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Imaging dynamics and transitions in colloidal clusters¹ REBECCA W. PERRY, Harvard University, School of Engineering and Applied Sciences, THOMAS G. DIMIDUK, Harvard University, Dept. of Physics, JESSE W. COLLINS, Harvard University, School of Engineering and Applied Sciences, JEROME FUNG, GUANGNAN MENG, Harvard University, Dept. of Physics, VINOTHAN N. MANOHARAN, Harvard University, Dept. of Physics and School of Engineering and Applied Sciences — We use digital holographic microscopy to measure the relative motions of particles in colloidal clusters containing micron-sized spherical particles interacting through short-range attractions. These clusters explore many configurations as they approach their equilibrium states. Furthermore, clusters formed with weak interactions continue to transition between equal-energy configurations. We solve the challenge of tracking closely-packed, thermally-driven colloidal spheres in three dimensions by fitting the holograms using an exact solution for the scattering from multiple spheres. The method allows us to track each sphere with 10 nm precision in all three dimensions with millisecond time resolution.

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