

Abstract Submitted
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Librational cooling of electrically-driven and optically-levitated microscopic rotors¹ DENZAL MARTIN, CHARLES P. BLAKEMORE, AKIO KAWASAKI, ALEXANDER FIEGUTH, NADAV PRIEL, ALEXANDER D. RIDER², GIORGIO GRATTA, Stanford University — The permanent electric dipole moment of an optically-levitated $\sim 2.4 \mu m$ radius silica microsphere can be driven into rotation by a constant magnitude, rotating electric field. Due to the microsphere's birefringence, some amount of the linearly polarized incident light is coupled into the perpendicular polarization as the microsphere rotates. In the frame of the rotating electric field, the microsphere's dipole moment undergoes libration about the instantaneous direction of the electric field. The power modulation of cross-polarized light transmitted through the microsphere is extracted and processed digitally to obtain the angular speed of the libration. We demonstrate cooling of the libration by applying a phase modulation to the electric field which is proportional to the instantaneous angular speed of the libration. This technique further improves the control over the microsphere's rotational degrees of freedom.

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