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Turbulence and the Hong-Ou-Mandel effect

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ABSTRACT:

The effect of a decoherence channel, such as a turbulent atmosphere, on the second-order quantum interference in the Hong-Ou-Mandel (HOM) effect is investigated. The investigation includes both theoretical analyses and an experimental implementation of the process. In our experiment, entangled input states are prepared with spontaneous parametric down-conversion. The atmospheric turbulence is modeled as a single-phase screen and simulated with spatial light modulators according to the theory of Kolmogorov. We find both theoretically and experimentally that the HOM dip is unaffected when only one of the photons passes through turbulence. When both photons pass through turbulence, the HOM interference is only slightly affected by the scintillation. The reasons behind these findings and their consequences for HOM-based teleportation are discussed.