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Quantum gravity with real clocks, fundamental decoherence and the black hole information puzzle JORGE PULLIN, Louisiana State University — We present work in collaboration with Rodolfo Gambini and Rafael Porto. Using the consistent discretization scheme we introduced, general relativity can be approximated by a constraint-free theory. This allows its quantization using the ideas of Page and Wootters, where one chooses a quantum physical variable as a clock. The resulting evolution in terms of the quantum clock is shown to be lose unitarity, even if one chooses the best possible clock. We present an estimate of such an effect, and show that it is large enough to render the black hole information puzzle unobservable: pure states would lose coherence due to this fundamental mechanism at a rate similar to the one that could be achieved by collapsing a pure state into a black hole that evaporates.

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