30a-D1-9

Quantum Interference Between Separated Photon Pairs at Telecommunication Wavelength

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We present a quantum interference with two spatially separated photon pairs. So far, the interference experiments at telecommunication wavelengths have been carried out using photon pairs generated via the spontaneous parametric down conversions (SPDCs) in two separately located periodically poled lithium niobate (PPLN) crystals (Type-0 phase matching) [1, 2]. In this work, using Type-II PPLN bulk crystals pumped by femtosecond optical pulses at 775 nm, paired photons at 1550 nm are emitted in the cross-polarization states |H>|V> (Fig.1). The use of 1.28-GHz sinusoidally gated InGaAs/InP APDs contributed significantly to the increase in the fourfold count rate [3, 4]. As a result, a Hong-Ou-Mandel dip [5] was successfully observed between photons from the independent photon sources. An interference visibility of 81.7% was obtained without subtracting accidental coincidences. The experiments lay a foundation for realizing a heralded indistinguishable single-photon source, a quantum relay in the 1550-nm band and for demonstrating polarization-based entanglement swapping.

This work is partially supported by the Grant-in-Aid for Scientific Research of Ministry of Education, Culture, Sports, Science and Technology, Japan (MEXT).

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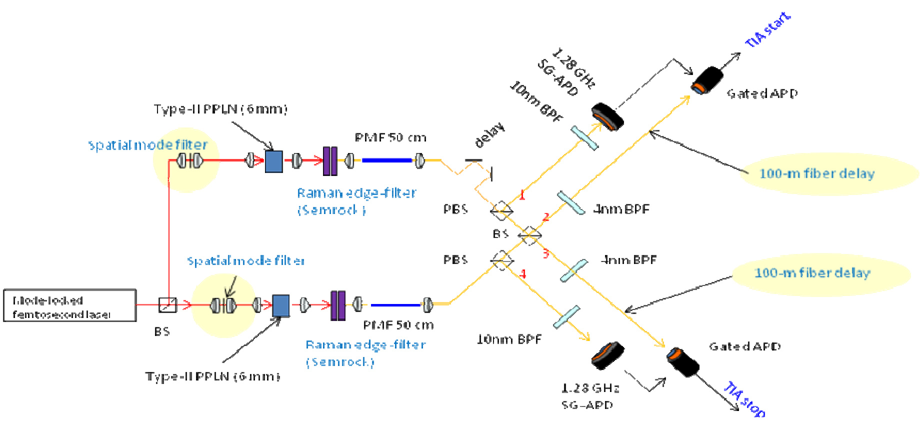

Fig. 1. Experimental setup. BS beam splitter; PPLN: periodically poled lithium niobate waveguide; PMF: polarization maintaining fiber; PBS: polarization beam-splitter; BPF: band-pass filter; SG-APD: sine-wave gating avalanche photodiode.