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Dear Editor,

please find enclosed a manuscript on "Distributing Polarization Entangled Photon Pairs with High Rate over Long Distance through Standard Telecommunication Fiber".

This work demonstrates the distribution of entanglement over a significant distance of 50km in standard optical fibers as they are widely deployed in current metropolitan areas. The physical challenge we managed to overcome in this demonstration was to prepare photon pairs at a very high brightness and narrow bandwidth around 1300nm for one of the photons, and around 600nm for the other photon. This has a few clear advantages for long distance entanglement distribution: First, we can use the zero dispersion spectral window in most deployed optical fibers around 1300nm, and we can use relatively simple single photon detectors, namely InGaAs and Si avalanche photodetectors, a major advantage in terms of infrastructure overhead compared with superconducting photodetectors. We manage to maintain a high degree of polarization entanglement (over 97% visibility of polarization correlations) even after 50km of optical fiber.

Such an approach will be very useful for carrying out any entanglement-related implementations of either quantum key distribution, or for more advanced quantum communication tasks that require entanglement over long distances. One of the practical advantages of our approach is also that we transmit over the largely dark O band of telecom fiber, while conventional traffic mostly is carried in the C band around 1500nm.

To the best of our knowledge, the brightness of the source we present exceeds earlier demonstrations by an order of magnitude. We do believe that this is an important step forward to simplify distribution of entanglement over metropolitan distances, and hope that the wide readership of nature photonics would be interested in this work. We posted a preprint of this work (https://arxiv.org/abs/2204.10571), and received already a number of positive reactions on this outcome which we included in this submitted manuscript, but we have no related manuscripts submitted or under consideration elsewhere.

Possible referees for this work could be Fabian Steinlechner, IOF/University of Jena, Germany, Prem Kumar, Northwestern University, Wolfgang Tittel, QuTech/TU Delft, and Geoff Pryde, Griffith University.

We look forward for your reply.

With Best Regards on behalf of all authors,

Christian Kurtsiefer