18p-C2-11

Control of two-photon production rates in a pulse: toward construction of ultra-bright photon sources

NICT [1], UEC[2], Sophia University[3], SIMIT-CAS[4]

° Rui-Bo Jin[1], Ryosuke Shimizu[2], Isao Morohashi[1], KentaroWakui[1], Masahiro Takeoka[1], Shuro Izumi[1,3], Takahide Sakamoto[1], Mikio Fujiwara[1], Taro Yamashita[1], Shigehito Miki[1], Hirotaka Terai[1], Zhen Wang[1,4], and Masahide Sasaki[1]

E-mail: ruibo@nict.go.jp

Ultra-bright photon sources play an important role in quantum information. The conventional photon source technique involves a ~ 80 MHz Ti Sapphire laser, a BBO crystal and Si avalanche photo detectors. However, this technique has several limitations, in terms of the brightness, multi-pair emission and speed. For the development of next generation of single photon sources, higher repetition-rate laser, more efficient crystal and faster detectors are required.

In this experiment, we demonstrated a photon source pumped by a 10/2.5 GHz repetition-rate tunable comb laser [1]. This photon source can achieve high count rates and low multi-photon emissions at high pump powers. The photons were generated from a group-velocity-matched PPKTP (GVM-PPKTP) crystal, which provided a high spectral purity [2, 3, 4]. Furthermore, the photons were detected with the state-of-the-art highly efficient superconducting nanowire single photon detectors (SNSPD) [5, 6].

From the signal to noise ratio (SNR) test and Hong-Ou-Mandel interference test, we concluded that the two-photon source pumped by a 2.5 GHz laser had a high SNR value and can maintain high visibilities at high pump powers, much higher than that pumped by the 76 MHz laser. We also constructed a theoretical model to analyze the experiment results. The theoretical analysis agreed well with the experimental data. We believe the combination of GHz laser, GVM-PPKTP crystal and SNSPD paves the road for the next generation of two-photon source with high-qualities, such as, high brightness, low multi-pair emission, high spectral purity, and high detection efficiency.

Reference：

[1] Takahide Sakamoto, *et al*, Opt. Lett., **33** 890-892 (2008)

[2] Rui-Bo Jin, *et al*, Opt. Express, **21** 10659-10666 (2013)

[3] Rui-Bo Jin, *et al*, Phys. Rev. A, **87** 063801 (2013)

[4] Rui-Bo Jin, *et al*, Opt. Express, **22** 11498-11507(2014)

[5] Shigehito Miki, *et al*, Opt. Express, **21** 10208-10214 (2013)

[6] Taro Yamashita, *et al*, Opt. Express, **21** 27177-27184 (2013)