

Abstract Submitted
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Transmission of photonic Bell states over a 2x32dB, 144km free-space link¹ ALESSANDRO FEDRIZZI, R. URSIN, T. HERBST, M. NESPOLI, R. PREVEDEL, T. SCHEIDL, F. TIEFENBACHER, T. JENNEWAIN, IQOQI, Austrian Academy of Sciences, ANTON ZEILINGER, IQOQI; Faculty of Physics, University of Vienna — We successfully transmitted both photons of various Bell states over a 144 km free-space link between the islands of Tenerife and La Palma. Creating and transmitting more than 6×10^6 highly entangled photon pairs/s over the 2×32 dB channel we received 0.07 pairs/s at the receiver. We were able to distinguish between $|\psi^-\rangle$ and $|\psi^+\rangle$ states and verified the presence of entanglement by violating a CHSH Bell inequality to $S = 2.61 \pm 0.11$, 5 standard deviations above the classical limit of 2. Using a small and compact photon source, we effectively emulate quantum communication in a loss regime comparable to a two-link satellite communication scenario. Furthermore, we convincingly demonstrate the feasibility of 2-photon quantum communication protocols like dense coding, teleportation or quantum cryptography without reference frame over long distance. Finally, with a flight time of 0.5 ms the transmitted Bell states are the longest lived photonic Bell states ever reported.

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