PiQ

Photon sources for integrated quantum processors

We analyse the improvement potentials of the photon source of DLR OS and the photonic quantum processor of QuiX Quantum in order to further improve their respective technologies and thus expand technological advantages. In this way, we are making an important contribution to the development of core technologies for the realisation of the first scalable, integrated optical quantum computer in Germany and Europe.

The Used Photon Source

Our photon source is the most advanced quantum light source operating at room temperature and producing narrowband photons. The pairs are generated by cavity-enhanced Spontaneous Parametric Downconversion (SPDC) in monolithic periodically poled potassium titanyl phosphate (ppKTP) resonators. Our unique design delivers exceptional performance in terms of efficiency and robustness, making it a key tool for the most demanding quantum research.

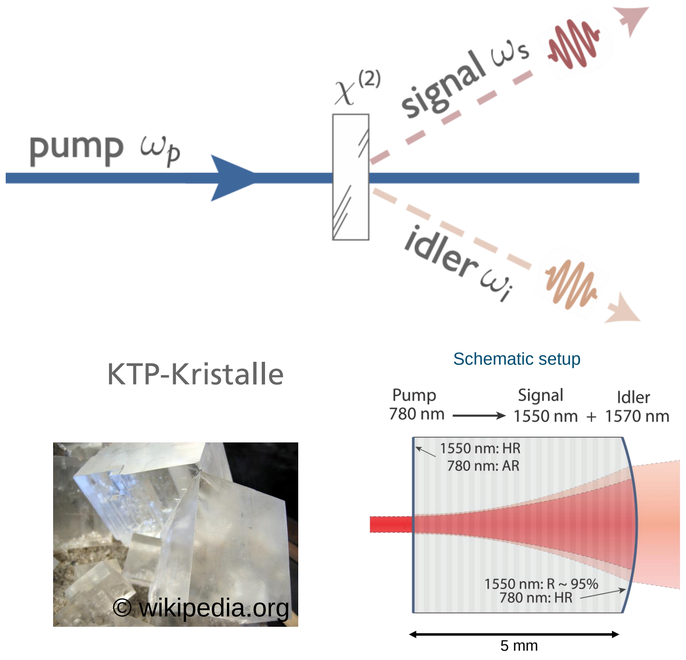
Key Properties

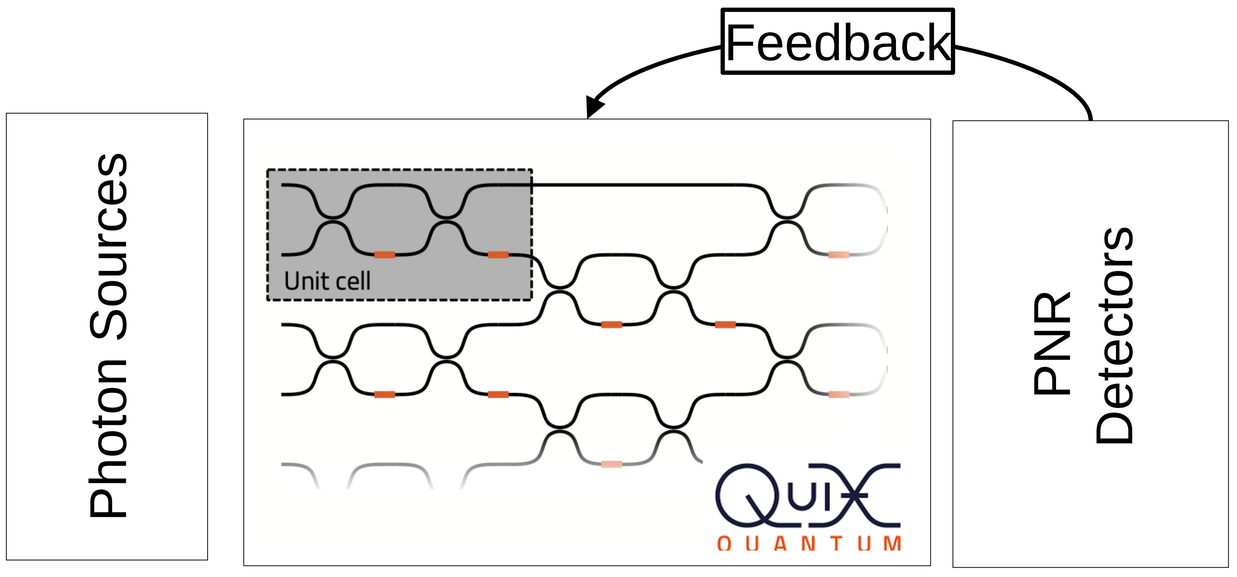
- Heralded photons in telecom c-band
- 100 MHz photon bandwidth
- Tuning range exceeds 10 GHz
- Heralding efficiency up to 85 %
- Room temperature operation
- PM fiber-coupled
- Robust continuous operation
- Flexible external pump laser source

These properties make the sources ideal for research in the fields of photon pairs, quantum memory, quantum communication, quantum metrology, quantum informatics, light-matter interaction

QCI PiQ tests the photonic quantum processor from QuiX Quantum

Operating principle of the photon sources used in PiQ: In a non-linear crystal, high-energy photons from a laser are converted into photon pairs of low energy.





Functional principle and key components of a photonic quantum computer.

Advantages of photonic quantum computers

- Photons are largely decoherence-free
- Photons can be transported over long distances
- Photonic technologies are well developed in Germany

Challenges for photonic quantum computers

- Photons do not interact with each other
- Photons can be lost unintentionally
- Ideal sources for photonic quantum states do not yet exist

Transfer

The commercialisation of our photon sources is currently being driven forward by the OS spin-off AQLS UG (haftungsbeschränkt).

AQLS Advanced Quantum Light Sources

Unique features
- Spectrally narrow
- Widely tunable
- Ultra efficient

Key Publications

- F. Wiesener et al., arXiv:2406.18257 (2024)
- G. Buser, et al., *PRX Quantum* **3**, 02049 (2022)
- R. Mottola, et al., *Optics Express* **28**, 3159 (2020)

More information about the project can be found on our website.

A Project of

DLR Institut für Optische Sensorsysteme

Partnering

AQLS Advanced Quantum Light Sources

QUIX QUANTUM

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Get in touch.
We enable quantum!

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