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Quantum Nonlinear Interferometry for Occultation Satellite Remote Sensing[1] FELIX JAETAE SEO, JIA SU, QUINTON RICE, DULITHA JAYAKODIGE, WILLIAM MOORE, PAT MCCORMICK, BAGHER TABIBI, Hampton University, HAMPTON UNIVERSITY TEAM — Quantum nonlinear interferometry is of great interest for quantum information and sensing applications. The quantum measurement of atmospheric gases is proposed with the principle of the nonlocal correlation of signal and idler beams by spontaneous parametric down conversion (SPDC). If the phase and amplitude of idler in the mid-infrared from a nonlinear crystal in the transmitter satellite at geosynchronous equatorial orbit (GEO) are nonlocally correlated to those of its own signal, and if the phase difference between two idlers of nonlinear crystals in the transmitter (GEO) and receiver (LEO or GEO) satellites forms a constructive interference, the measurement of signal interference between visible photons from two nonlinear crystals provides the information of interaction between idler photon and atmospheric gases. The transmittance reduction of idler due to atmospheric gas absorption results in the interference amplitude reduction, which is nonlocally correlated to the interference amplitude of signal beams. If the nonlocal interference visibility of signal beams indicates the normalized difference of outer and inner envelopes, the absorption coefficients and the concentration of atmospheric gases can be analyzed through the quantum nonlinear interferometry. Therefore, the nonlocal and nonlinear quantum interferometry is proposed to develop satellite remote sensing with shallow and deep occultation techniques, and promote the laser interferometer space antenna for gravitational wave measurement.

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