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Coherent neutron scattering and collective dynamics on mesoscale VLADIMIR NOVIKOV, Department of Chemistry, University of Tennessee, Knoxville, TN 37996, KENNETH SCHWEIZER, Department of Materials Science and Frederick Seitz Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801, ALEXEI SOKOLOV, Department of Chemistry, University of Tennessee, Knoxville, TN 37996 and ORNL, Oak Ridge, TN 37831 — By combining and extending, a variety of theoretical concepts for the dynamics of liquids in the supercooled regime, we formulate a simple analytic model for the temperature and wavevector dependent collective density fluctuation relaxation time that is measurable using coherent dynamic neutron scattering. Comparison with experiments on the ionic glass-forming liquid CKN in the lightly supercooled regime suggests the model captures the key physics in both the local cage and mesoscopic regimes, including the unusual wavevector dependence of the collective structural relaxation time. The model is consistent with the idea that the decoupling between diffusion and viscosity is reflected in a different temperature dependence of the collective relaxation time at intermediate wavevectors and near the main (cage) peak of the static structure factor. More generally, our analysis provides support for the ideas that decoupling information and growing dynamic length scales can be at least qualitatively deduced by analyzing the collective relaxation time as a function of temperature and wavevector, and that there is a strong link between dynamic heterogeneity phenomena at the single and many particle level. Though very simple, the model can be applied to other systems, such as molecular liquids.

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