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**Multiple-Stage Melting and Freezing of Colloidal Crystallites with Short-range Attraction** LIQUAN PEI, Department of Physics, University of Massachusetts Amherst, J.R. SAVAGE, Department of Physics, Cornell University, 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 micelles. The micelles induce depletion attraction whose range is less than 2% 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. For samples with area fraction less than 40%, we have observed that melting and freezing occur in multiple stages, with a metastable liquid phase appearing in both processes. For the freezing sample at area fraction 55%, we have found that the gas droplets are nucleated from high area fraction background. The data also show how nucleation dynamics are affected by the metastable gas-liquid binodal. We are also investigating the role of the second, metastable solid phase in melting and freezing. Our results are relevant to systems where non-equilibrium states may play a role in phase separation.

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