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High Data Rate Quantum Cryptography PAUL KWIAT, BRADLEY CHRISTENSEN, KEVIN MCCUSKER, DANIEL KUMOR, University of Illinois, DANIEL GAUTHIER, Duke University — While quantum key distribution (QKD) systems are now commercially available, the data rate is a limiting factor for some desired applications (e.g., secure video transmission). Most QKD systems receive at most a single random bit per detection event, causing the data rate to be limited by the saturation of the single-photon detectors. Recent experiments have begun to explore using larger degree of freedoms, i.e., temporal or spatial qubits, to optimize the data rate. Here, we continue this exploration using entanglement in multiple degrees of freedom. That is, we use simultaneous temporal and polarization entanglement to reach up to 8.3 bits of randomness per coincident detection. Due to current technology, we are unable to fully secure the temporal degree of freedom against all possible future attacks; however, by assuming a technologically-limited eavesdropper, we are able to obtain 23.4 MB/s secure key rate across an optical table, after error reconciliation and privacy amplification. In this talk, we will describe our high-rate QKD experiment, with a short discussion on our work towards extending this system to ship-to-ship and ship-to-shore communication, aiming to secure the temporal degree of freedom and to implement a 30-km free-space link over a marine environment.

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