Figure 1: **Quantum teleportation between the Canary Islands La Palma and Tenerife over both quantum and classical 143-km free-space channels.**

From

Quantum teleportation over 143 kilometres using active feed-forward

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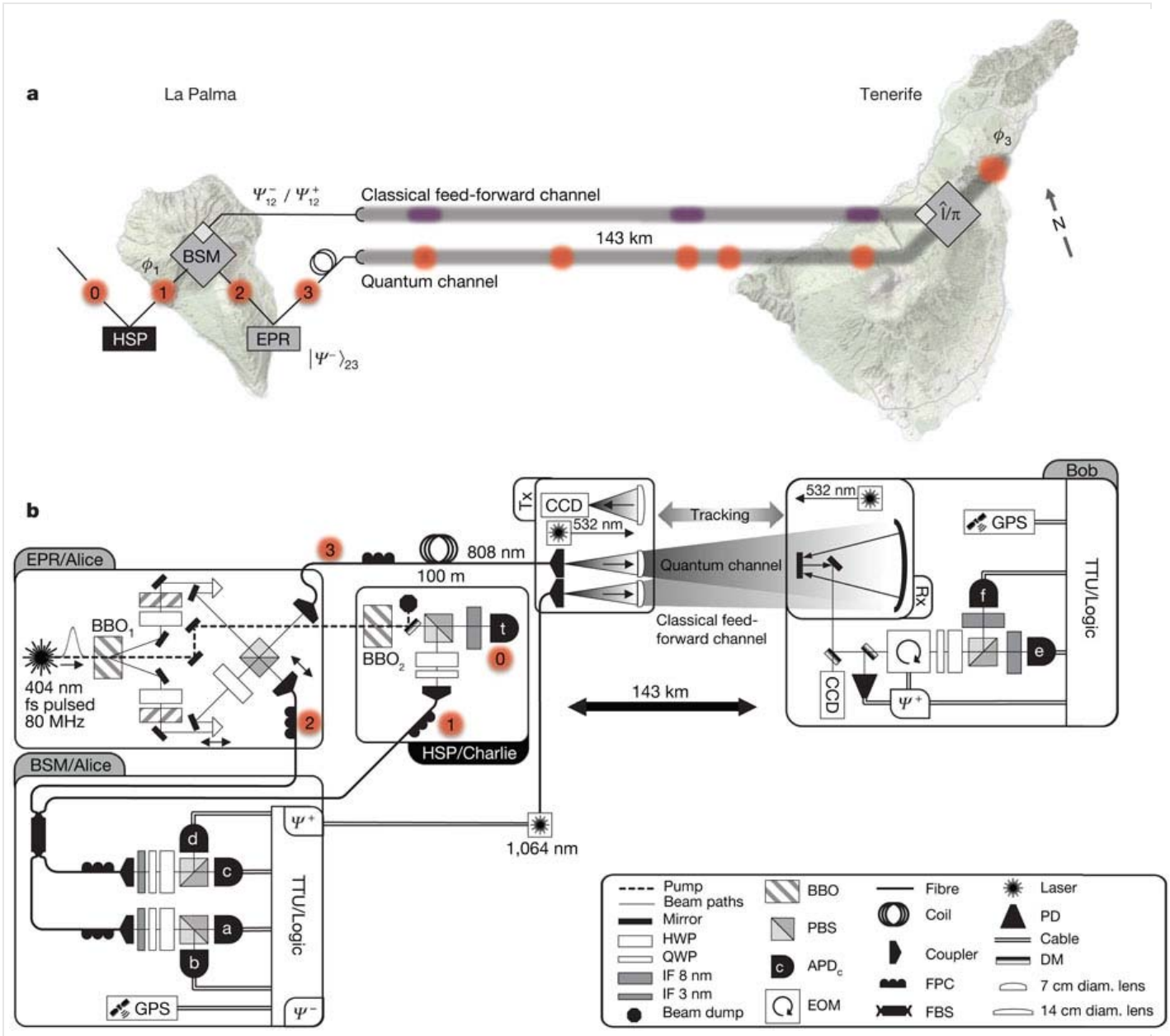
Nature **489**, 269–273 (13 September 2012) doi:10.1038/nature11472



a, Experimental scheme. Alice and Charlie are situated in La Palma, and Bob in Tenerife. Charlie prepares the teleportation input photon 1 in $|\varphi\rangle_1$, using a heralded single-photon (HSP) source with a trigger photon 0 (photons are indicated by black numerals on red circles). An Einstein–Podolsky–Rosen (EPR)[23] source generates an entangled pair of photons 2 and 3 in the state $|\Psi^-\rangle_{23}$. Alice then performs a Bell-state measurement (BSM) on photons 1 and 2, and projects them onto two of the four Bell states ($|\Psi^-\rangle_{12}/|\Psi^+\rangle_{12}$), and sends the result via the classical feed-forward channel to Bob. Photon 3 is sent via the free-space quantum channel to Bob, who applies a unitary transformation (identity operation or π phase shift) on photon 3 depending on the BSM result and thus turns its state $|\varphi\rangle_3$ into a replica of the initial quantum state $|\varphi\rangle_1$. **b**, Set-up. In La Palma, a frequency-uncorrelated polarization-entangled photon pair source generated photons 2 and 3 in BBO_1 (EPR/Alice) and a collinear photon pair source generated photons 0 and 1 in BBO_2 (HSP/Charlie). All single photons were coupled into single-mode fibres. For implementing the BSM, photons 1 and 2 interfered in a fibre beam splitter (FBS) followed by polarization-resolving single-photon detection (BSM/Alice). Photon 3 was guided to the transmitter telescope via a 100-m single-mode fibre and sent to Bob in Tenerife, where the unitary transformation was implemented using an electro-optical modulator (EOM) and photon 3's polarization was measured. A real-time feed-

forward operation was implemented by encoding the $|\Psi^+\rangle_{12}$ BSM result in 1,064-nm laser pulses, which were then sent to Bob via the feed-forward channel. On Bob's side, they were separated by a dichroic mirror (DM), detected with a photodetector (PD) and used to trigger the EOM to perform the required π phase shift operation. See main text for details.

Nature ISSN 0028-0836 EISSN 1476-4687

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