Hong-Ou-Mandel interference between heralded pulsed photon sources with PPKTP

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Abstract

We present a photon pairs source based on spontaneous parametric down-conversion in a 30 mm-long bulk periodically poled $KTiOPO_4$ (PPKTP) crystal pumped with a 390 nm pulsed laser. A narrow filter method is employed to increase the spectral purity of the photon pairs. We realized the spectral brightness high as 57000 pairs / (s mW nm) $^{-1}$, which is two orders of magnitude larger than in β-barium borate (BBO). Further, to show the multiphoton application, we demonstrate a Hong-Ou-Mandel interference (HOMI) between two heralded single photon sources and observed nonclassical visibility of 73.5% which is beyond the classical limit.

Motivation

- Seek candidate source for multiphoton application at 780nm
- BBO: 170 pairs/ (s mW nm)$^{-1}$, fs laser.
- PPKTP: Low cost for pump laser, high generation rate, ps laser.

Spectral purify

- Long crystal:
  high spectral brightness
- Spectral correlation(SPDC):
  needs to be eliminated
- Straightforward method: narrow bandpass filters
- Optimized parameter:
  Type II PPKTP, L = 30 mm, λ_p = 390 nm, $\Delta\lambda_p$ = 15pm, $\Delta\lambda_{\{i,s\}}$ = 30pm
- Tradeoff: 1/20 pairs left.

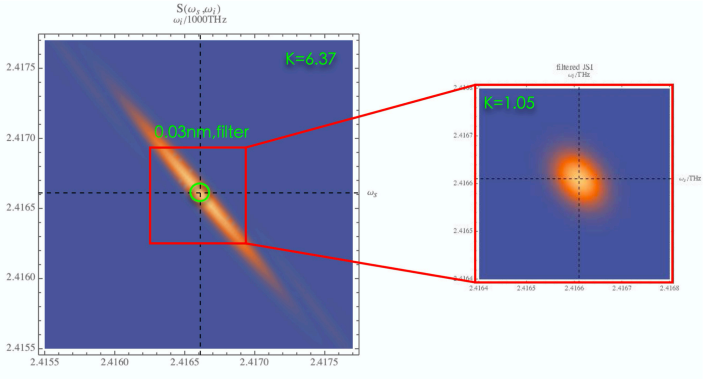

Fig.1 Spectral correlation elimination with Narrow filter

Experiment setup

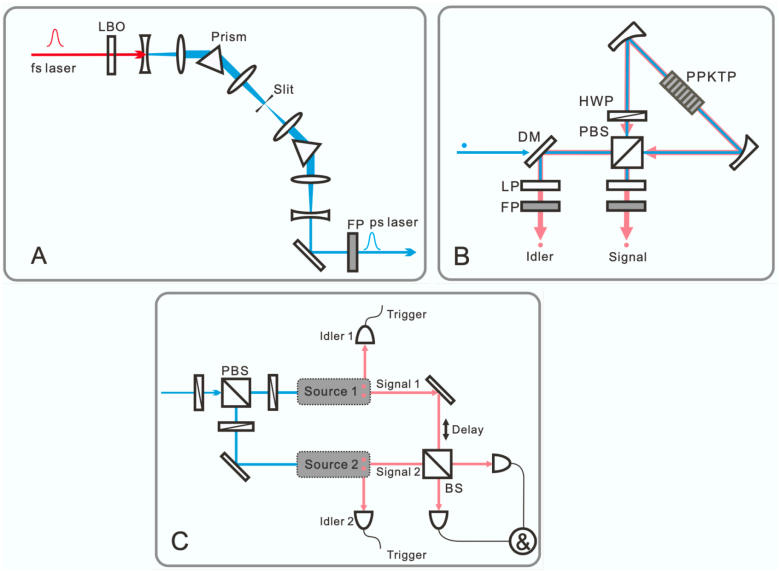

Fig.2 experimental configuration
(A), Picosecond pump laser, modified from a femtosecond laser.
(B) Sagnac-PPKTP photon pair source.
(C) HOMI between two heralded Sagnac-PPKTP sources.

Result

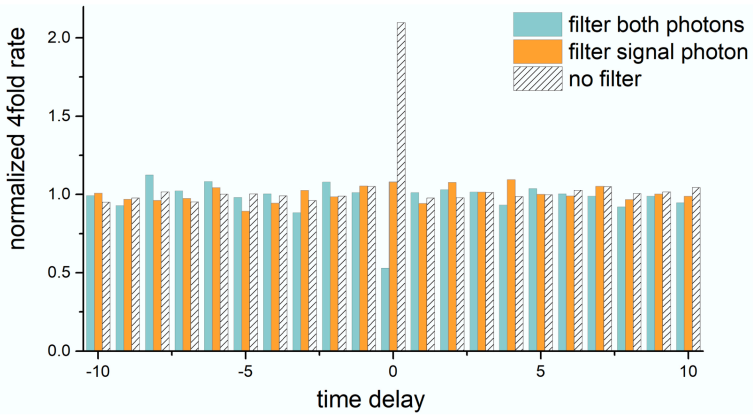

Fig.3 HOMI result