

Measurements of optical trap stiffness based on the Stokes' law and Boltzmann equation

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Single beam gradient force trap or optical laser tweezer is a powerful tool for manipulating microstructures of micron sized particles and directly measuring their interparticle forces on piconewton scale. In order to precisely determine the interaction force, calibration procedures of optical trap stiffness should be preceded. In this work, we evaluate accuracy of the trap calibration methods. One method used is based on the drag calibration method in which an optically trapped particle is subjected to surrounding flows with varying the fluid velocity. The trap stiffness is then extracted via the Stokes' equation. Another simple method is to use the Boltzmann equation. In this case, the trap stiffness can be determined by fitting trajectories of a trapped particle in the absence of fluid flows.