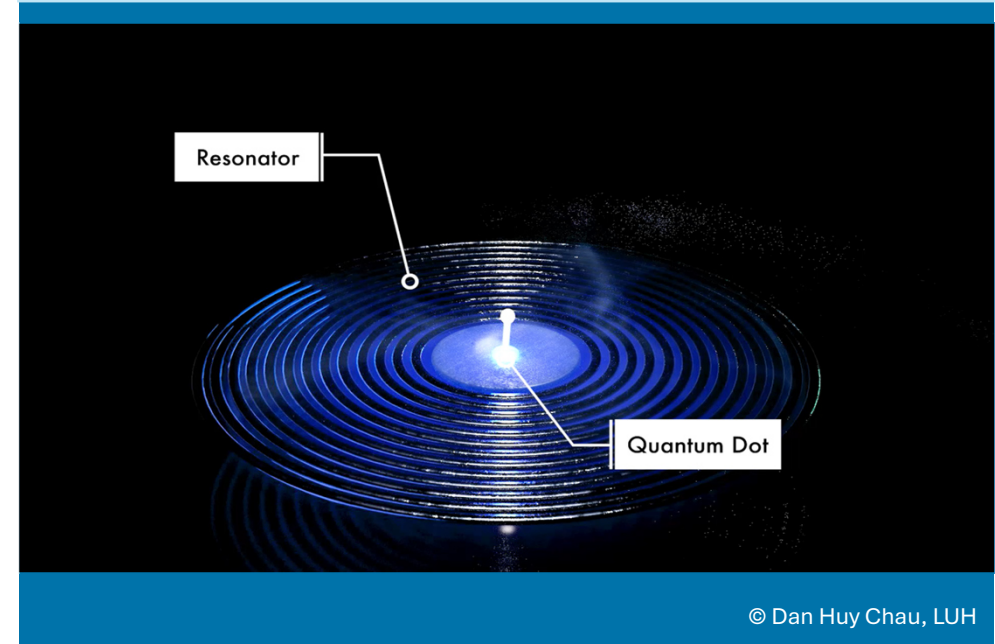


Overview

Quantum communication exploits the transmission of information encoded by single quanta or via the quantum mechanical effects superposition, interference, and entanglement. In addition to secure message transmission, quantum communication will include future capabilities for the distribution of entangled states in the areas of communication, sensor technology and computing and is therefore the basis for long-term developments in quantum technology as a whole.

However, current applications of quantum communication are limited, mainly due to the degradation of quantum information during transmission via fiber optics or satellite. Advancing the underlying metrology for quantum communication is crucial to paving the way for robust and certified commercial quantum communication systems. The Optics Division at PTB is involved in a number of projects and initiatives at the national and European level to promote improved metrology for quantum communication.

Illustrative Video



[Click for metrology details](#)

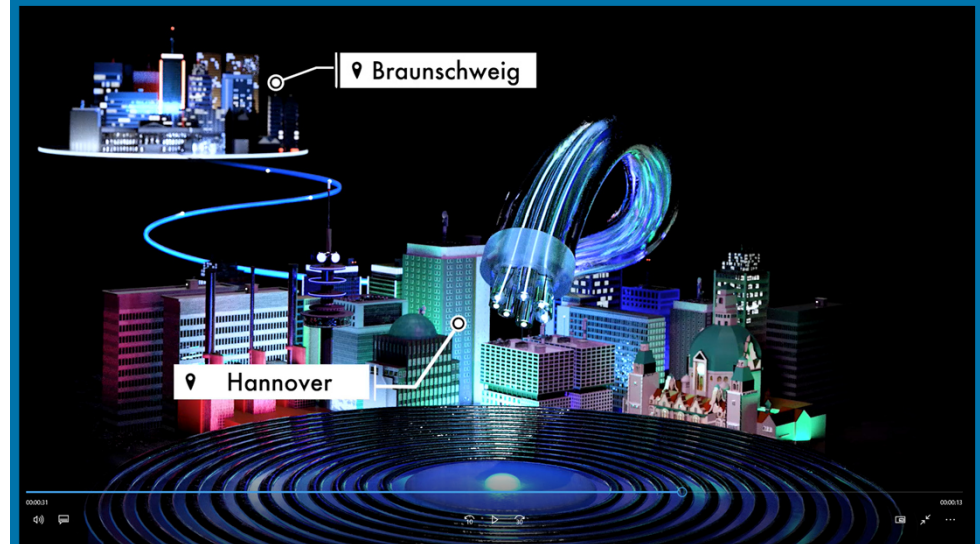
[Click for goals](#)

