

Characterization of spectrally filtered heralded single photons

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Abstract. One method to produce pure heralded single photons (HSP) is by modifying, by means of spectral filters, the joint spectrum of the photon pairs produced via spontaneous parametric down conversion (SPDC). In this work, we characterize the dependence of the spectral purity and heralding efficiency of the HSP. The values we report for purity and heralding efficiency are obtained from measurements of the joint spectrum under different filtering conditions [1]. Our results are in agreement with the theoretical model and complement similar measurements that have been done for heralded single photons produced by other type of sources.

Keywords: single photons, parametric down conversion, purity, heralding efficiency.

An interesting application of SPDC photon pairs is its use as a source of heralded single photons (HSP) [1-4]. When this is the case, one of the photons from a pair is detected to herald the presence of its twin which then is available to be used in different applications. The HSP quality can be characterized by means of its purity, both in the spatial and spectral variables, its heralding efficiency and the indistinguishability between the different HSP produced by the same source. In this work, we report values for the heralding efficiency and the spectral purity using a technique based on retrieving parameters from measurements of the joint spectrum under different filtering conditions [5-6].

Heralded single photons at 808 nm are generated in a bulk-type II SPDC crystal pumped by a CW laser. The joint spectrum is measured when different gaussian filters are placed in the paths of signal and idler photons. Figure 1 shows the values for the purity and the heralding efficiency obtained as a function of the spectral filter bandwidth [1]. The experimental results show that the spectral purity decreases while the heralding efficiency increases when the strength of the spectral filtering is weaker.

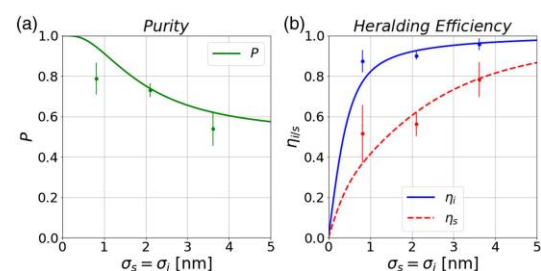


Figure 1 (a) Purity and (b) heralding efficiency as a function of the spectral filter bandwidth. The solid and dashed lines correspond to the theoretical model and the dots correspond to values obtained from experimental data

The experimental results reported agreed with the theoretical model and show a clear advantage in the heralding efficiency when heralding with the idler photon. All our results are based on a technique based on retrieving parameters from measurements of the joint spectrum of SPDC photons and therefore, we also reported the behaviour of the joint spectrum under different filtering conditions. Our results complement previous experiments adding to the efforts for finding an ideal single photon source that can be used as a resource for applications in quantum technologies.

<https://www.osapublishing.org/josab/abstract.cfm?uri=josab-37-4-1190>

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