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Direct measurements of the pair potentials of colloids with light scattering and optical traps KISUN YOON, SEAS, Harvard University, VINOTHAN MANOHARAN, Department of Physics, SEAS, Harvard University
— We present a methodology of directly measuring the pair potentials of colloids. We take snapshots of the thermal fluctuation of a pair of colloidal particles in equilibrium. The probability distribution of the separation distance obtained from the snapshots should follow the Boltzmann distribution because the separation distance of the particle pair is the only independent variable necessary to describe the effective free energy of a macrostate of the colloidal particle pair in equilibrium. The measurement of the pair potentials can be achieved by appropriately subtracting the unwanted potentials due to optical traps and optically induced interactions from the effective free energy. Accurate measurement of the separation distance between colloidal particles has critical importance in measuring colloidal interactions. Conventional Video Microscopy used for separation distance measurement is significantly restricted due to the two-dimensional nature of the measurement. Furthermore, the measurement is seriously distorted when the two particles are nearly in contact because of the diffraction of light and multiple scattering effect. We introduce a new technique to accurately measure the separation distances using light scattering. This light scattering technique can measure the separation distance in 3D and appropriately considers the multiple scattering effect.

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