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Tamper-indicating Quantum Optical Sensing TRAVIS HUMBLE, DUNCAN EARL, WARREN GRICE, Oak Ridge National Laboratory — Monitoring systems based on fiber-optic seals actively monitor inventories of closed containers for tampering. However, the physics underlying these tamper-indicating optical systems make them susceptible to deception. The basis for this deception lies in the description of the electromagnetic field transmitted through the fiber. Within classical physics, knowledge of the light source, e.g., carrier frequency and pseudorandom modulation, can be used by an intruder to replicate the transmission. Once a replicated field is injected into the fiber, the downstream detector cannot discriminate it from the original transmission. Motivated by this context, we demonstrate a quantum optical, tamper-indicating device inherently immune to replication. We use time-bin entanglement (TBE) distributed through a pair of fibers, where each fiber couples to a Mach-Zehnder interferometer (MZI) detector. We monitor coincident detection as a function of the combined MZI phase $\phi = \phi_1 + \phi_2$ to statistically quantify entanglement in terms of TBE visibility. The presence or absence of the expected interference consequently serves as a test for tampering, and we quantity the probability of detection and false alarm using this statistic. We anticipate this form of quantum-based sensing to support future intrusion detection technologies.

Travis Humble
Oak Ridge National Laboratory

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