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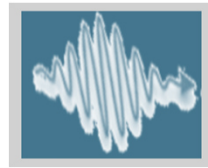
Illustrative Video



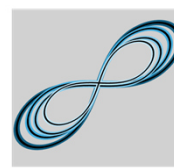
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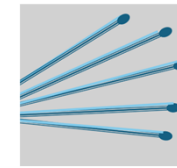
Detectors:
traceable absolute detection efficiency with a measurement uncertainty of $< 1\%$, dead time and polarization dependence



Single and pair photon sources:
photon flux, photon statistics, wavelength, bandwidth, polarization characteristics and temporal stability



Entangled Photon Sources:
quantum tomography, fidelity



Transmission line:
noise due to changes in temperature, polarization, vibrations, cross-talk, and Raman scattering,

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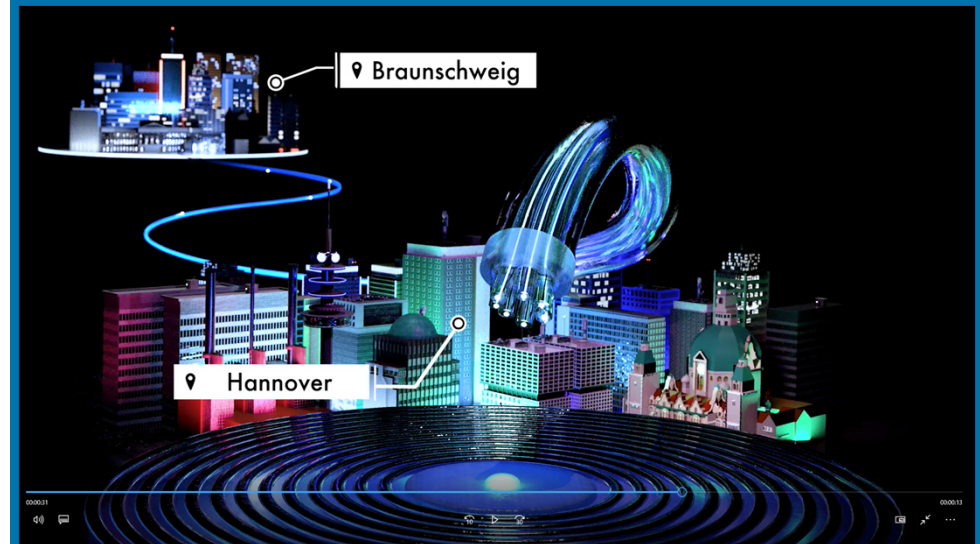
System:
traceable measurements of Quantum Bit Error Rate (QBER) and sifted key rate

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Illustrative Video



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Goal 1

Realize and improve real-world implementation of quantum communication

Goal 2

Develop approaches for future standards and protocols of quantum networks

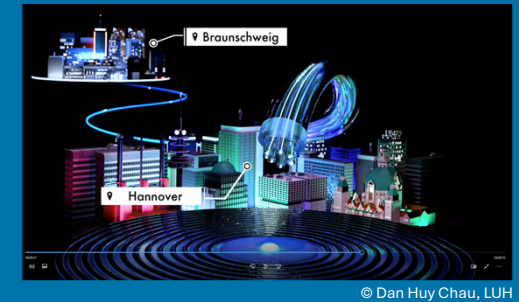
Goal 3

Provide consultation for technology transfer, certification, and network infrastructure

Overview

Quantum communication exploits the transmission of information encoded by single quanta or via the quantum mechanical effects superposition, interference, and entanglement....
The Optics Division at PTB is involved in a number of projects and initiatives at the national and European level to promote improved metrology for quantum communication.

Illustrative Video

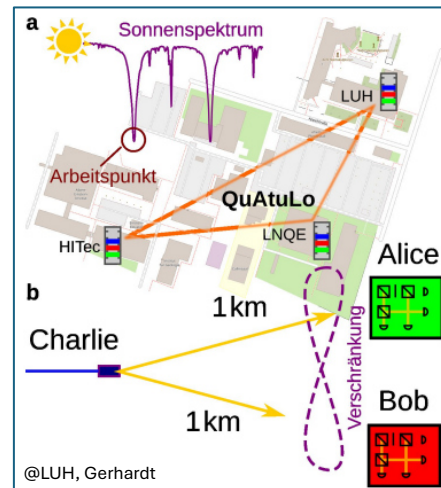


Goal 1

Realize and improve real-world implementation of quantum communication

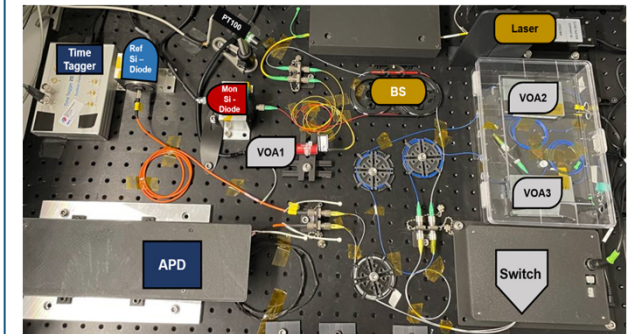
[Click for Goal 2](#)

