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Collective versus single-particle dynamical fluctuations in a glass-forming liquid RAJIB PANDIT, Department of Physics and Astronomy and Nanoscale and Quantum Phenomena Institute, Ohio University, Athens, Ohio, ELIJAH FLENNER, Department of Chemistry, Colorado State University, Fort Collins, Colorado, HORACIO E. CASTILLO, Department of Physics and Astronomy and Nanoscale and Quantum Phenomena Institute, Ohio University, Athens, Ohio —
We propose a decomposition of the four-point dynamic structure factor $S_4(k,t)$ of a glass-forming liquid into two contributions: a single-particle contribution $S_4^{sp}(k,t)$ and a collective contribution $S_4^{coll}(k,t)$. We apply this decomposition to the case of a binary hard-sphere mixture in three dimensions. For packing fractions near the glass transition, we find that at times of the order of the alpha relaxation time τ_α, the collective contribution can be up to two orders of magnitude larger than the single-particle one. By contrast, at times two orders of magnitude longer than τ_α, the single particle contribution becomes dominant. The collective part can be cleanly extracted at all times, and we use it to study the dynamic correlation length and the collective part of the dynamic susceptibility for timescales up to $100\tau_\alpha$.

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