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Testing Ionizers for Nitrogen Discharge of Interferometer Optics[1]

TIMOTHY AMEN, DENNIS UGOLINI, Trinity University — Interferometric gravitational-wave observatories consist of suspended optics in a vacuum chamber. Charge can build up on and then discontinuously jump across an optic, creating a changing electric field, causing the optic to sway, creating a false signal. We studied possible ways to discharge an optic without damaging their reflective coatings. We tried two types of electron guns. The first was built at the University of Washington and uses an ultraviolet LED to free electrons from a magnesium target. We found the current to be three orders of magnitude less than necessary for discharge in a reasonable time. The second gun used was a Bayard-Alpert gauge. To eliminate sputtering caused by the gauge above 10^{-4} torr, we employed a differential pumping system. We were able to flow nitrogen gas through the main chamber at pressures between 10^{-2} and 10^{-3} torr while the gauge chamber was kept two orders of magnitude lower. We successfully discharged the optic. The discharge rate varied exponentially with charge level and operating current and nearly linearly with acceleration voltage, and peaked when the pressure was 8 x 10^{-3} torr in the main chamber.

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