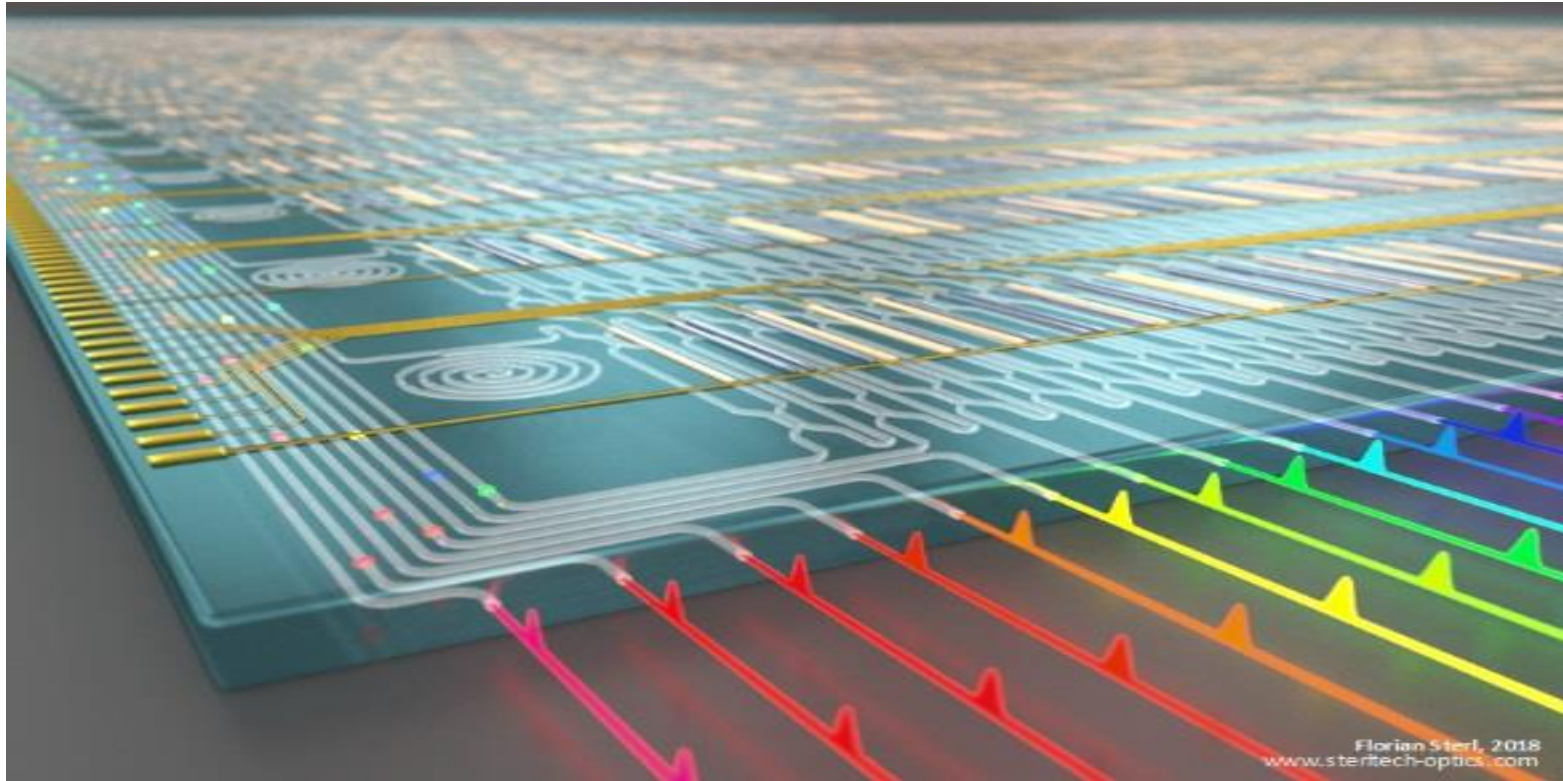


QuiX B.V.



Dr. J.J.Renema
j.j.renema@quix.nl

QuiX BV



Mission statement: deliver quantum technology solutions based on silicon nitride photonic integrated circuits

Spin-off of University of Twente (Jan 2019). Focused on development and commercialization of Quantum Technology solutions based on silicon nitride PICs.

QuiX BV



Mission statement: deliver quantum technology solutions based on silicon nitride photonic integrated circuits

Started Jan 2019

Management: JR & Hans van den Vlekkert

Shareholders: academic photonics community in Twente + UT + Raph2Invest

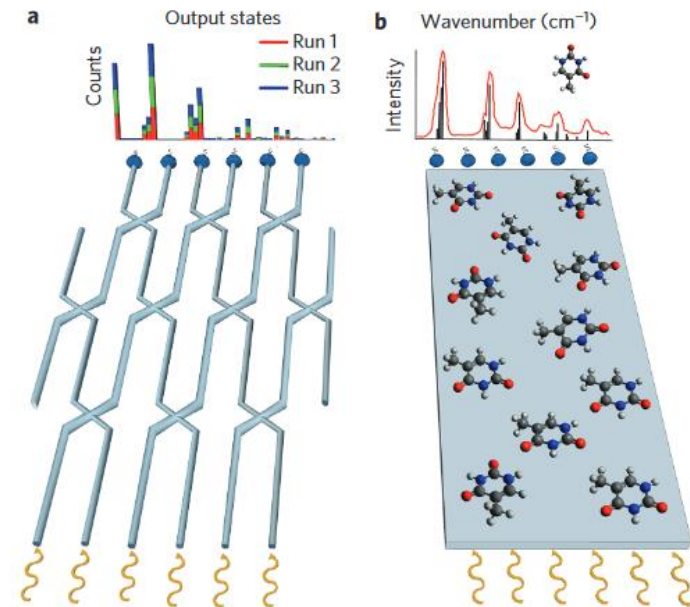


Photonic quantum technology

- Non-universal quantum computing
- Main applications:
 - machine learning
 - quantum simulation
- Advantages:
 - No cryo
 - High integration with photonic technologies

Boson sampling for molecular vibronic spectra

Joonsuk Huh*, Gian Giacomo Guerreschi, Borja Peropadre, Jarrod R. McClean
and Alán Aspuru-Guzik*

