

Quantum communication with shaped single photons

Chih-Sung Chuu

Department of Physics, National Tsing Hua University, Hsinchu 30013, Taiwan

Quantum key distribution (QKD) promises an absolutely secure communication based on the principles of quantum mechanics. However, the probabilistic nature of the bit measurements and the random choices of the measurement basis usually lead to low key creation efficiency (KCE). Differential-phase-shift (DPS) QKD, which encodes the bit information in the phase difference between two sequential pulses of a single photons, offers the possibility to achieve 100% KCE at large number of pulses. Here we demonstrate the DPS QKD with 89% KCE in a field test using shaped single photons. The 1550-nm single photons, generated by the monolithic doubly resonant parametric down-conversion with high spectral brightness and long coherence time, are modulated into a sequence of pulses with controlled phase differences. The double-exponential shape of the unmodulated single photons results in a higher KCE compared to the square-pulse shape, with a negligible effect on the quantum bit error rate.