Towards measuring quantum electrodynamic torque with a levitated nanorod\textsuperscript{1} ZHUJING XU, JAEHOON BANG, JONGHOON AHN, THAI M. HOANG, TONGCANG LI, Purdue University — According to quantum electrodynamics, quantum fluctuations of electromagnetic fields give rise to a zero-point energy that never vanishes, even in the absence of electromagnetic sources. The interaction energy will not only lead to the well-known Casimir force but will also contribute to the Casimir torque for anisotropic materials. We propose to use an optically levitated nanorod in vacuum and a birefringent substrate to experimentally investigate the QED torque. We have previously observed the libration of an optically levitated non-spherical nanoparticle in vacuum and found it to be an ultrasensitive torque sensor. A nanorod with a long axis of 300nm and a diameter of 60nm levitated in vacuum at \(10^{-8}\) torr will have a remarkable torque detection sensitivity on the order of \(10^{-28}\) Nm/√Hz, which will be sufficient to detect the Casimir torque.

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