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Distinguishing cluster phases as a unique scenario of intermediate range order in colloidal suspensions and protein solutions PAUL DOUGLAS GODFRIN, University of Delaware, RAMON CASTAÑEDA-PRIEGO, Universidad de Guanajuato, YUN LIU, National Institute of Standards and Technology, NORMAN J. WAGNER, University of Delaware — A state of stable clusters is characterized by the reversible aggregation of colloidal particles to a finite, energetically favored size. Clusters can arise from a competition between short range attraction, driving aggregation, and long range repulsion, stabilizing clusters. Recent interest in systems with these interactions has brought attention to the formation of a low-q peak in the structure factor and the proposition that this peak directly indicates cluster formation. To understand the structures that produce a low-q peak, Metropolis Monte Carlo simulations are performed to calculate the partial structure factors by decomposing the system into cluster-cluster, monomer-monomer, and cross-correlations. We find that a low-q peak appears in fluids with strong cluster-cluster correlations but also in systems dominated by monomer-monomer correlations and percolated states. Thus, this low-q peak is more appropriately termed the intermediate range order (IRO) peak. Consequently, an IRO peak does not necessarily signal the existence of a cluster state in solution. Rather, it reflects the presence of a preferred length scale related to the two competing potential features. Determining cluster formation is most accurately accomplished by combining experiment with simulation.

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