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Probing Quantum Space-Time with Interferometers

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The standard model of particle physics has been remarkably successful in accounting for every experimental result to date, with the exception of the acceleration of the universe. However, this theory becomes inconsistent at intervals shorter than the Planck scale, where quantum mechanics and general relativity collide, unless the geometry of space-time itself also acquires some quantum character. Some ideas of quantum geometry, based only on general principles of covariance and quantum mechanics, predict correlated quantum position fluctuations detectable with current technology. The Fermilab Holometer is the first experiment designed to measure transverse position fluctuations, expressed in spectral density units, smaller than a Planck time. This precision is achieved by cross-correlating the anti-symmetric signals of two 40-meter power-recycled Michelson interferometers. When operating at its design sensitivity, the Holometer will either detect or conclusively rule out candidate forms of holographic quantum geometry. In this talk I will provide an overview of the Holometer experiment and an update on its current operational status.

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