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Construction and commissioning of a 40m long Fabry–Pérot cavity at Fermilab: toward exploring Planck scale space-time phenomena

Macroscopic effects of space-time quantization due to the holographic principle will soon be tested at Fermilab, by cross-correlating the signals from two neighboring power-recycled Michelson interferometers. The diffractive nature of the predicted holographic position noise allows it to be amplified to a detectable level using 40m interferometer arms, in which the beams are recycled using cavity mirrors. The resulting high laser power buildup enables precision measurements of phase, and hence position. We present here studies of the initial 40m cavity that has been built, including Pound-Drever-Hall locking of the laser frequency to the cavity, and alignment control systems.

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