

Joint spectral distribution of a periodically poled KTP source for quantum information applications*

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We present our experimental results obtained from a periodically poled KTP (pp-KTP) crystal designed to produce a pure squeezed vacuum near 1550 nm. A pure squeezed vacuum in a single mode is one of the building blocks towards high fidelity optical cat state generation via photon subtraction. Measurement of the joint spectral distribution allows determining the mode output of the squeezing source. The experimental scheme for determining the joint spectral output is presented in Figure 1a. The type-II two-mode squeezing output is sent to a polarizing beam splitter and both modes are coupled into two optical fibers. We time-multiplex the two photon modes using a 35 m long piece of SMF28. A 1.3 km piece of SMF28 is then used as a dispersive medium. Due to dispersion of the optical fiber, the photons' time-of-arrival depends on their wavelength, and hence accurate timing of the arrival determines the photons' wavelength.

We found that the beam geometry inside the pp-KTP strongly determines the shape of our joint spectral output of the squeezing source. A smaller pump waist generally leads to a less circular joint spectral distribution. The roundness of the joint spectral distribution generated with a pump waist of 30 μm is presented in Figure 1b. The data show that the two photon wave functions are factorable and useful for unfiltered pure squeezing. These promising results indicate pure squeezing that can be used for the production of high fidelity optical cat states.

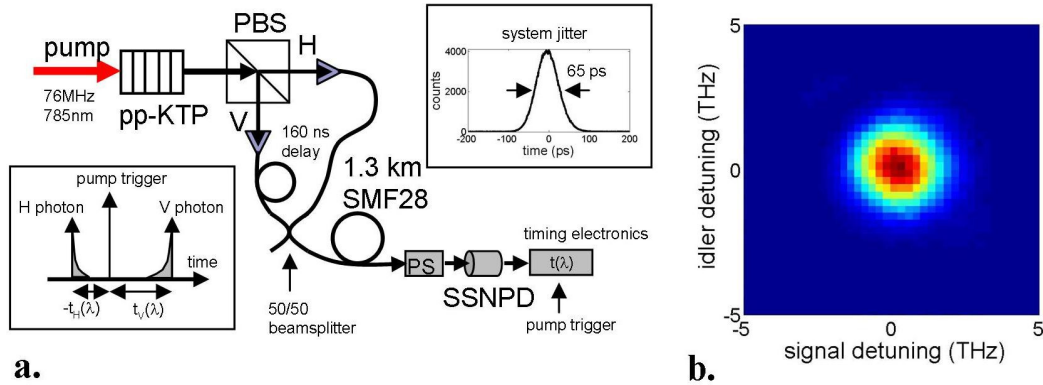


Fig. 1. a. Experimental setup scheme for the measurement of the joint spectral distribution of a periodically poled pp-KTP crystal. b. Measured joint spectral distribution of the periodically poled KTP source