Abstract Submitted
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Decoupling of Rotational and Translational Diffusion in Supercooled Colloidal Fluids[1] KAZEM V. EDMOND[2], Emory University, MARK T. ELSESSER[3], New York University, GARY L. HUNTER, Emory University, HYUNJOO PARK, DAVID J. PINE, New York University, ERIC R. WEEKS, Emory University — Using high-speed confocal microscopy, we directly observe the three-dimensional rotational dynamics of rigid clusters of microspheres suspended in dense colloidal suspensions. The clusters are highly ordered packings of fluorescently-labeled PMMA particles, fabricated using a recently developed emulsification technique. Our colloidal suspensions serve as an excellent model of hard spheres, perhaps the simplest system with a glass transition, while the clusters probe the system's local rotational and translational dynamics. Far from the colloidal liquid's glass transition, both rotational and translational motion of the clusters are purely Brownian. However, in the liquid's supercooled regime, we observe a decoupling between the two types of motion: as the glass transition is approached, rotational diffusion slows down even more than translational diffusion. The nature of the decoupling is in good agreement with theoretical predictions and experiments with molecular glass formers. Our observation supports the notion that supercooled liquids are not merely liquids with large viscosities but that diffusion takes place by fundamentally changed mechanisms.

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