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“Entangled Photon Polarimetry”

Optical quantum information processing holds promise of exponential speedups for certain computational problems, physically guaranteed cryptographic security, and classically impossible communications protocols [1]. Just as real-time classical polarimetry—the in-situ, complete characterization of an optical field’s polarization—has facilitated progress in nearly every branch of modern optics, a real-time system for entangled photon polarimetry—the in-situ, complete characterization of arbitrary two-photon states—would find immediate use in optical quantum information processing. Here we report on the construction and characterization of a telecom-band entangled photon polarimeter capable of displaying an evolving quantum state in real-time. We use this to record a 9 frame-per-second live video of a two-photon state’s transition from separability to entanglement.

[1] M. A. Nielsen and I. L. Chuang, Quantum Computation and Quantum Information (Cambridge University Press, 2000).