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Emergent Rotation from the Planck Scale and the Fermilab Holometer[1] OHKYUNG KWON, Korea Adv Inst of Sci Tech , CRAIG HOGAN, University of Chicago and Fermilab, JONATHAN RICHARDSON, University of Chicago and University of Michigan — We present a statistical model of rotational fluctuations of the inertial frame arising from quantum geometry, based on Planck scale information bounds and exact causal symmetry. In an emergent spacetime assembled from noncommuting quantum elements at the Planck scale, in the Minkowskian limit with no dynamics or curvature, quantum correlations are represented by covariant random transverse spatial displacements on light cones. Light that propagates in a nonradial direction inherits a projected component of the rotational correlation that accumulates as a random walk in phase. A calculation of the projection and accumulation leads to exact predictions for statistical signatures in an interferometer of any configuration. Coherent and consistent local inertial frames emerge as observer-dependent statistical approximations at large scales, and the cross-covariance for nearly co-located interferometers is shown to depart only slightly from the autocovariance. A specific example computed for the reconfigured second-generation Fermilab Holometer shows that the model can be rigorously tested with the sensitivity already achieved in the first-generation instrument.

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