Temporal synchronization of multiple SPDC photon generation events

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Spontaneous parametric down-conversion (SPDC) is one of the most mature techniques for producing photon pairs and heralded single photons, although there is an inherent trade-off between efficiency and single-photon purity, which limits deterministic single-photon emission. This limitation can be mitigated using multiplexing [1], for example with switchable storage cavities [2,3]. Here, we demonstrate synchronization of many heralded photons from an SPDC source via time-multiplexing using an actively switched fiber loop. The photon-pair source consists of a monolithic ppKTP cavity used for pulsed SPDC, as presented in detail in Ref. [4]. It heralds photons into a well-defined cavity mode of 168 MHz bandwidth at 1540 nm wavelength with 96(3)% spectral purity. The heralded photon is actively routed into a fiber-coupled loop using a Pockels cell and a polarizing beam splitter, as shown in Fig. 1(a). The fiber loop achieves 89% round-trip transmission, which allows synchronization and storage across 20 time bins before releasing the photon at a clock synchronzed rate. Figure 1(b) shows the measured rates for obtaining n synchronized photons and the corresponding multiphoton contamination, for the multiplexed (MUX) and non-multiplexed (NMUX) cases. Multiplexing enhances synchronized photon rates by approximately 6, 29, and 180 for one-, two-, and three-photon events, respectively, with only slightly increasing multiphoton contamination by a factor of 1.5, demonstrating the favorable scaling of this approach.

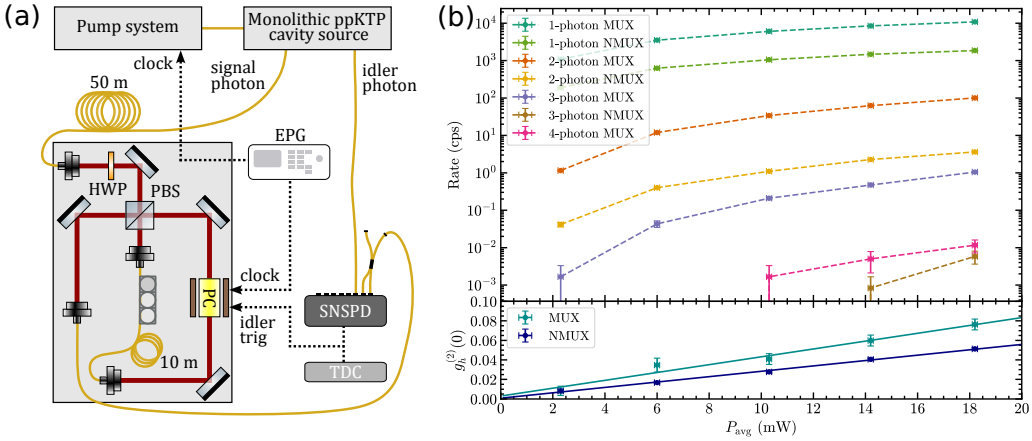

Fig. 1: *(a) Experimental setup. (b) Measured n-photon synchronized rates and g2.*

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References

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