study concentrated colloidal suspensions, a model system which has a glass transition. These are suspensions of small solid particles in a liquid, and exhibit glassy behavior when the particle concentration is high; the particles are roughly analogous to individual molecules in a traditional glass. We view the motion of these colloidal particles in three dimensions by using an optical confocal microscope. This allows us to directly study the microscopic behavior responsible for the macroscopic viscosity divergence of glasses. In particular, we study the influence of confinement, which in our experiments slows the particle motion. This suggests that confinement causes the onset of the colloidal glass transition to happen "sooner," at particle concentrations which are not normally glassy. We examine confinement between parallel glass plates, in thin cylindrical capillary tubes, and in emulsion droplets, finding similar behavior in these geometries. The particles exhibit spatially heterogeneous dynamics, although the character of this behavior depends on the geometry and boundary conditions. Work done in collaboration with Kazem Edmond, Gary Hunter, Carolyn Nugent, and Nabiha Saklayen.

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