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Optical trapping of micrometer sized latex spheres in the undergraduate advanced lab: learning goals and outcomes

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The all-optical manipulation of 1 to 4 μm latex spheres with a 20 mW He-Ne laser has been used to demonstrate the concepts of single beam optical trapping in the case when the particle size is comparable to the laser wavelength. Drag coefficient, particle diameter, laser beam waist and trap strength are some of the calculated parameters for the calibration of the optical trap. A CCD camera with high sampling rate is used to video capture the Brownian motion of the spheres in the optical trap as is periodically switched on and off. Students are tested on optics building set-ups and alignment skills. To expand learning outcomes, students conduct analyses on large sets of digitized images for the interpretation of the optical trap properties.

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