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**Experimental studies on the local structure, dynamics, and dynamic heterogeneity in colloidal glasses<sup>1</sup>**  
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As the temperature of a glass-forming liquid is lowered, its relaxation time diverges. It is believed that this divergence of relaxation time during the glass transition is related to dynamic heterogeneity, the spatio-temporally heterogeneous, highly correlated motion of constituents. However, the structural causes of dynamic heterogeneity and dynamic arrest remain elusive. Colloidal glasses exhibit much of the same phenomenology as molecular glasses. In this talk I will present two colloidal experiments to study glassy dynamics, and hope to shed some light on the relationship between local structure, dynamics, and dynamic heterogeneity. First, we employ a unique optical heating/quenching technique to study the non-equilibrium aging process in glasses. We found that during aging dynamical heterogeneity grows. The size of locally correlated rearranging domains associated with so-called irreversible rearrangements increases, leading to the slowing dynamics characteristic of aging in glasses. Second, we utilize a novel colloidal system with tunable attractive potential. We are able to change the inter-particle potential from repulsive to attractive *in situ*, which allows a direct comparison between glassy dynamics in repulsive and attractive glasses. We find that more particles are involved in cooperative rearrangements in attractive glasses than their repulsive counterparts. As a result, dynamics in attractive glasses are heterogeneous over more length scales and time scales.

<sup>1</sup>Reference: PRL 103, 115701 (2009), Nature 459, 230 (2009); Grants: DMR-080488, DMR-0520020; Collaborators: Peter Yunker, Kevin B. Aptowicz, Piotr Habdas, Arjun G. Yodh.