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Reconstructing cosmological dynamics from quantum communication between particle detectors

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Particle detector models have been recently proven to be an effective mean to know how curved spacetimes affect quantum systems. For example, particles generated by the Unruh effect could be detected by an accelerating system and can provide a reliable communication of quantum messages, usually prevented by the no-cloning theorem. Motivated by this fact, we propose a quantum communication protocol between harmonic oscillators detectors undergoing a cosmological expansion. We see that the maximum rate of classical information they exchange is dependent on the barotropic factor of the cosmological fluids and on the coupling between the field and the scalar curvature. Consequently, we can extract information of the cosmic dynamics studying how these detectors communicate. Further, we establish a necessary condition to achieve a quantum capacity greater than zero. Because of the no-cloning theorem, it finally turns out that maximally symmetric metrics do not lead to a reliable communication of quantum messages between particle detectors and, so, alternative cosmological spacetimes could instead exhibit more detectable outcomes.

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