Nano-Optomechanics with a levitated nanoparticle in vacuum

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Optomechanics holds great promises to push the limits of experimental physics, opening new opportunities in ultra-weak force sensing, thermodynamics and giving us further insight on the transition between the quantum and classical worlds. In this talk, we introduce the use of a levitated nanoparticle in vacuum as a nano-optomechanical system with unprecedented performances. We first describe its unique linear and nonlinear mechanical properties including its high sensing capability and bi-stable dynamics [1-3]. Subsequently, we present our efforts in cooling its motion towards mechanical ground state at room temperature. In particular, we report on an experiment that combines active parametric feedback cooling with passive resolved side band cooling in a macroscopic high finesse optical cavity [4,5]. Finally, we discuss how the concept of levitation optomechanics can be extended to optical nanocavity by exploiting their subwavelength mode confinement.

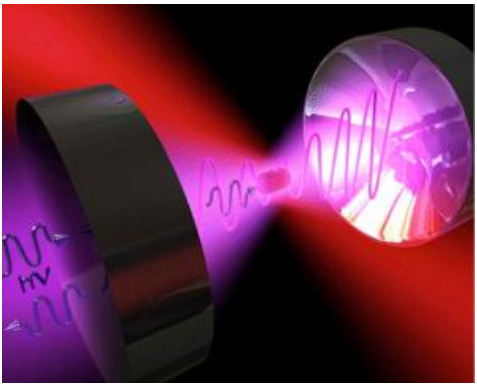

Figure1 Sketch of our experiment in which a levitated nanoparticle is cooled down by resolved side band cooling in a high finesse optical cavity.

References

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