Title: Quantum Information Theory of the Gravitational Anomaly

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Abstract: <p>In this talk I prove that the standard notion of entanglement is not defined for gravitationally anomalous two-dimensional theories because they do not admit a local tensor factorization of the Hilbert space into local Hilbert spaces. I make this precise by combining two observations:

   First, a two-dimensional CFT admits a consistent quantization on a space with boundary only if it is not anomalous.

   Second, a local tensor factorization always leads to a definition of consistent, unitary, energy-preserving boundary condition.

   As a corollary we establish a generalization of the Nielsen--Ninomiya theorem to all two-dimensional unitary local QFT:

   No continuum quantum field theory in two dimensions can admit a lattice regulator unless its gravitational anomaly vanishes.

I also show that the conclusion can be generalized to six dimensions by dimensional reduction on a four-manifold of nonvanishing signature. I will advocate that these points be used to reinterpret the gravitational anomaly quantum-information-theoretically, as a fundamental obstruction to the localization of quantum information.</p>