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Frequency stabilization of a laser used to measure Plank scale indeterminacy ROBERT LANZA, AARON CHOU, YOUNG-KEE KIM, The University of Chicago and Fermilab — Macroscopic effects of spacetime quantization due to the holographic principle will soon be tested using precision power recycled interferometers at Fermilab. The relative transverse position of two objects is predicted to experience a quantum blurring, resulting from the overall reduction in the number of spacetime degrees of freedom set by holographic entropy bounds. This blurring is manifested in a spectrally flat noise signal in relative phase measurements made in large Michelson interferometers. In the proposed experiment, the holographic noise levels are amplified to a detectable level using $\sim$40 m interferometer arms, in which the beams are recycled using cavity mirrors. The frequency of the laser must be sufficiently stable before injection into the long, narrow bandwidth cavity arms of the interferometer. We present here studies of the shorter, wider bandwidth cavities which we are developing to pre-stabilize the laser frequency. This technology will also be applied to a Fermilab cavity-enhanced search for axions created from a laser beam.

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