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A Fine Pointing System Suitable for Quantum Communications on a Satellite

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In order to perform quantum key distribution (QKD) to a moving satellite, a fine pointing system is needed to ensure the collection of as many photons as possible. Since QKD only relies on the number of detected photons, any lost signal will not reduce security but will decrease the amount of key generated. A dedicated fine pointing system would help reduce the amount of photons that are lost within the satellite after collection by the primary optics.

We have designed a novel fine pointing apparatus, along with the Institute national d'optique and Neptec Design Group, to assist photon coupling into multimode fibres after the photons undergo polarisation analysis on a QKD receiver. This system keeps in mind weight and volume restrictions imposed by future space applications. It also mitigates polarisation error through the design of custom mirror coatings. Pointing accuracy of the APT is sufficient to allow QKD to be performed even with angular disturbances to the receiver telescope and fluctuations of the laser beacon.

This presentation will outline the APT design concept, summarize the fine pointing performance of the unit as demonstrated through various laboratory tests, and discuss plans to use the device to perform outdoor QKD trials with receivers aboard trucks, boats or aircraft.

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