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Investigating optically trapped spherical particles by Mie scattering.

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We investigate Mie scattering from particles in an optical trap. Optical tweezers and counter propagating optical traps allow micron sized particles to be optically trapped and investigated by scattering white light off the particles. In optical tweezers, a high numerical aperture microscope objective is used to focus a laser beam and create an optical trap for microscopic particles, such as polystyrene beads or biological cells suspended in water. The trapped particle has a higher refractive index than the medium which surrounds the particle. The light refracts through the particle and due to conservation of momentum, a net force pushes the particle towards the focus of the beam. In a counter propagating optical trap, microscope objectives with a longer working distance can be used. Using two high numerical aperture microscope objectives, two counter propagating beams create a trap where the two foci overlap in space. The design and construction of the counter propagating optical trap will be discussed. In this work, the ultimate aim is to trap microscopic water droplets suspended in air. Once trapped, the droplet's morphology can be studied using whispering gallery modes, also known as morphologically dependent resonances, formed within the particle when it is illuminated with white light. Specific wavelengths resonate within the spherical cavity due to total internal reflection of the light. These resonances can be seen on the measured spectrum of the Mie scattered light from the particle. By comparing the spectrum of the scattered light to that predicted by Mie Theory one can precisely determine the particle's diameter and/or its refractive index. Mie scattering theory and simulations will be briefly discussed to illustrate this.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

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