Near-Infrared and Telecommunication-Wavelength Photon-Pair Source in Optical Fiber

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We present a high-rate photon-pair source based on spontaneous four-wave mixing (SFWM) in commercially available telecommunication polarization-maintaining optical fiber (PMF). We utilize a cross-polarized SFWM scheme [1] and the high birefringence of the PMF [2] to produce highly nondegenerate photon pairs, with one photon in the 1500 nm E- and S-band telecommunication range and the other in the 830 nm NIR range. The high nondegeneracy allows the photon pairs to be far-detuned from Raman noise, resulting in a high coincidence-to-accidental ratio even with room temperature operation, while also allowing compatibility with hybrid free-space and in-fiber quantum networks. Additionally, due to the PMF supporting multiple spatial modes for the pump light and NIR photons, the source produces two spectrally and spatially distinct phase-matched processes with low spectral cross-talk and distinct transverse spatial modes in the NIR, while maintaining a single fundamental spatial mode in the telecommunication range compatible with existing commercially deployed single-mode fiber**.** The source's room-temperature operation, off-the-shelf materials, operating wavelengths, and multiplexing potential make it promising for deployment in quantum networks for free-space and in-fiber photon distribution at high rates.

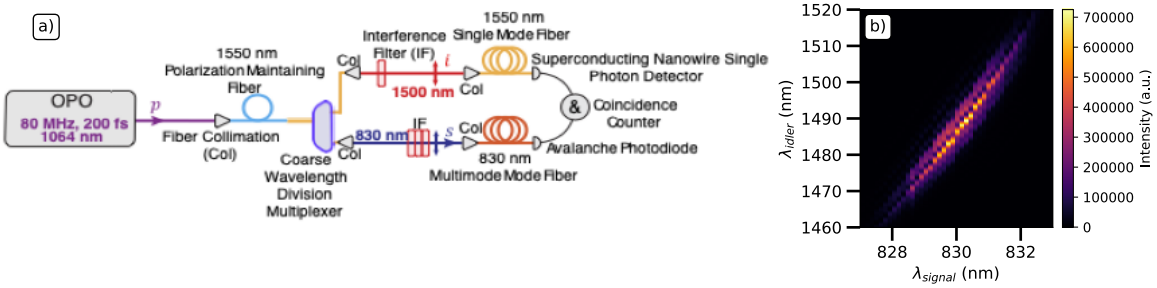

Fig. 1: *(a) Experimental setup for generating and characterizing photon pairs created via SFWM. A 1550 nm PANDA PMF is pumped with 1064 nm light to generate photon pairs which are separated using a coarse wavelength division multiplexer and subsequently spectrally filtered in free space before detection. (b) Joint spectral intensity of the photon pairs from the fundamental spatial mode process via stimulated four-wave mixing in the PMF using a tunable seed laser.*

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