A Covariant Information-Density Cutoff in Curved Space-Time

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abstract In information theory, the link between continuous information and discrete information is established through well-known sampling theorems. Sampling theory explains, for example, how frequency-filtered music signals are reconstructible perfectly from discrete samples. In this Letter, sampling theory is generalized to pseudo-Riemannian manifolds. This provides a new set of mathematical tools for the study of space-time at the Planck scale: theories formulated on a differentiable space-time manifold can be completely equivalent to lattice theories. There is a close connection to generalized uncertainty relations which have appeared in string theory and other studies of quantum gravity.