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Active and Passive Interferometric Fringe Stabilization for Quantum Communications in Space JOSEPH CHAPMAN, TRENT GRAHAM, PAUL KWIAT, Department of Physics, University of Illinois Urbana-Champaign — In interferometry, the relative phase between the paths is liable to drift over time due to environmental factors, i.e., vibrations in the components and from turbulence and temperature fluctuations in the air. If time-bin encoded photons are received from a moving space platform, e.g., a satellite or the International Space Station, there would be an additional large relative temporal shift because of the movement of the source toward or away from the receiver. This shift would alter the temporal coherence of adjacent timebins-as measured by a suitable temporally-unbalanced interferometer-in addition to the relative phase errors from the environment. To achieve accurate measurements in this situation, the interferometer needs to be stabilized against phase drifts. We have employed an active and passive stabilization scheme for a double unbalanced Mach-Zehnder interferometer configuration; while passive damping reduces most of the phase drift due to vibrations and fluctuations from the air, we designed and implemented an active feedback correction system to stabilize the remaining phase drift and the simulated temporal drift.

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