Connecting nanoscale motion and rheology of gel-forming colloidal suspensions HONGYU GUO, Physics, Johns Hopkins University, SUBRAMANIAN RAMAKRISHNAN, Chemical and Biomedical Engineering, Florida State University, JAMES HARDEN, Physics, University of Ottawa, ROBERT LEHENY, Physics, Johns Hopkins University — We report a combined x-ray photon correlation spectroscopy (XPCS) and rheometry study of the evolution of concentrated suspensions of nanometer-scale colloids undergoing gelation and aging. The suspensions are comprised of silica colloids, 45 nm in diameter, stabilized with octadecylhydrocarbon chains in decalin at colloidal volume fractions near 0.20. At low temperature, the solvent quality is poor for the octadecyl chains, leading to a weak, temperature-dependent, short-range attraction between the colloids that drives a reversible gel transition. Following a quench through this transition, the shear modulus grows rapidly as a function of time after an extended induction period. The intermediate scattering function measured with XPCS displays two features, a plateau value that provides information about constrained local dynamics in the gel and a terminal relaxation time that provides information about relaxation of residual stress. From the wave-vector dependence of the plateau value, a localization length can be extracted. Except at early times, the relationship between the localization length and the shear modulus agrees quantitatively with the prediction of Chen and Schweitzer based on a simplified mode coupling theory.