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Bright Photon Pair Source with High Spectral and Spatial Purity[1] J. SCHAAKE, University of Tennessee, R. BENNINK, P. EVANS, W. GRICE, T. HUMBLE, Oak Ridge National Laboratory — We report the design and experimental characterization of a down-conversion source that has been optimized for high spectral and spatial purity. Spectral purity is achieved through the choices of the pump properties and phase-matching characteristics. Spatial entanglement is minimized via a collinear configuration in non-critically phase-matched periodically poled potassium titanyl phosphate. This geometry eliminates walk-off effects and maximizes the overlap of the pump, signal, and idler fields. With a properly focused pump, nearly all of the photons are emitted into a single spatial mode, thus yielding a single-mode emission rate of 123,000 pairs/s/mW. With its high brightness and spectral and spatial purity, this source is ideal for experiments requiring multiple pairs of identical photons, or for use as a heralded single-photon source. In addition to describing the methods for eliminating the spectral and spatial entanglement, we also show how the source can be configured to produce N-photon polarization-entangled states.

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