Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Decoding the pair correlations and properties of equilibrium microscopic cluster phases JONATHAN BOLLINGER, RYAN JADRICH, THOMAS TRUSKETT, University of Texas at Austin — Due to competing interactions acting between particles, dispersed colloidal suspensions can reversibly transition to phases comprising aggregate clusters. Cluster phases have been reported for both model colloidal particles and complex monomers (e.g., proteins); however, many questions remain regarding how to detect and characterize cluster phases given only pair structural correlations (the information most accessible across diverse systems) and how to relate clustering susceptibility and behavior to underlying monomer-monomer interactions. Using molecular simulations and liquid-state theory across a wide survey of conditions, we decode the widely-observed intermediate range order pre-peak in the structure factor by: (1) validating a physically-intuitive rule for detecting clustering based on the pre-peak thermal correlation length; and (2) relating pre-peak position to cluster size and bulk monomer density. We further demonstrate how clustering transitions and resultant properties relate to monomer interactions along coordinates tunable in experiments. These trends are suitable for comparing against clustering systems that can be directly visualized (via, e.g., confocal microscopy), which should aid in assessing the realism of commonly-adopted monomer interaction potentials.

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Date submitted: 04 Nov 2015 Electronic form version 1.4