Entangle polarization of whole photon pairs generated in beam shape and in doughnuts shape

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After the development of optical fiber communications, light have been used as one of the most useful media for information transfer. Especially, utilizing entangled photon pair, security of the communication can be theoretically guaranteed by quantum theory. In typical scheme, the polarization entangled photon pair can be generated from the cross-section of the light cones of spontaneous parametric down conversion photon pair. Thus, the pairs generated outside of the cross-section cannot be used for application, which suppress the information transfer rate.

I will talk about several methods which we have demonstrated to entangle whole photon pairs generated by the non-linear crystal. Two methods used photon pairs generated in beam shape, in which the second method is easier than the first method. The other third method has used photon pairs generated in doughnuts shape which requires the simplest alignment among the three methods. My talk will also contain preliminary demonstration experiment results for the quantum key distribution.