

Abstract Submitted
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A non-local quantum eraser¹ X. MA, J. KOFLER, A. QARRY, N. TETIK, T. SCHEIDL, R. URSIN, S. RAMELOW, L. RATSCHBACHER, T. HERBST, A. FEDRIZZI, T. JENNEWEIN, A. ZEILINGER, Univ. of Vienna and OEAW — The complementarity behavior of quantum systems is strikingly illustrated by the quantum eraser, where one can actively choose whether or not to erase which-path information of one particle by performing suitable measurements on another particle entangled with it [1-2]. Quantum mechanics predicts that this choice can be arbitrarily delayed and spatially separated from interference [1-3]. We report the first quantum eraser experiment performed under Einstein locality, i.e. under relativistic space-like separation. We employ the hybrid entanglement between path and polarization of photon pairs and distribute the photons over an optical fibre link of 55 m and, in another experiment, over a free-space link of 144 km. A complementarity inequality is measured and well fits the predictions of quantum mechanics. Our experiment represents a conclusive demonstration of the quantum eraser concept.

[1] M. O. Scully, K. Drühl, *Phys. Rev. A* 25, 2208 (1982). [2] J. A. Wheeler, in *Quantum Theory and Measurement* (1984). [3] V. Jacques, *et al.*, *Science* 315, 966 (2007).

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