High-Fidelity Down-Conversion Source for Secure Communications Using On-Demand Single Photons

Novel device provides down-conversion pairs with enhanced spectral properties

AdvR, Inc., has built an efficient, fully integrated, waveguide-based source of spectrally uncorrelated photon pairs that will accelerate research and development (R&D) in the emerging field of quantum information science. Key to the innovation is the use of submicron periodically poled waveguides to produce counter propagating photon pairs, which is enabled by AdvR's patented segmented microelectrode poling technique. This novel device will provide a high brightness source of down-conversion pairs with enhanced spectral properties and low attenuation, and it will operate in the visible to the midinfrared spectral region. A waveguide-based source of spectrally and spatially pure heralded photons will contribute to a wide range of NASA's advanced technology development efforts, including on-demand single photon sources for high-rate spaced-based secure communications.

Applications

NASA

- High-rate space-based secure communications
- Quantum metrology for precision space-based navigation
- Space-based entanglement tests of quantum and gravitational theories
- Characterization, optimization, and calibration of photon-starved detectors

Commercial

- R&D in quantum communications and computations
- Characterization and optimization of detectors used for low light level discovery
- Optical Schrödinger-cat states
- Teleportation-based quantum repeaters for quantum key distribution over unlimited distance

Phase II Objectives

- Design and fabricate potassium titanyl phosphate waveguides, optimized for quantum-phase matching, counter-propagating down-conversion pairs
- Demonstrate that macroscopic spectral properties of the individual waveguides can be matched between waveguides
- Establish the purity and separability of the down-converted photons

Benefits

- Provides a high brightness source of down-conversion photon pairs
- Accelerates R&D in the field of quantum information science

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