Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Torsional and rotational optomechanics of an optically trapped nanoparticle in vacuum[1] TONGCANG LI, Purdue University — An optically levitated nanoparticle in vacuum is excellent for precision measurements. Recently, we optically levitated pure silica nanodumbbells in high vacuum. With a circularly polarized laser, we drove it to rotate beyond 1 GHz [Phys. Rev. Lett., 121, 033603 (2018)]. With a linearly-polarized laser, we observed its torsional vibration. A nanodumbbell levitated by a linearly polarized laser in vacuum will be a novel torsion balance with a torque detection sensitivity on the order of $10^{-28}Nm/\sqrt{Hz}$. This will be sufficient to detect the Casimir torque due to the angular momentum of quantum vacuum fluctuations. This system can also be used to study the nonadiabatic dynamics and geometric phase of a fast rotating electron spin [arXiv:1811.01641]. With a levitated nanoparticle under drive, we also tested the differential fluctuation theorem and a generalized Jarzynski equality that is valid for arbitrary initial states [Phys. Rev. Lett. 120, 080602 (2018)].

[1]This work is supported by NSF (Grant No. PHY-1555035) and Office of Naval Research (Grant No. N00014-18-1-2371).

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Date submitted: 26 Jan 2019 Electronic form version 1.4