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Free-Space Quantum Key Distribution using Polarization Entangled Photons[1]

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We report on a complete experimental implementation of a quantum key distribution protocol through a free space link using polarization-entangled photon pairs from a compact parametric down-conversion source [1]. Based on a BB84-equivalent protocol, we generated without interruption over 10 hours a secret key free-space optical link distance of 1.5 km with a rate up to 950 bits per second after error correction and privacy amplification. Our system is based on two time stamp units and relies on no specific hardware channel for coincidence identification besides an IP link. For that, initial clock synchronization with an accuracy of better than 2 ns is achieved, based on a conventional NTP protocol and a tiered cross correlation of time tags on both sides. Time tags are used to servo a local clock, allowing a streamed measurement on correctly identified photon pairs. Contrary to the majority of quantum key distribution systems, this approach does not require a trusted large-bandwidth random number generator, but integrates that into the physical key generation process. We discuss our current progress of implementing a key distribution via an atmospherical link during daylight conditions, and possible attack scenarios on a physical timing information side channel to a entanglement-based key distribution system.

[1] I. Marcikic, A. Lamas-Linares, C. Kurtsiefer, Appl. Phys. Lett. 89, 101122 (2006).

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