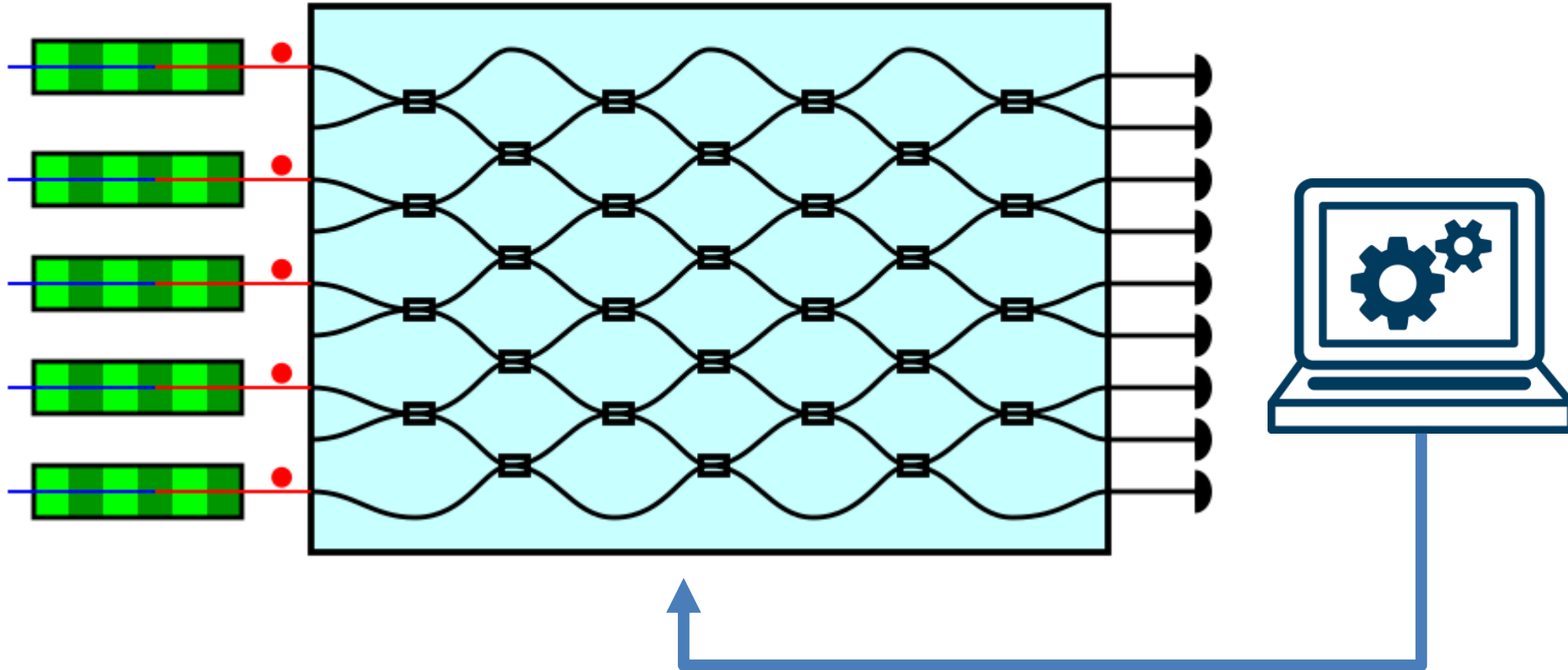


Principle

Sources

Interferometer

Detectors

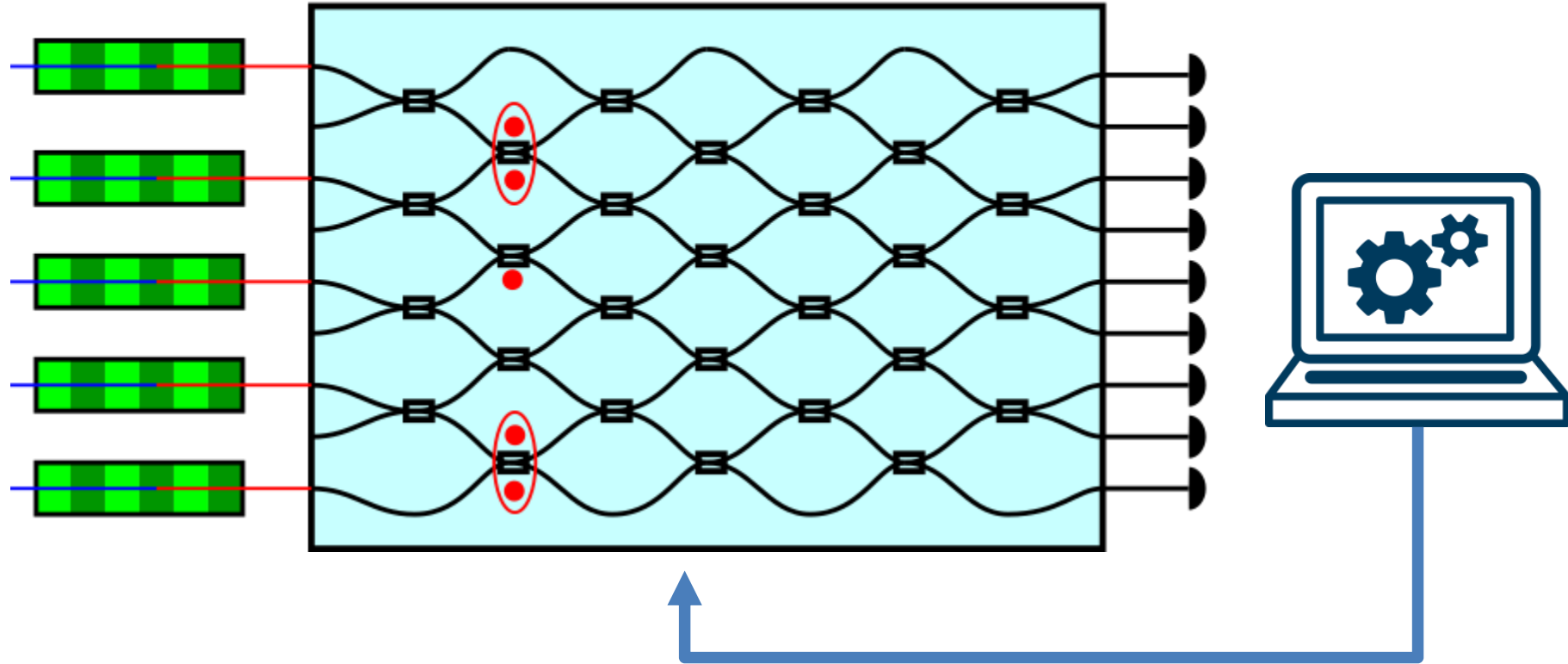


Principle

Sources

Interferometer

