Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Measuring Coatings Brownian Noise for LIGO Mirrors ANCHAL GUPTA, ANDREW WADE, CRAIG CAHILLANE, RANA ADHIKARI, LIGO Caltech — The Laser Interferometer Gravitational-Wave Observatory (LIGO) uses precision laser interferometry to probe minute gravitational wave signals originating from distant astrophysical events. LIGO uses dielectric coatings on the large test mass mirrors to achieve low loss, high reflectivity ($> 99.9994\%$) and cancellation of thermo-optic noise. This enables the measurement of displacement due to gravitational waves (GW) to the order of $10^{-19} m/\sqrt{\text{Hz}}$. Present noise floor limitations in the interferometer, in part, come from the mirror coatings Brownian noise. This experiment directly measures estimate for this noise due to crystalline coatings made with alternate layers of $Al_{0.92}Ga_{0.08}As$ and GaAs. The noise is measured by beating light from two identical high finesse cavities, locked via high-performance feedback with two independent lasers, and measuring the fluctuations in the beat note frequency. This approach complements the indirect measurement methods and helps in developing the theory of the origin of this noise. This work contributes to the ongoing efforts on increasing the sensitivity for future GW detectors as well as other high precision optical experiments. We present our latest estimate of this noise contribution and details of the experiment.

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Date submitted: 18 Feb 2020 Electronic form version 1.4