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Quantum Communication with a Twist: QKD using Orbital Angular Momentum Photons[1] WARNER MILLER, AYMAN SWEITI, Florida Atlantic University — We briefly outline our progress in developing a programmable-optics QKD system that utilizes the orbital angular momentum (OAM) eigenstates of photons. A photon can be prepared in a state that exhibits both its polarization as well as OAM. A single photon with polarization can communicate one bit of information. However a single photon from an appropriate set of axial eigenstates (OAM or "twisted photon") can, in principle, transmit many bits. While there is no improvement in bandwidth over conventional spin-based QKD devises, the use of an OAM eigenmodes in an n-state QKD system can substantially reduce the system's optical fidelity requirements. We outline the relative strengths and weaknesses in using OAM states verses polarization states regarding the (1) state preparation, (2) state propagation and (3) state detection. An essential element of any QKD system is the generation, propagation and sorting of mutually unbiased (MUB) quantum states. We demonstrate here the diffractive optics generation of MUB states built from the superpositions in an n-dimensional Hilbert space of OAM photons. In particular, we show the generation of a MUB state utilizing a liquid crystal spatial light modulator.

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