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Digital holographic microscopy of weakly scattering nanoparticles in solution AARON M. GOLDFAIN, Harvard University, School of Engineering and Applied Sciences, YOAV LAHINI, Massachusettes Institute of Technology, Department of Physics, and Harvard University, School of Engineering and Applied Sciences, VINOTHAN N. MANOHARAN, Harvard University, School of Engineering and Applied Sciences and the Department of Physics — Many important biological processes, such as virus capsid self-assembly, protein transcription, and lipid vesicle formation involve biological molecules in solution that are $\sim$10 nanometers in size. Such particles are difficult to detect using visible light because they diffuse rapidly and have small scattering cross-sections. Digital holographic microscopy (DHM) has been used to image micrometer-sized particles in solution at fast time scales in 3 dimensions, but conventional in-line DHM techniques used on nanoparticles yield low signal to background ratios. We explore methods to increase the signal to background ratio of holograms by both increasing the amount of light that is coherently scattered from objects, and by decreasing the intensity of the reference beam used to form a hologram. We record holograms of gold and polystyrene nanoparticles in solution and track them in three-dimensions with high precision at frame rates of 1 kHz. The goal is DHM of single proteins.

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