Detectors

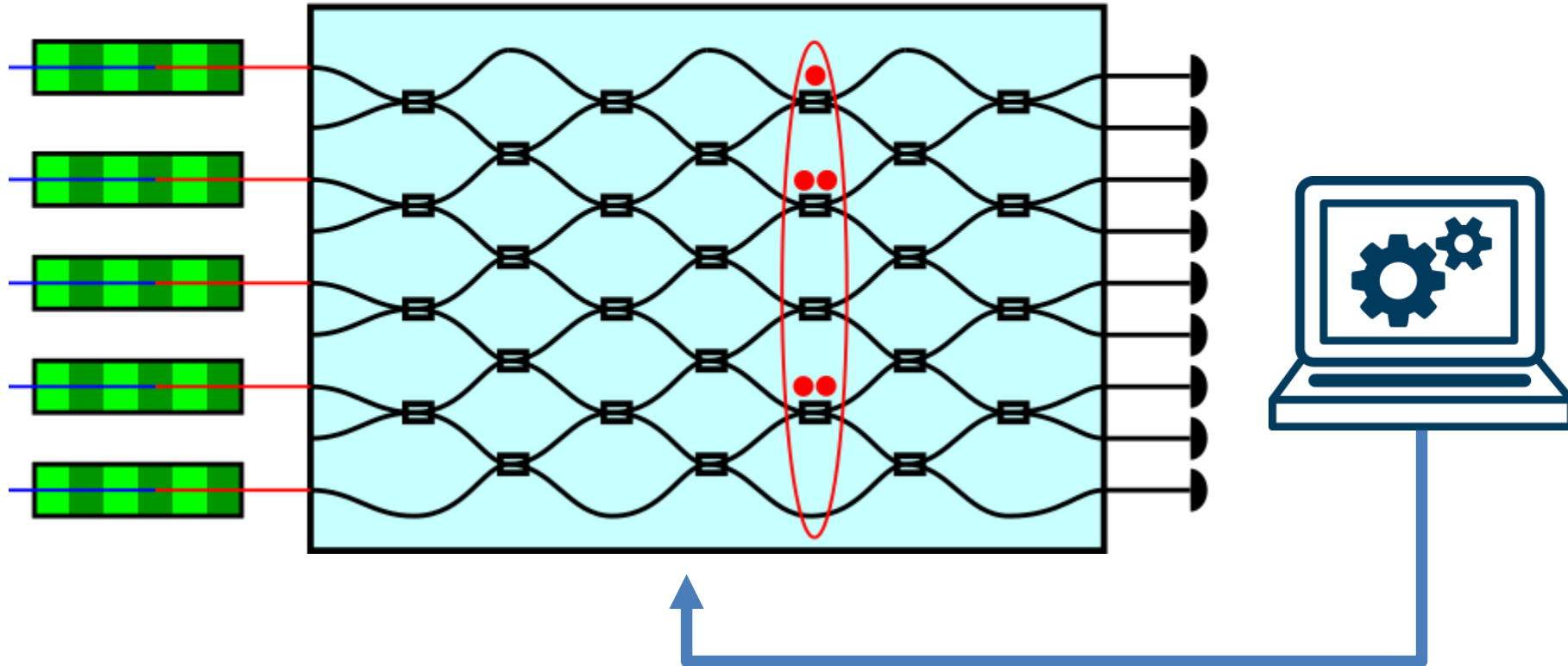


Principle

Sources

Interferometer

Detectors

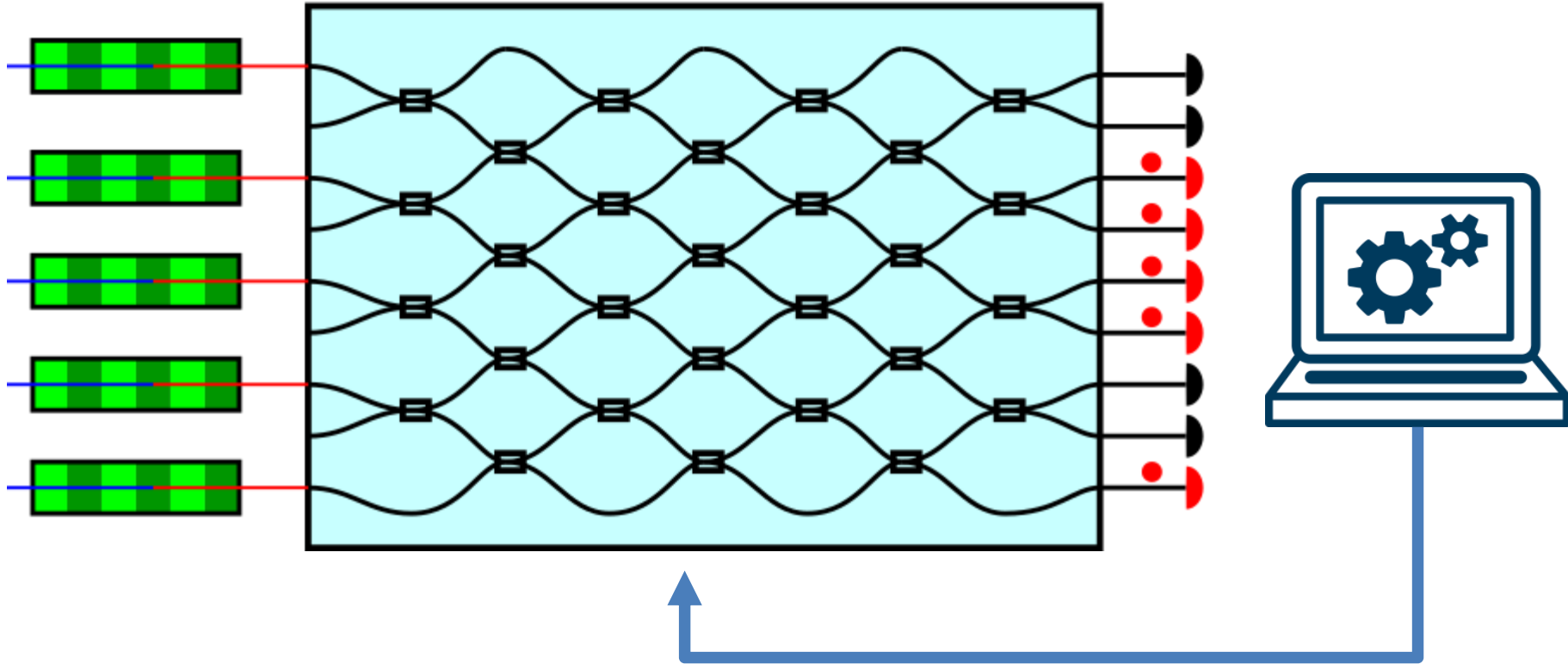


Principle

Sources

Interferometer

