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Differential Dynamic Microscopy of Weakly Scattering and Polydisperse Protein Rich Clusters JACINTA CONRAD, MOHAMMAD SAFARI, PETER VEKILOV, University of Houston — Biological objects often scatter light weakly and are frequently smaller than the diffraction limit, complicating measurements of their dynamics. Differential dynamic microscopy (DDM) is a recently developed method used to quantify dynamics of sub-μm particles in solutions from fluctuations in intensity in optical micrographs. DDM is well established for monodisperse particles but has not been applied to polydisperse biological nanoparticles. Here, we used DDM to measure dynamics of polydisperse nanoscale objects, protein-rich liquid clusters in protein solutions, whose size ranged from tens to hundreds of nanometers and whose total volume fraction was less than 10^{-5}. For solutions of two proteins, lysozyme and hemoglobin A, we measured the dynamics of clusters using DDM and evaluated their diffusion coefficients from the dependence of the diffusion lag time on the scattering wave vector. The average diffusion coefficient of clusters measured using DDM was consistently smaller than that obtained from dynamic light scattering at 90°. The apparent discrepancy between results was explained by Mie scattering theory, which indicates that larger clusters preferentially scatter more light in the forward direction.

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