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Multiple-Stage Melting and Freezing of Colloidal Crystallites with Short-range Attraction¹ LIQUAN PEI, J.R. SAVAGE, A.D. DINSMORE, Department of Physics, University of Massachusetts Amherst — We study the dynamics of melting and freezing in a model colloidal system with short-range, temperature tunable attraction. In particular, we mix micron-sized, charge stabilized polystyrene spheres with salt and the surfactant pluronic P103. The pluronic micelles induce depletion attraction whose range is approximately 1.5% of the sphere diameter and whose magnitude changes strongly with temperature. We use optical microscopy to record the dynamics of freezing and melting following temperature changes. We use particle tracking algorithms to identify the particles with sub-pixel resolution and measure metastable cluster sizes, order parameters, and bond lengths. We have observed that melting and freezing occur in multiple stages, with a metastable liquid phase appearing in both processes. Our results are relevant to protein crystallization where the interactions are also of short range, and to other systems where non-equilibrium states may play a role in phase separation. We thank the NSF for support through grant DMR-0605839.

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