Detectors

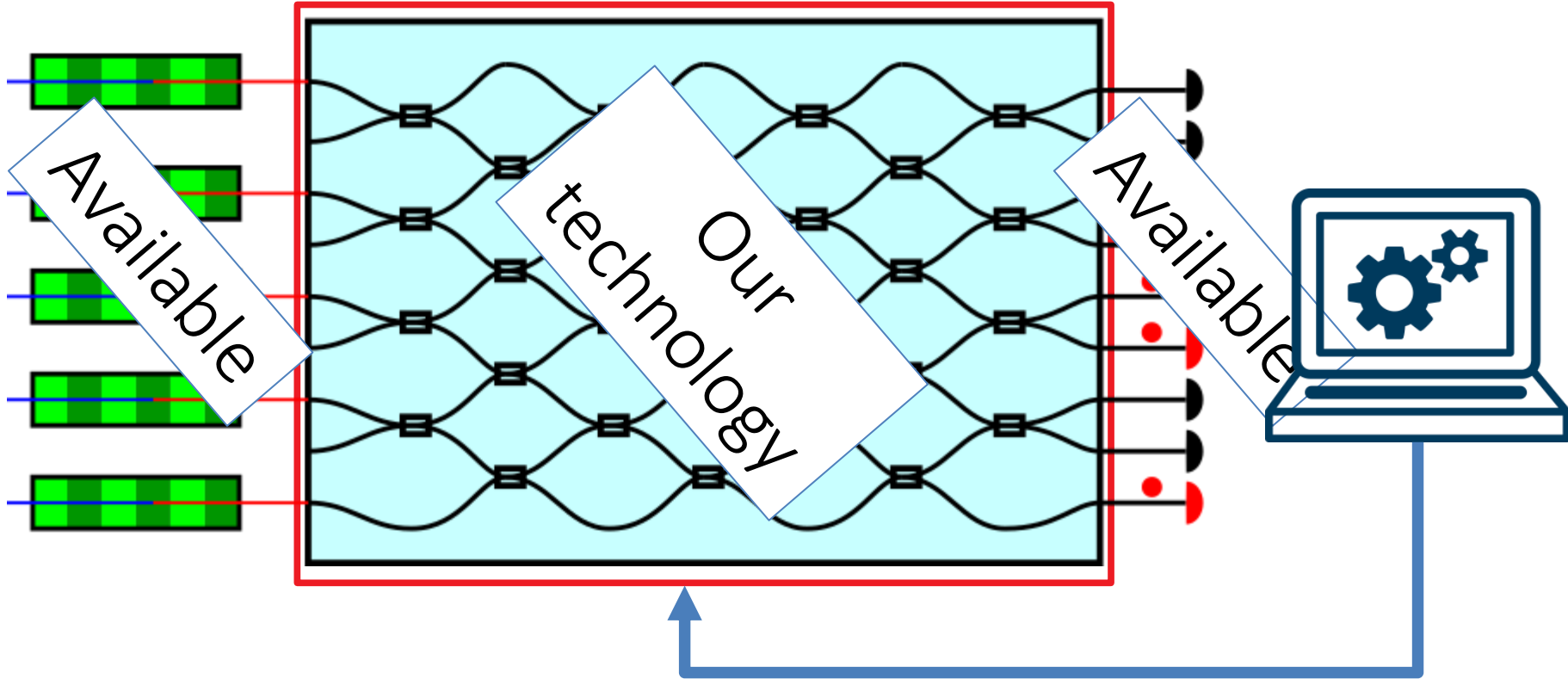


Principle

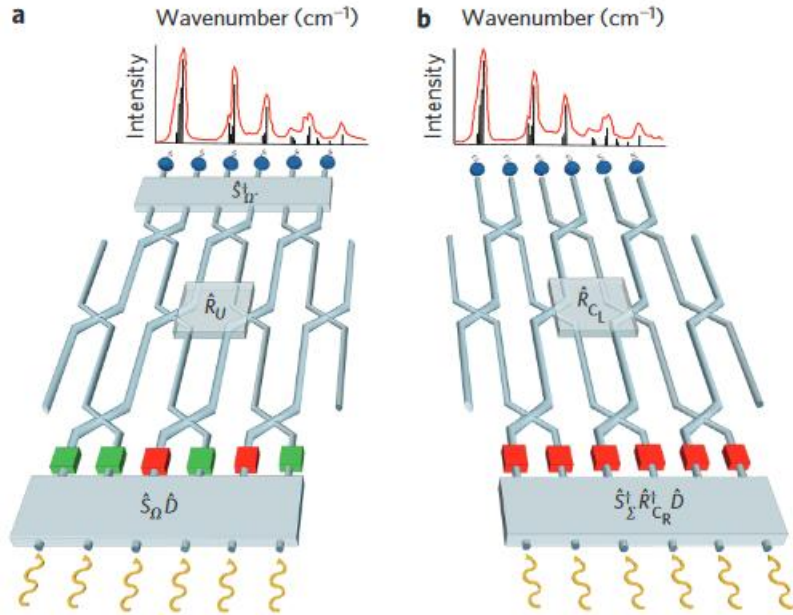
Sources

Interferometer

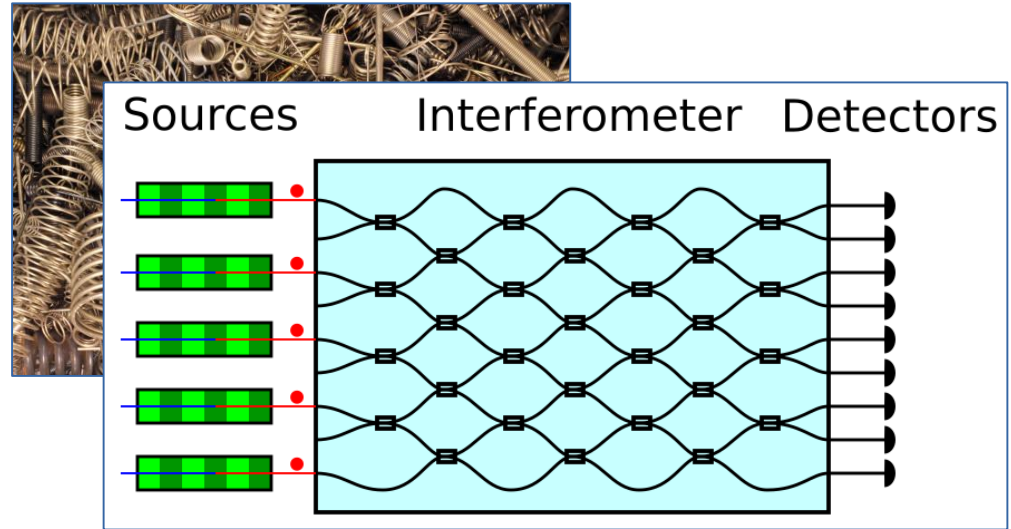
