MAR08-2007-001003

Abstract for an Invited Paper
for the MAR08 Meeting of
the American Physical Society

Single particle dynamics of aging in colloidal systems

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When a liquid is quenched to form a glass it becomes trapped in a non-equilibrium state, and many of the system's properties depend on the time elapsed since the quench. This phenomenon is known as aging. We study concentrated colloidal suspensions, a model system which has a glass transition when the particle concentration is increased. We use an optical confocal microscope to view the motion of these colloidal particles in three dimensions. Aging is most commonly detected by measuring the evolution of variables (such as the mean squared displacement) averaged over the entire system, but these quantities cannot yield information about the detailed, structural changes that occur during aging. In contrast, confocal microscopy lets us study the the relationship between local structure and the motion of the colloidal particles, in both monodisperse and binary colloidal glasses. We find that particle motion occurs in cooperative groups, and that this motion is facilitated by the relatively poor packing of the particles in these regions. Work done with G. C. Cianci, J. M. Lynch, and R. E. Courtland.