Brownian dynamics of levitated nanoparticles

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Micro and nanoparticles can be individually manipulated by different trapping mechanisms, among which optical tweezers and Paul traps are the most extended approaches. Trapped particles are subject to Brownian motion due to collisions with water or gas molecules, depending on the dispersing medium. Once trapped, the particles can be driven out of equilibrium under the action of external fields, giving rise to a very rich dynamics. In this talk, we will discuss some of our work with trapped nanoparticles dispersed in different media, including water, air and vacuum (see Fig. 1) [1, 2, 3, 4, 5]. We will demonstrate that an exquisite control over the dynamics that can be achieved by using state-of-the-art instrumentation, thanks to the sensitivity over position and forces that these provide.

In particular, we will present recent experimental results demonstrating the occurrence of stochastic resonance [3] and the Kovacs effect [6] on the dynamics of a single levitated nanoparticle.

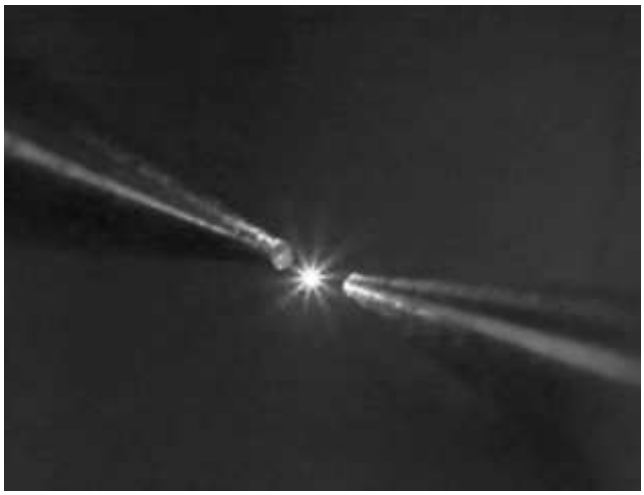

Fig. 1. Picture of a single nanodiamond (size = 100 nm) levitated by a Paul trap. The distance between the conical electrodes is 1.5 mm. The bright spot is due to the scattering of a laser beam focused at the position of the nanoparticle.

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