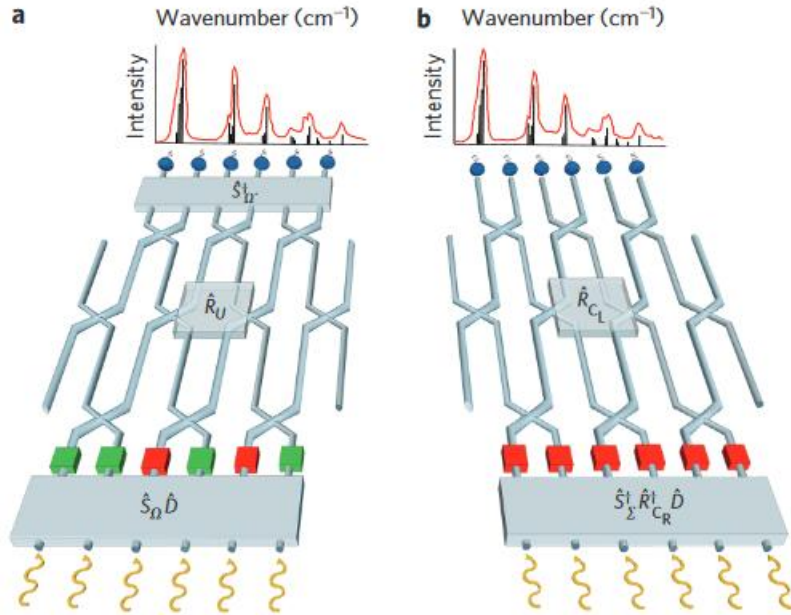
Detectors



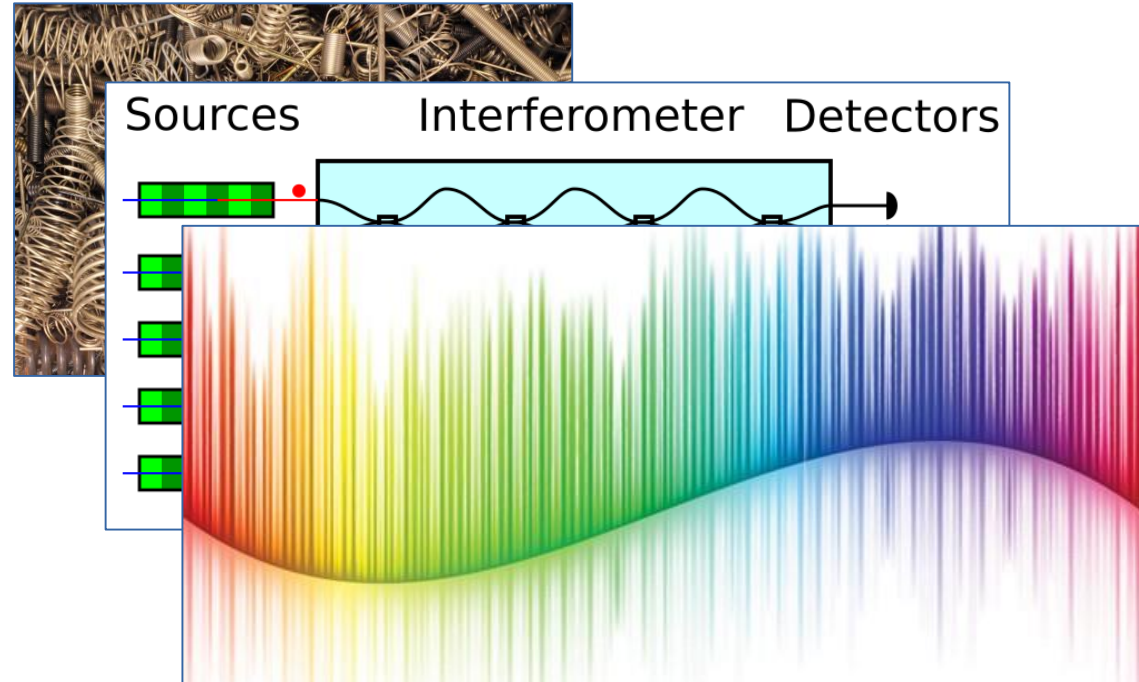
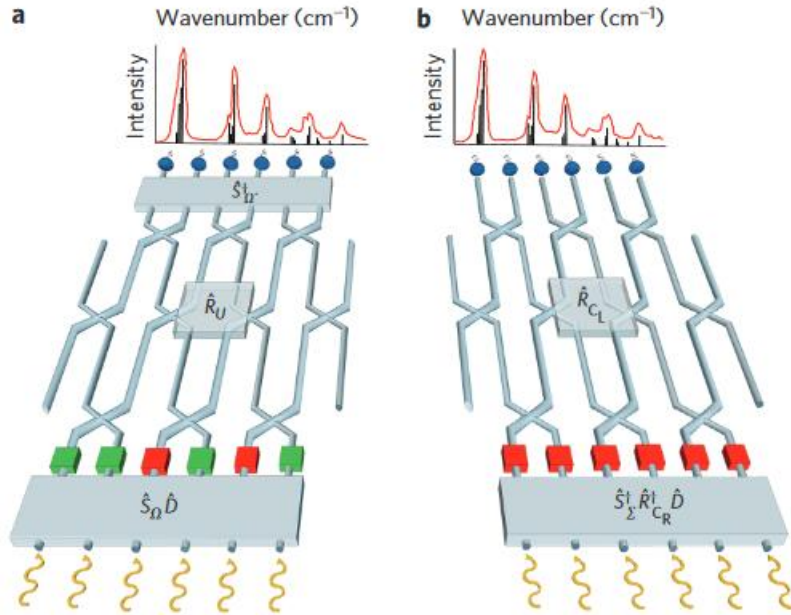
Quantum simulation with photonics



