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Violation of local realism with freedom of choice JOHANNES KOFLER, THOMAS SCHEIDL, RUPERT URSIN, SVEN RAMELOW, XIAO-SONG MA, Institute for Quantum Optics and Quantum Information (IQOQI), Austrian Academy of Sciences, THOMAS HERBST, Faculty of Physics, University of Vienna, LOTHAR RATSCHBACHER, ALESSANDRO FEDRIZZI, NATHAN LANGFORD, THOMAS JENNEWEIN, ANTON ZEILINGER, Institute for Quantum Optics and Quantum Information (IQOQI), Austrian Academy of Sciences — Bell's theorem shows that local realistic theories place strong restrictions on observable correlations between different systems, giving rise to Bell's inequality which can be violated in experiments using entangled quantum states. Bell's theorem is based on the assumptions of realism, locality, and the freedom to choose between measurement settings. In experimental tests, "loopholes" arise which allow observed violations to still be explained by local realistic theories. Violating Bell's inequality while simultaneously closing all such loopholes is one of the most significant still open challenges in fundamental physics today. We present an experiment that violates Bell's inequality while simultaneously closing the locality loophole and addressing the freedom-of-choice loophole, also closing the latter within a reasonable set of assumptions. Reference: T. Scheidl et al., Proc. Natl. Acad. Sci. USA 107, 19708 (2010)

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