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High-Efficiency Time-Multiplexed Single-Photon Source[1] COLIN P. LUALDI, FUMIHIRO KANEDA, JOSEPH C. CHAPMAN, PAUL G. KWIAT, Department of Physics, University of Illinois at Urbana-Champaign — A single-photon source capable of on-demand generation of indistinguishable single- and multi-photon states is a key requirement for optical quantum information processing (QIP) applications. While heralded single-photon sources (HSPSs) via spontaneous parametric down-conversion have long served this purpose, they are not suitable for large-scale QIP due to their probabilistic nature. As a solution, we utilize time-multiplexing techniques by pairing an adjustable delay line with our low-loss HSPS generating highly indistinguishable ($\sim 90\%$) photons. We report our most current results, which include a $66.7 \pm 2.4\%$ presence probability of single-photon states collected into a single-mode optical fiber by multiplexing 40 periodic time bins, a $10\times$ enhancement over the non-multiplexed case. We also discuss ongoing efforts to improve multiplexing performance by suppressing the second-order correlation function $g^{(2)}(t = 0)$ via increasing the efficiency and photon-number-resolving capabilities of our heralding detectors. Overall, we believe our results present a compelling case for the use of time-multiplexing techniques with HSPSs to enable large-scale optical QIP.

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