Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

The Origin of Hyperdiffusive Relaxations in Soft Glasses SAMANVAYA SRIVASTAVA, DONALD KOCH, LYNDEN ARCHER, Cornell University — Small particles suspended in fluids move randomly over long length- and timescales. This motion is the expected response of weakly interacting particles to uncoordinated bombardments from the fluid molecules. This feature of suspensions is considered a fundamental characteristic of their equilibrium state and, over long-enough observation times, leads to universal diffusive particle motions. We report on the motions of particles in single component suspensions in which the suspended (particle) and suspending (fluid) phases are chemically linked. We find that even in equilibrated systems these motions are hyperdiffusive. Our observations add to a large number of recent reports, which show that diffusive motion is not the norm in soft matter such as colloidal gels, nanoemulsions and soft nanoparticle glasses. In such systems, particle motions can be highly correlated over long distances and time, belying long-lived, directed forces thought to arise from out-of-equilibrium, metastable states that can drive sudden irreversible structural re-arrangements. We show that hyperdiffusive motion in soft matter does not require such states and can arise naturally from volume fluctuations brought about by thermal forces. We further show that the simplicity of the force dipoles produced by volume fluctuations in our single-component suspensions leads to a physical origin for hyperdiffusion as fundamental as that commonly thought to produce diffusion of particles in dilute suspensions.

Samanvaya Srivastava
Cornell University

Date submitted: 15 Nov 2013 Electronic form version 1.4