Abstract Submitted
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Optical RF to mechanical coupling of a thin membrane as one end of a cylindrical cavity ALESSANDRO CASTELLI, LUIS MARTINEZ, University of California, Merced, JERRY SPEER, None, JAY SHARPING, RAYMOND CHIAO, University of California, Merced — We demonstrate coupling of an 11.1 GHz radio frequency (RF) TE011 cylindrical cavity mode to the mechanical motion of a silicon nitride (Si3N4) membrane. The membrane is driven into motion through radiation pressure forces arising from the transverse magnetic field present at the membrane boundary. We use a cylindrical aluminum cavity where one end consists of a 500-nm thick Si3N4 membrane that has been sputtered with 300 nm of niobium (Nb). Cavity frequency tuning is controlled via an aluminum plunger attached to a micrometer at the other end of the cavity. The plunger was machined to leave a small air gap at the border of the cavity face in order to eliminate frequency degeneracy of the TM111 mode. The membrane is driven into motion by modulating the amplitude of the RF signal at the membrane's resonant frequency of approximately 6.7 KHz. The membrane's displacement is measured by means of a Michelson interferometer. This experiment shows that the TE011 mode gives rise to radiation pressure on the ends of a cylindrical cavity and demonstrates the feasibility of future work using high Q superconducting RF cavities to realize a dynamical Casimir effect (DCE) due to the membrane's motion at GHz frequencies.

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