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## DELIVERABLE REPORT

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A novel 6-photon source for the generation of heralded entangled states has been developed. So far the best available source for photonic entanglement, parametric down-conversion, is a process in which the photons are created at random times. All photons involved in a protocol need to be measured, including detection of the desired output state, which impedes the scalability of optical quantum information processing. We recently overcame the probabilistic character of such sources by presenting the first heralded generation of polarization-entangled photon states with linear optics and standard photon detection from spontaneous parametric down-conversion [BCZ1-10]. This heralded source relied on the down-conversion emission of an entangled six-photon state, where the coincident detection of four auxiliary photons unambiguously heralds the preparation of the entangled output state. Achieved preparation efficiencies of 77% and measured fidelities of 84% are promising for using such kind of source for quantum information processing task.

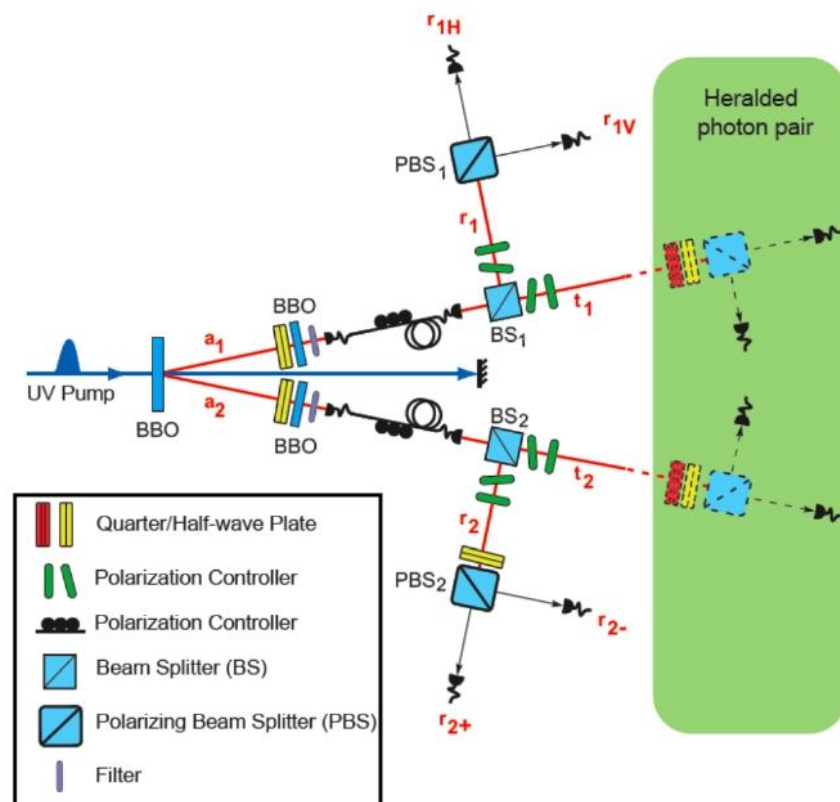


Figure: Schematic drawing of the six-photon setup where the six-photon emission is split at the beam splitters  $BS_1$  and  $BS_2$ . The successful detection event of four photons in the output modes of the polarizing beam splitters (PBS) heralds the emission of an entangled photon pair in the output modes  $t_1$  and  $t_2$ . A half-wave plate (HWP) is responsible for the quantum interference at  $PBS_2$ .

#### References:

[BCZ1-10] S. Barz, G. Cronenberg, A. Zeilinger, P. Walther, *Heralded generation of entangled photon pairs*, [Nature Photonics 4 553 \(2010\)](#).