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Precision Laser Transmission Spectroscopy: Applications to Nanoparticle Systems CAROL TANNER, FRANK LI, CHING-TING HWANG, ROBERT SCHAFER, STEVEN RUGGIERO, University of Notre Dame — We describe the implementation of precision laser transmission spectroscopy (LTS) for determining the size, shape, and number of nanoparticles in suspension. Our apparatus incorporates a tunable laser and balanced optical system, which measures light transmission over a wide wavelength range (210-2300 nm) with high precision and sensitivity. Spectral inversion is employed to determine both the particle size distribution and the absolute number density of particles ranging in diameter from 5 to 3000 nm with ∼3 nm resolution. With respect to density, the sensitivity or our measurement system ranges from ∼1000 particles/mL up to 10^{10} particles/mL ($5x10^{-8}$ vol.% to 0.5 vol. %). The size range of applicability is comparable to that of dynamic light scattering (DLS) but with approximately six orders of magnitude higher sensitivity and five times the resolution. The technique also allows us to determine the length and width of rod shaped particles including biological objects. Currently, LTS is being applied as a tool to investigate various biological and non-biological nanoparticle systems including: metals, oxides, carbon, organic materials, proteins, viruses, bacteria, liposomes, DNA, etc. We acknowledge the support of the University of Notre Dame Office of the Vice President for Research and NDnano/MIND.

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