Dynamical Heterogeneities and Cooperative Rearrangements in Attractive Colloidal Glasses

(Talk #3)

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The nature of glass remains a deep and long-standing unsolved problem in condensed matter physics. The diverging viscosity of all glasses, for example, is believed to derive from domains of collectively rearranging particles, often called cooperative rearrangement regions, CRRs. In this talk, I will present new insights about CRRs from both colloidal experiments and computer simulations. Using a novel binary solvent, the interactions between colloidal particles are tuned, *in situ*, from repulsive to attractive. This scheme permits study of glassy dynamics of the same collection of particles but with different interactions. We discovered that attraction leads to formation of long-lived bonds between particles, and slows down the dynamics. Additionally, we found that CRRs in attractive glasses involve more particles and form compact clusters, while CRRs in repulsive glasses involve less particles and form strings. Thus, the glassy dynamics and the CRRs are shown to be strongly influenced by interparticle potential, and new ways to manipulate the properties of glasses by controlling of particle interaction are now apparent.

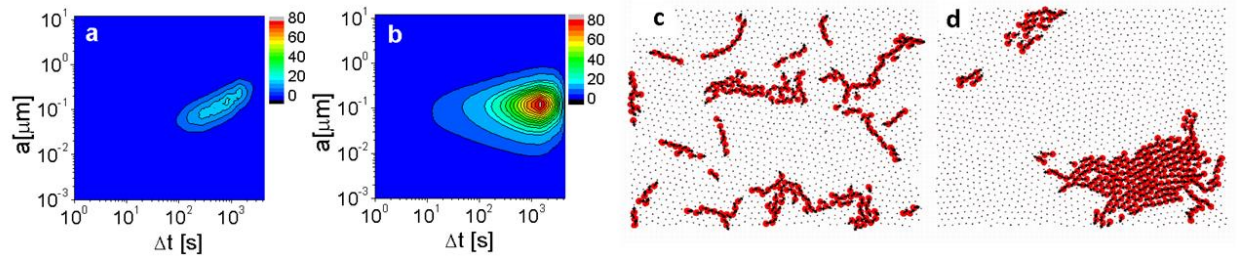

Figure 1 (a-b) Dependence of dynamical susceptibility, χ_4 on probing length scales, a, and time scales, Δt, for (a) repulsive glass and (b) attractive glass. (c-d) Snapshots of cooperatively rearranging particles for (c) repulsive glass and (d) attractive glasses. The red spheres represent the 10% fastest particles. The rest of particles are shown as black dots.

References:

[1] Z. X. Zhang, P. J. Yunker, P. Habdas, and A.G. Yodh, *Phys. Rev. Lett.* 107, 208303 (2011)
[2] P. J. Yunker, Z. X. Zhang, K. B. Aptowicz, and A. G. Yodh, *Phys. Rev. Lett.* 103, 115701 (2009)
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