Quantum simulation with photonics



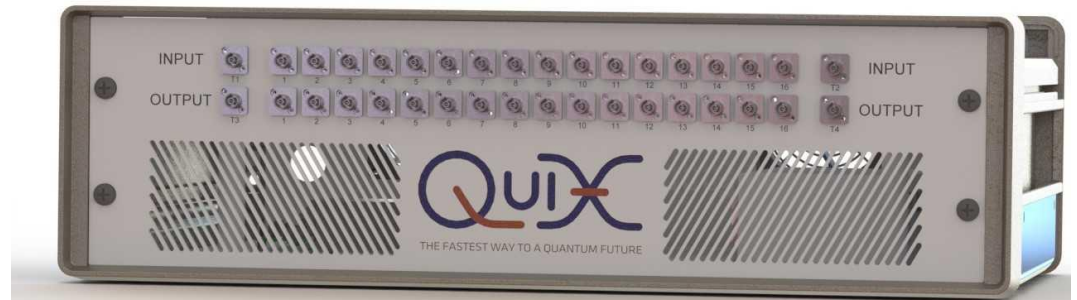
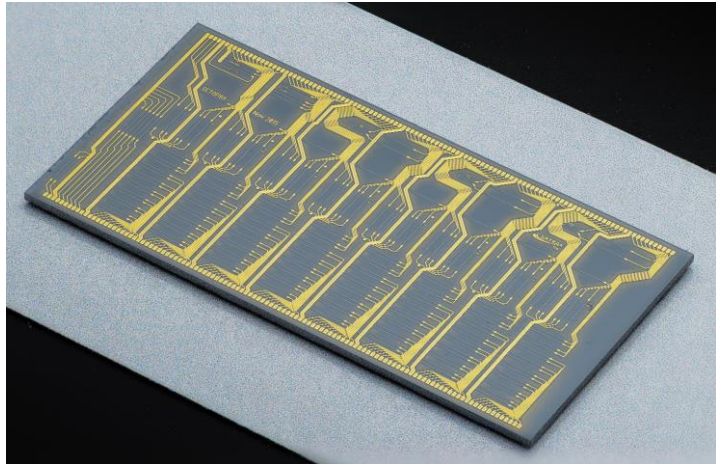
Quantum simulation with photonics



The product

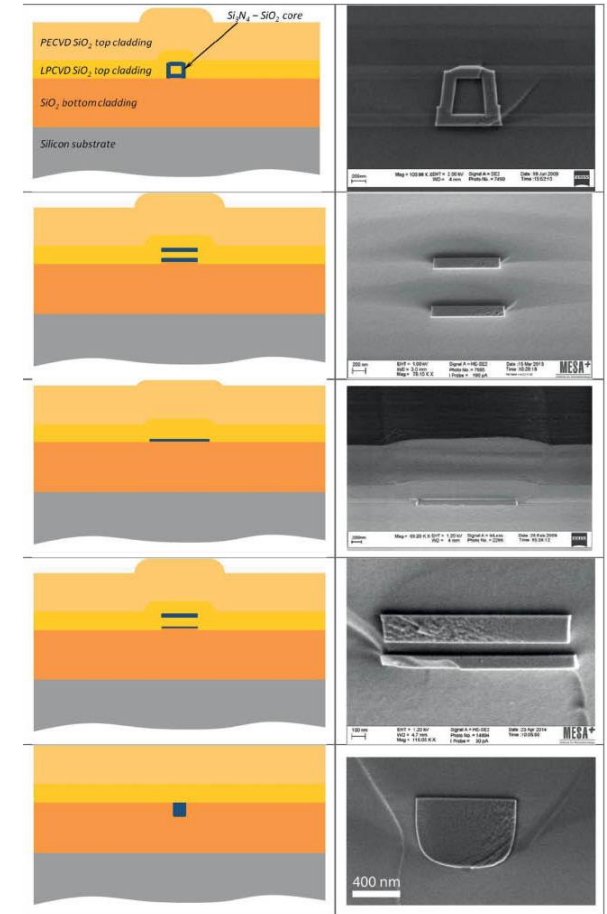
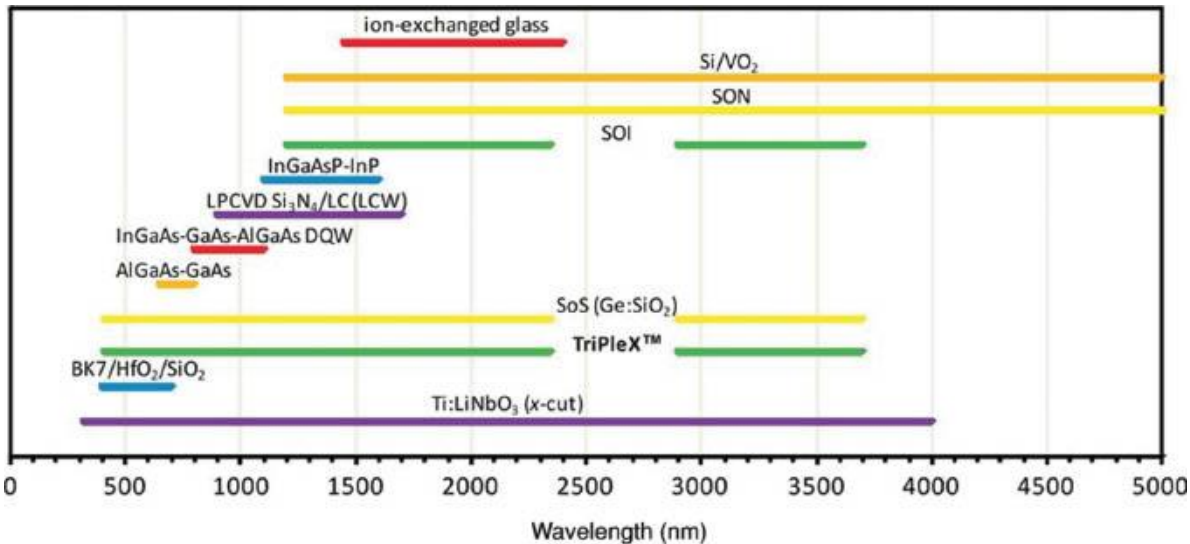
A box with a power cord, USB cable and fiber sockets

You plug in the box, dial a transformation via USB and the software makes it happen



