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A New Technique for Measuring Concentration Dependence of Self and Collective Diffusivity by using a Single Sample[1] KRITTANON SIRORATTANAKUL, CHONG SHEN, DANIEL OU-YANG, Department of Physics, Lehigh University — Diffusivity governs the dynamics of interacting particles suspended in a solvent. At high particle concentration, the interactions between particles become non-negligible, making the values of self and collective diffusivity diverge and concentration-dependent. Conventional methods for measuring this dependency, such as forced Rayleigh scattering, fluorescence correlation spectroscopy (FCS), and dynamic light scattering (DLS) require preparation of multiple samples. We present a new technique to measure this dependency by using only a single sample. Dielectrophoresis (DEP) is used to create concentration gradient in the solution. Across this concentration distribution, we use FCS to measure the concentration-dependent self diffusivity. Then, we switch off DEP to allow the particles to diffuse back to equilibrium. We obtain the time series of concentration distribution from fluorescence microscopy and use them to determine the concentration-dependent collective diffusivity. We compare the experimental results with computer simulations to verify the validity of this technique. Time and spatial resolution limits of FCS and imaging are also analyzed to estimate the limitation of the proposed technique.

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