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Coupled spatial and spectral properties of a spectrally broadband photon pair source in bulk PPLN (G)*

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While quantum properties of light promise much-needed enhancements to metrology, further development of quantum light sources are needed to readily harness energy-time correlations for applications in imaging and spectroscopy. Spectrally broadband photon pairs, generated from the process of spontaneous parametric down-conversion (SPDC), require tight energy-time anti-correlations in order to achieve appreciable quantum frequency conversion rates needed in many of these applications. Such photon pair sources with Type-0 (eee) wave interactions have been characterized for periodically poled potassium titanyl phosphate (PPKTP) but not for periodically poled lithium niobate (PPLN), a more nonlinear, or efficient, crystal. Here, we demonstrate an easier method of (indirectly) characterizing the "x-spectrum", or coupled spatial and spectral photon emission properties, in a simpler, single-shot method of SPDC spatial mode measurement. A high brightness photon pair source, operating at 532 nm ⟶ 1064 nm + 1064 nm, is characterized with this method using a ubiquitous silicon CCD beam profiling camera and spectral filters and compared with a theoretical model. Such a method and a model can allow for tailored control of spatial and spectral entangled photon pair properties and is adaptable to other photon pair source brightnesses and camera efficiencies. This can be especially useful in quantum optical experiment design.

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