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Short-Time Glassy-like Dynamics Observed in Viscous Protein Solutions with Competing Potential Features. NORMAN WAGNER, DOUG GODFRIN, University of Delaware, YUN LIU, University of Delaware/ NCNR NIST — Structures in concentrated protein solutions caused by the combination of short-range attraction (SA) and long-range repulsion (LR) have been extensively studied due to their importance in understanding therapeutic protein formulations and the phase behavior in general. Despite extensive studies of kinetically arrested states in colloidal systems with short-range attraction, less is understood for the effect of an additional longer-range repulsion on model colloidal systems with a SA interaction. Highly purified lysozyme is used a model experimental system due to its stable globular structure and SALR interactions at low ionic strength that can be quantitatively modeled. The fluid microstructure and protein short time self diffusion are measured across a broad range of conditions by small angle neutron scattering (SANS) and neutron spin echo (NSE), respectively. Newtonian liquid behavior is observed at all concentrations, even with an increase of zero shear viscosity by almost four orders of magnitude with increasing concentration. However, dynamic measurements demonstrate a sub-diffusive regime at relatively short time scales for concentrated samples at low temperature. The formation of a heterogeneous density distribution is shown to produce localized regions of high density that reduce protein motion, giving it a glassy-like behavior at the short time scale. This heterogeneity occurs at the length scale associated with the intermediate range order driven by the competing potential features, distinguishable from heterogeneous colloidal gels.

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