[Click for Goal 3](#)



QuaTulo (Open-source atom-based quantum local networking):
Implementation of a free-space QKD network with multiple stations, utilizing entangled single photon pairs at 589 nm

Detector Calibration for QKD in Daylight

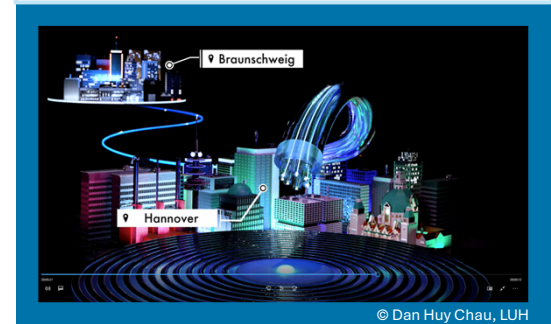


All-fiber set-up: to calibrate detectors developed to be sensitive to ADHV polarization with the purpose to realize BB84 in a free space network in daylight. The scale of optical radiant power is reduced to the power range of quantum communication via several intermediate steps using suitable semiconductor detectors, calibrated attenuators and linearity measurements on the semiconductor detectors.

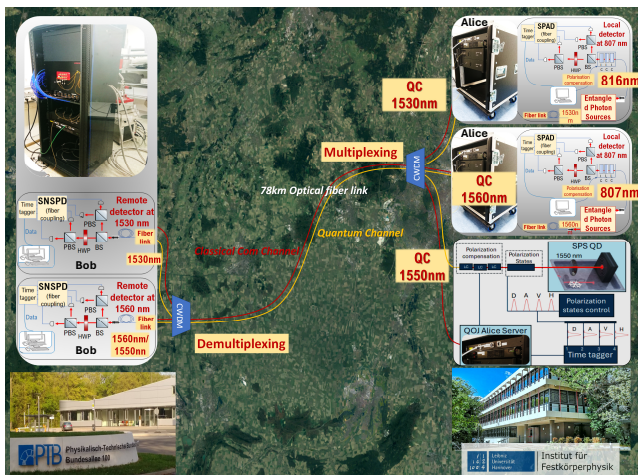
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Illustrative Video



Multiplexing of QKD signals



Set-up of the QKD signals multiplexing at PTB-LUH link (1560 nm, 1550nm and 1530 nm): allows for the operation of multiple systems on a single optical fiber, using wideband course wavelength division multiplexing (CWDM).

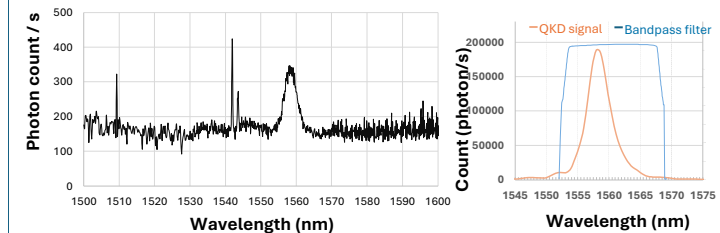
Goal 2

Develop approaches for future standards and protocols of quantum networks

Click for Goal 1

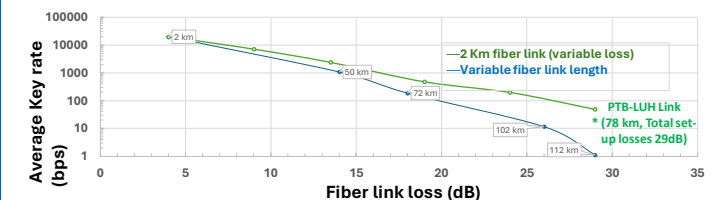
Click for Goal 3

PTB-LUH Quantum link noise and QKD system performance



Measurement of the signal propagating on the dark fiber (quantum channel): Dark noise is detected on the fiber link., Photons couple from signals in adjacent optical fibers

Filtering of the dark noise on the fiber link with band pass filter.



Quantum key rate vs link attenuation and length loss (Lab test and PTB-LUH link) of the 1560nm entanglement based QKD system.

