Pseudo-Photon-Number-Resolving Heralding for Improved Single-Photon Character in a Type-II SPDC Source

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Highly anti-bunched heralded single photons are a key resource for quantum communication, photonic quantum computing, and quantum metrology [1]. Spontaneous parametric down-conversion (SPDC) is one of the most widely used methods for heralded single-photon generation; however, its intrinsically probabilistic nature leads to higher-order pair emission, especially at increased pump powers [2]. These multi-pair events degrade the single-photon character of the heralded output and limit source performance in practical applications. In this work, we present an enhanced heralded Hanbury Brown and Twiss (HBT) scheme aimed at suppressing multi-photon contamination in a type-II SPDC source [3]. A 405 nm pump laser and a type-II PPKTP crystal are used to generate degenerate photon pairs at 810 nm. Instead of employing a single detector in the heralding arm, we implement a pseudo-photon-number-resolving configuration using a 50:50 beam splitter and two single-photon avalanche diodes (SPADs) [4]. This arrangement enables partial discrimination of higher-order photon-number events in the herald channel: coincidence clicks between the two herald detectors are used to identify and veto likely multi-photon contributions. The method is expected to reduce the heralded second-order correlation function, $g_h^2(0)$, and improve the single-photon character of the source while remaining compatible with standard SPDC hardware. This approach provides a simple and experimentally accessible route toward improved heralded single-photon generation.

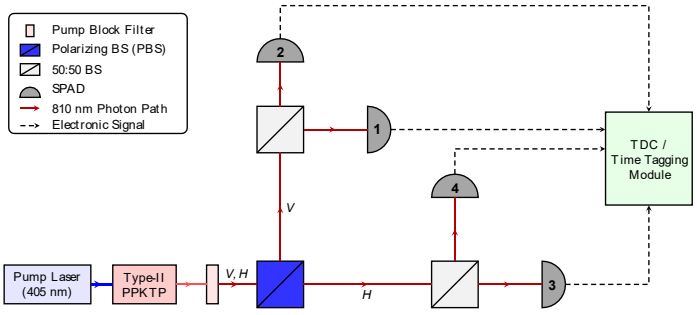

Fig. 1: *Heralded HBT setup scheme with pseudo-PNR via 50:50 BS on the heralding arm.*

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References

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