Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Nanoprobes with optical tweezers for biological applications[1]
MARK KENDRICK, DAVID MCINTYRE, OKSANA OSTROVERKHOVA, VALERIYA BYCHKOVA, ALEXEY SHVAREV, Oregon State University — We explore the use of sub-micron sized particles in optical tweezer traps as nanoprobes in microfluidic devices and biological cells. For applications that require high spatial resolution, the ability to suppress the particle's natural Brownian motion down to the nanometer or sub-nanometer scales is essential. However, the optical tweezer force scales with the volume of the particle making it difficult to confine and manipulate nanometer sized particles with high precision. To overcome this difficulty, we explore the possibility of using optically resonant particles as nanoprobes. The resonant particles should experience an increase in the optical tweezer force at wavelengths on the red side of the absorption resonance, resulting in a tighter confinement. We explore this phenomenon by measuring the trapping force acting on resonant particles (dye-filled polymeric and metallic particles) as a function of trapping laser wavelength and discuss the feasibility of using them as a high spatial resolution probe. In addition, we use similar particles as optically trapped nanoprobes to monitor temporal and spatial differences in an inhomogeneous environment; for example, we have developed pH-sensitive fluorescent nanoprobes for biological applications.

[1]Supported by ONR grant N0014-07-1-0457.

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Date submitted: 27 Nov 2009 Electronic form version 1.4