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Satellite-based quantum communications[1]

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Single-photon quantum communications offers the attractive feature of "future proof" security rooted in the laws of quantum physics for the transfer of cryptographic keys. Secure distribution of keys is necessary for the encryption and authentication of conventional communications. Ground-based quantum communications experiments in optical fiber have attained transmission ranges in excess of 200km, but for larger distances to become feasible we proposed a methodology that would make satellite-to-ground quantum communications possible. Satellite feasibility studies have been published by research groups in the US, Europe, Japan and China, and collaborations in several countries have published conceptual experimental plans. In this talk we will review the main features required for low-earth orbit satellite-toground quantum communications, and describe the results of ground-based quantum communications experiments across atmospheric paths conducted by our team over the past decade. Using these results as an anchor, we will describe a link model, incorporating photon transmission, loss and background physical processes, for estimating satellite-to-ground quantum communications performance. We will show results from this model for the projected performance of a hypothetical quantum communications terminal on the International Space Station, with a hypothetical ground terminal in Los Alamos, NM.

[1]In collaboration with Jane Nordholt, Los Alamos National Laboratory.