

## Resonant optical tweezers with anti-reflection coated titania microspheres

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Brownian motion is exhibited by an optically trapped particle due to the thermally driven molecules of the surrounding medium. This motion is often considered to be a frequency-independent phenomenon which is known as a white noise process. However, fluid entrainment influences the particle in the trap and results in a frequency-dependent motion. Therefore, the power spectral density (PSD) of the noise that drives the motion is “colored”. The “colored noise” of the Brownian motion can change the behavior of an optical trap from an overdamped oscillator to a resonant one. Here, our goal was to amplify this resonance. Theoretical calculations predict that particles with a large diameter and a high trap stiffness enhance the resonance effect. Therefore, we synthesized large anti-reflection coated titania microspheres. These microspheres have a high trap stiffness in the optical trap. In comparison to our previous work [1], the results showed a roughly 4 times enhancement of the resonance in acetone. The resonant behavior could be used as a sensor in analogy to other resonant probes such as an atomic force microscope cantilever.

### References

- [1] A. Jannasch, M. Mahamdeh, E. Schäffer: *Inertial effects of a small Brownian particle cause a colored power spectral density of thermal noise*. Phys. Rev. Lett. **107**, 228301 (2011)