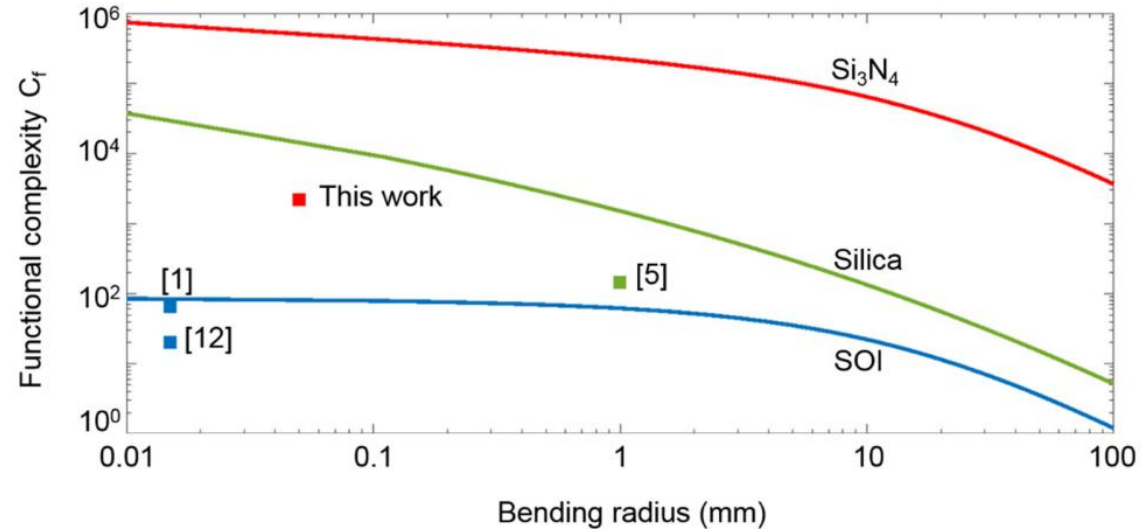
Why silicon nitride?

- Low loss (0.1 dB/cm)
- Wide transparency window (425 – 3700 nm)
- Mature technology (Lionix)



Competing photonic technologies

- Key parameter is optical loss
- SiN wins in elements per loss length



Track record

8×8 Programmable Quantum Photonic Processor based on Silicon Nitride Waveguides

Caterina Taballione¹, Tom A. W. Wolterink², Jasleen Lugani², Andreas Eckstein², Bryn A. Bell², Robert Grootjans³, Ilka Visscher³, Dimitri Geskus³, Chris G. H. Roeloffzen³, Jelmer J. Renema⁴, Ian A. Walmsley², Pepijn W. H. Pinkse⁴ and Klaus-Jochen Boller¹

¹*Laser Physics and Nonlinear Optics (LPNO), University of Twente, PO Box 217, 7500 AE Enschede, The Netherlands. Tel: +31 53 489 5278, e-mail: c.taballione@utwente.nl*

²*Ultrafast Quantum Optics and Optical Metrology, University of Oxford, Clarendon Laboratory, Parks Road, Oxford OX1 3PU, UK*

³*Lionix International BV, PO Box 456, 7500 AL Enschede, The Netherlands*

⁴*Complex Photonic Systems (COPS), University of Twente, PO Box 217, 7500 AE Enschede, The Netherlands*

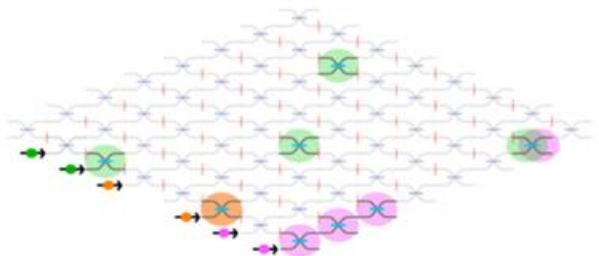


← Started 1/4/2019 as first employee

Proof of principle experiments

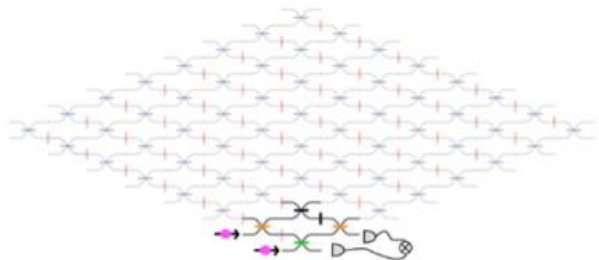
Quantum interference

(a)

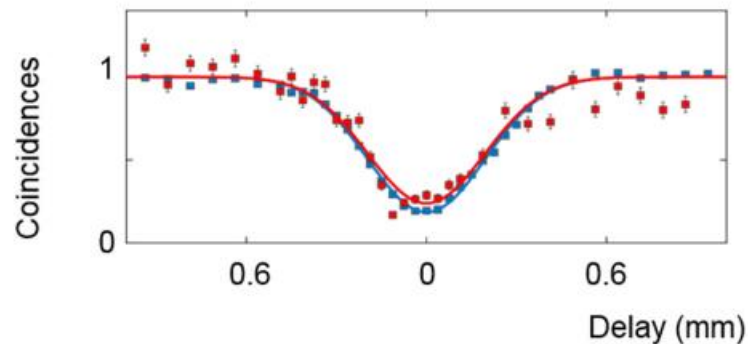


Bosonic coalescence/anti-coalescence

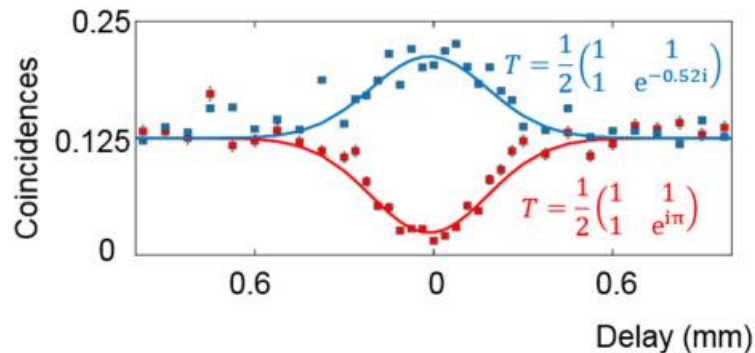
(c)



(b)

