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Probing Cooperative Motion in Super-Cooled Colloidal Suspensions PRASAD SARANGAPANI, Y. ELAINE ZHU, University of Notre Dame, Department of Chemical and Biomolecular Engineering, 182 Fitzpatrick Hall, Notre Dame, IN 46556 — The physics of the glass transition remains inadequately understood despite its broad technological relevance. The anomalous divergence of viscosity without apparent structural change as a liquid is cooled has been attributed to the existence of growing dynamic length scales of "cooperatively rearranging regions" (CRR). In this work, we use ultra-fast fluorescence correlation spectroscopy (FCS) combined with high-speed imaging to determine the CRR sizes by measuring single-particle dynamics of tracer nano-particle embedded in super-cooled "hard-sphere" colloidal suspensions. Fluorescent poly-(methyl methacrylate) (PMMA) tracer particles of radii ranging from r =0.1-0.4 μm, mixed with plain PMMA particles of radius, r =0.6 μm and bulk volume fraction, ϕ = 0.38-0.58, serve as excellent probes for changes in the energy barrier landscape of the suspensions of increasing volume fraction and are sensitive to the creation and annihilation of icosahedral order in metastable colloidal fluids. We also find that the correlation length, determined by fluctuation-dissipation relations from the measured auto-correlation functions, shows a dramatic increase in the super-cooled regime until it diverges at ϕ=0.58.

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