17a-D10-3

Broadband Polarization Entangled Photon Pair Generation in Type-II Parametric Down-Conversion

Nandan S. Bisht and Ryosuke Shimizu

Center for Frontier Science and Engineering, University of Electro-Communications, Tokyo Japan

E-mail: sa001074@edu.cc.uec.ac.jp, bisht.nandan@gmail.com

Entangled photon pair sources play essential role for many quantum information experiments, such as quantum teleportation, entanglement swapping, quantum computing, quantum key distribution (QKD) and tests of bell inequalities [1]. QKD is most practical application in quantum communication using entangled photon pair [2]. Spontaneous parametric down-conversion (SPDC) has been widely used to generate photon-pair [1]. This is a second order nonlinear process in which a high energy photon splits in two photons under the constraints of phase matching conditions, i.e., energy and momentum conservations. There are mainly two type of phase matching conditions, type-I in this process both daughter photons having same polarization on the other hand in type-II daughter photons having orthogonal polarization.

To distribute the quantum key among the multiple users, the bandwidth of entangled photon pair is a key parameter. Traditionally broadband photons were generated in SPDC process using thin crystals but the brightness of the source is low and high brightness source has also been demonstrated using type-0 SPDC [3]. The collinear type-II SPDC is convenient source of polarization entanglement without state preparation and can be deterministically separated in their polarization mode but suffers from the generation of broadband photons. Recently fiber based type-II broadband photon pair source has been demonstrated which is more suitable for practical applications but it has limitations as low brightness and stimulated Raman scattering as a noise [4].

We are demonstrating a broadband polarization entangled photon pair by exploring the weak birefringence property of the PPMgSLT crystal [4]. We could able to generate 30 nm bandwidth of entangled photon pair in telecom band which is measured with spectrum analyzer. The source is characterized by two photon interference [1]. These photons will be distributed through the wavelength division multiplexer (WDM) network and characterize for each correlated pair using polarization correlation measurement, i.e., quantum state tomography [1]. The current experimental progress will be presented.

References:

[1] J-W Pan, *et al*., Rev. Mod. Phys. 84, 777 (2012).

[2] N. Gisin, *et al*., Rev. Mod. Phys., 74, 145 (2002).

[3] H C Lim, *et al*., Optics Express 16, 22099 (2008).

[3] E. Y. Zhu, *et al*., Phys. Rev. Letts. 108, 213902 (2012).

[4] R. Shimizu, *et al*., Optics Express 19, 16385 (2009).