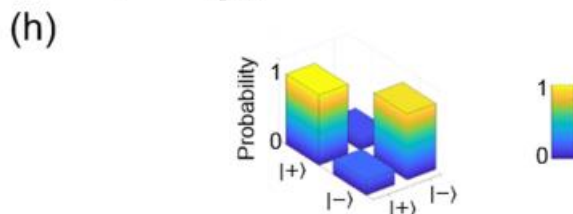
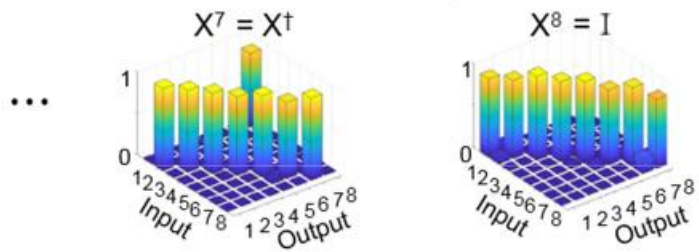
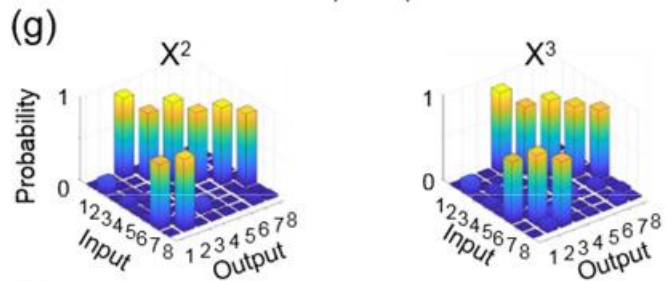
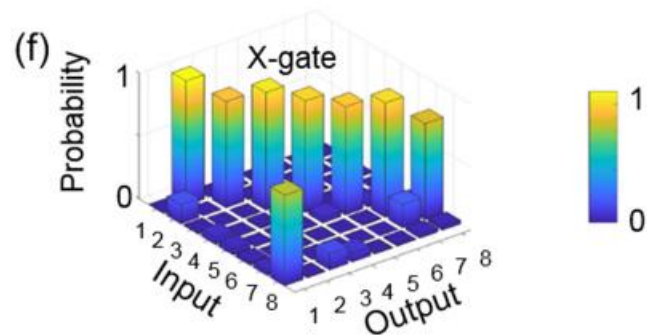
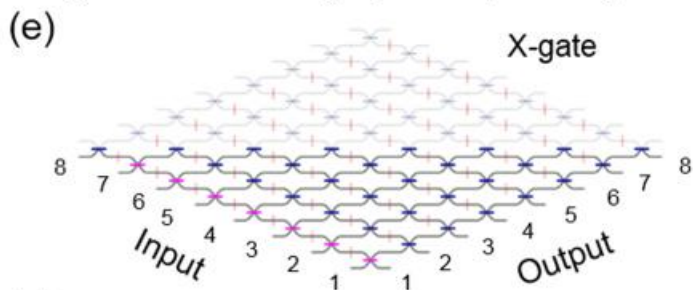


(d)



Proof of principle experiments

High-dimensional single-photon quantum gates



Reflectivity	
— (cross)	= 0
— (bar)	= 1
—	= 0.5
—	= 0.25
—	= 0.33

Metrics / goals

of photons -> quantum computational power

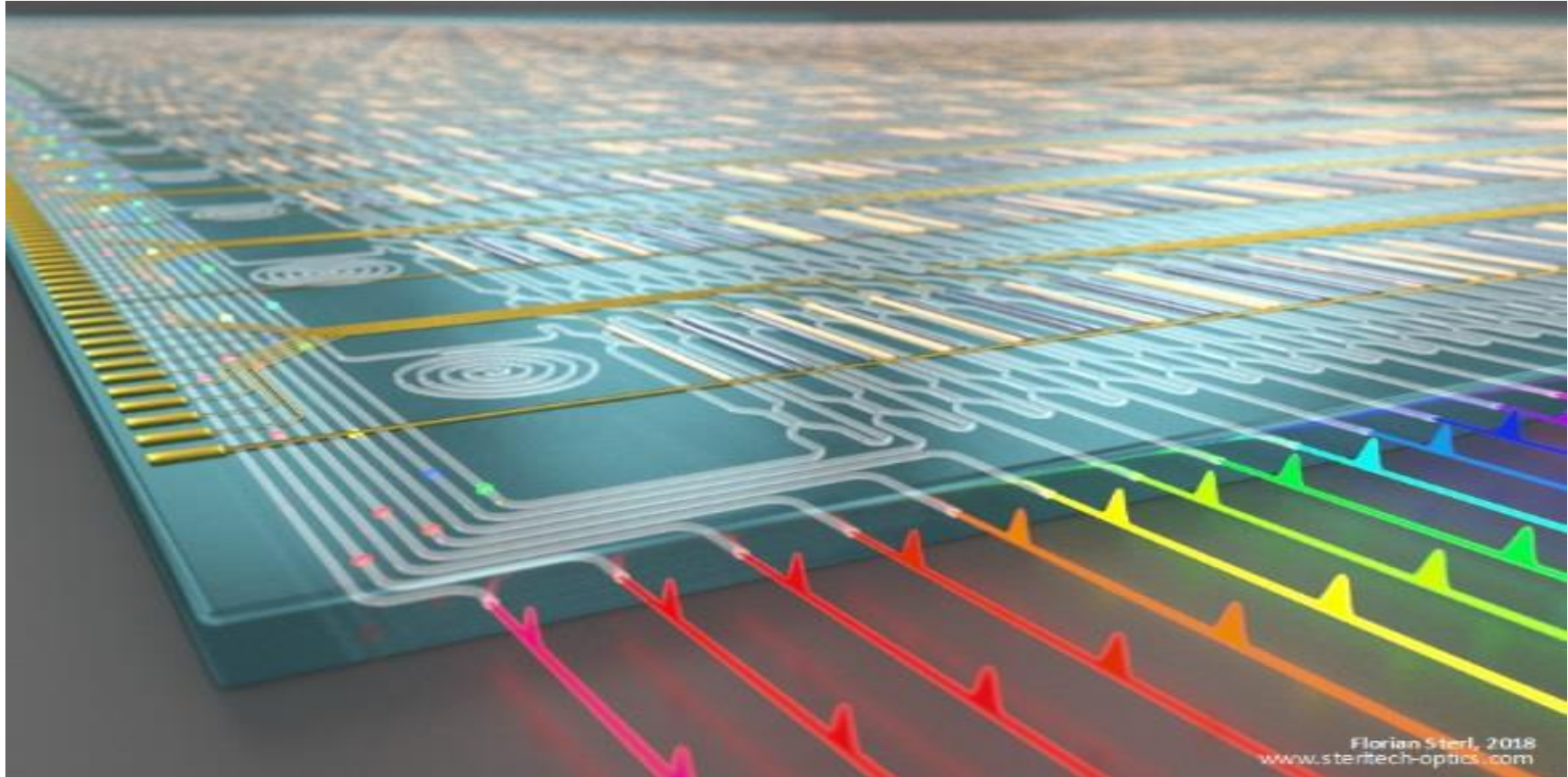
of modes -> number of photons you can support

Optical loss -> degree of 'quantumness' of the computation

Technological development plan



- Push on 3 fronts:
 - Transmission: up from 40% to >80%
 - # of modes: up from 8 to 20 to 50
 - Programmability: from partial to full



This presentation was presented at EPIC Meeting on New Space 2019

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