Abstract Submitted
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Analytic Solution of the Equation of Motion for an Optically-Torqued, Overdamped Nanorod W.C. KERR, H. NASIF, S. RAYNOR, Wake Forest Univ. — Shelton et al.[1] performed an experiment to drive a nanorod, immersed in a viscous medium, by an optical field with rotating polarization. The nanorod had a length of about 5 microns, was held in an optical trap and placed in water, which provided a frictional torque. A linearly polarized optical beam was incident rod, and its polarization plane was rotated by passing it through a rotating half-wave plate. The rod's polarizability tensor was anisotropic, so its induced dipole moment was not parallel to the field; thus a driving torque was exerted on the nanorod. The experimental parameters were such that the inertial term of the equation of motion could be ignored. When this simplified equation was written in terms of an auxiliary variable proportional to the nanorod's angle in a rotating frame, the equation was the same as that of a damped, driven pendulum. We find that this ODE is amenable to analytic solution. The solution identifies a certain critical angular frequency, such that qualitatively different motions occur when the light polarization rotation frequency is less than or greater than the critical frequency. All features of the analytic solution agree quantitatively with the experiment.

[1]W. A. Shelton, *et al*, Phys. Rev. E **71**, 036204 (2005)

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