



Quantum Delta NL

A growth fund initiative

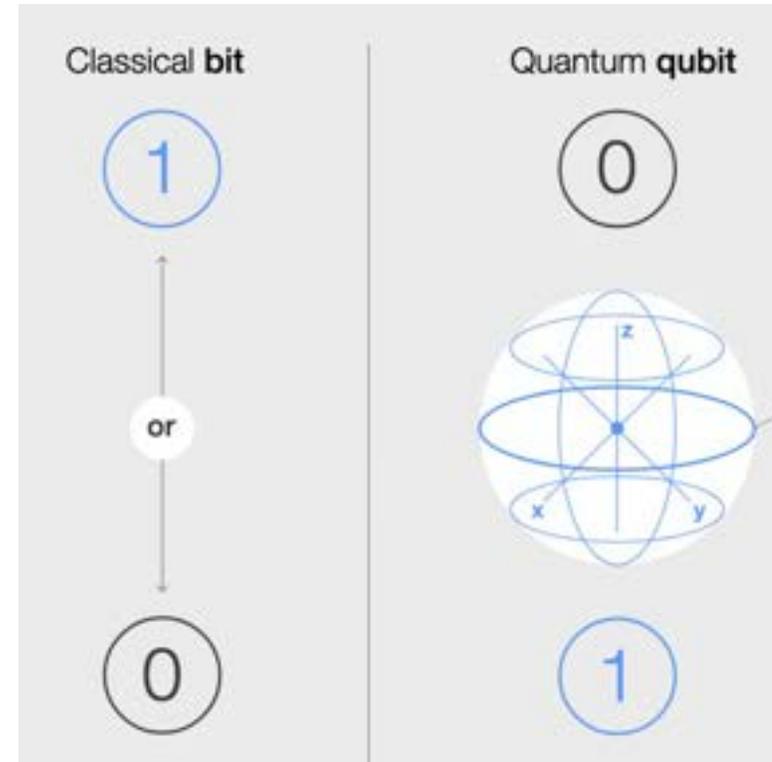
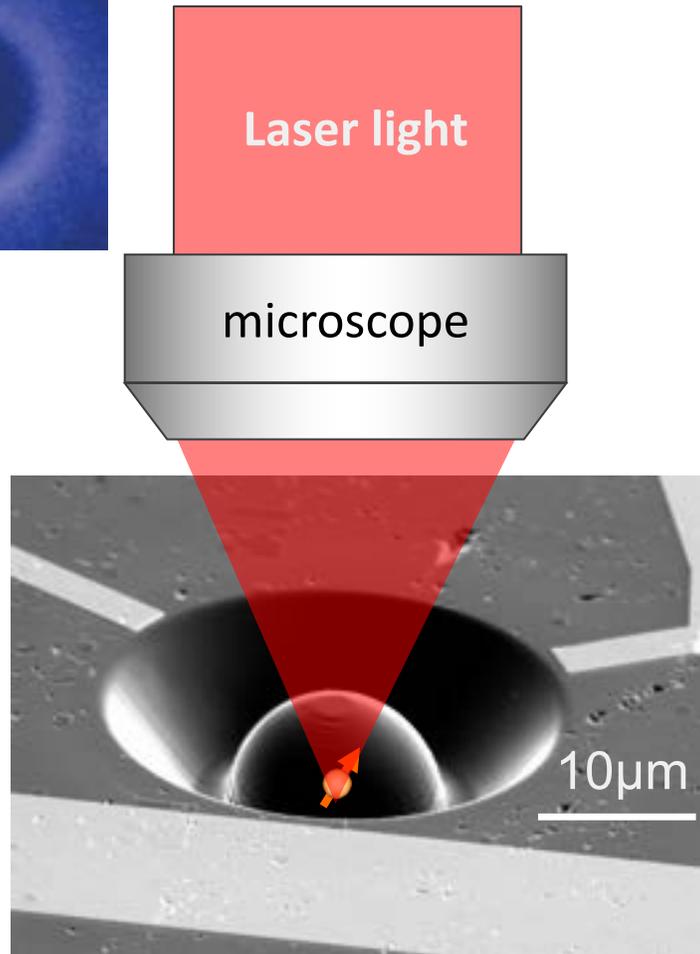
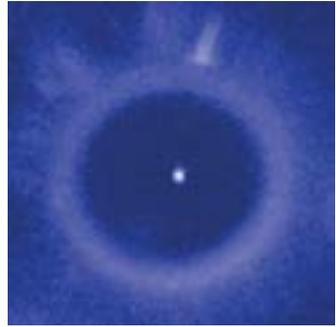
Dutch Photonics Event 21 September 2022

Pieter de Witte

Dir. Research programmes & IP

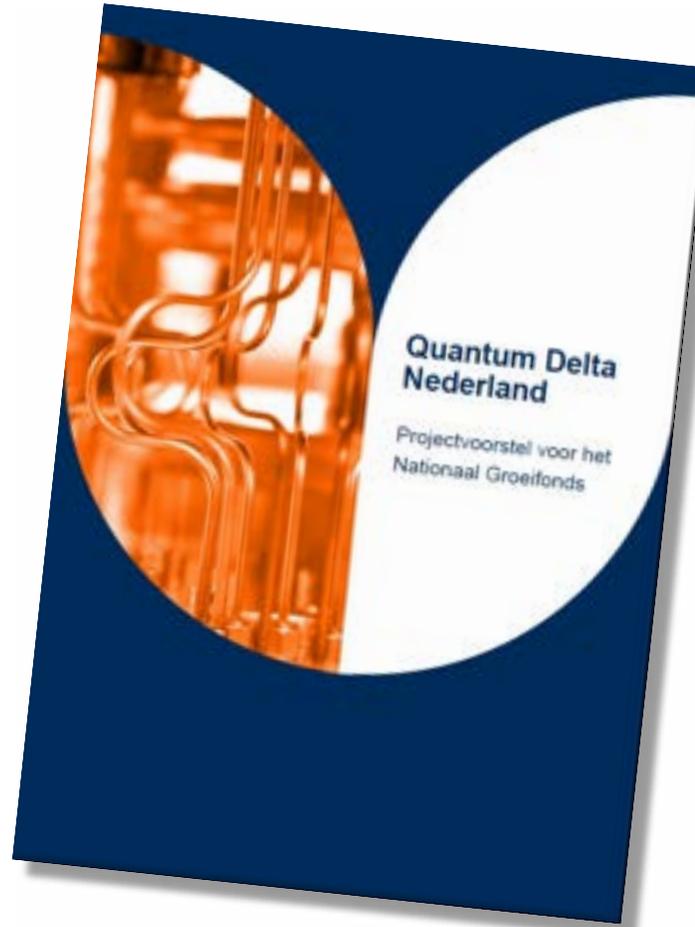
pieter.dewitte@quantumdelta.nl

2nd Quantum revolution – Utilising Entanglement & Superposition



Control of quantum objects – driven by
(nano)technology
Hardware platforms

From national agenda to growth fund proposal



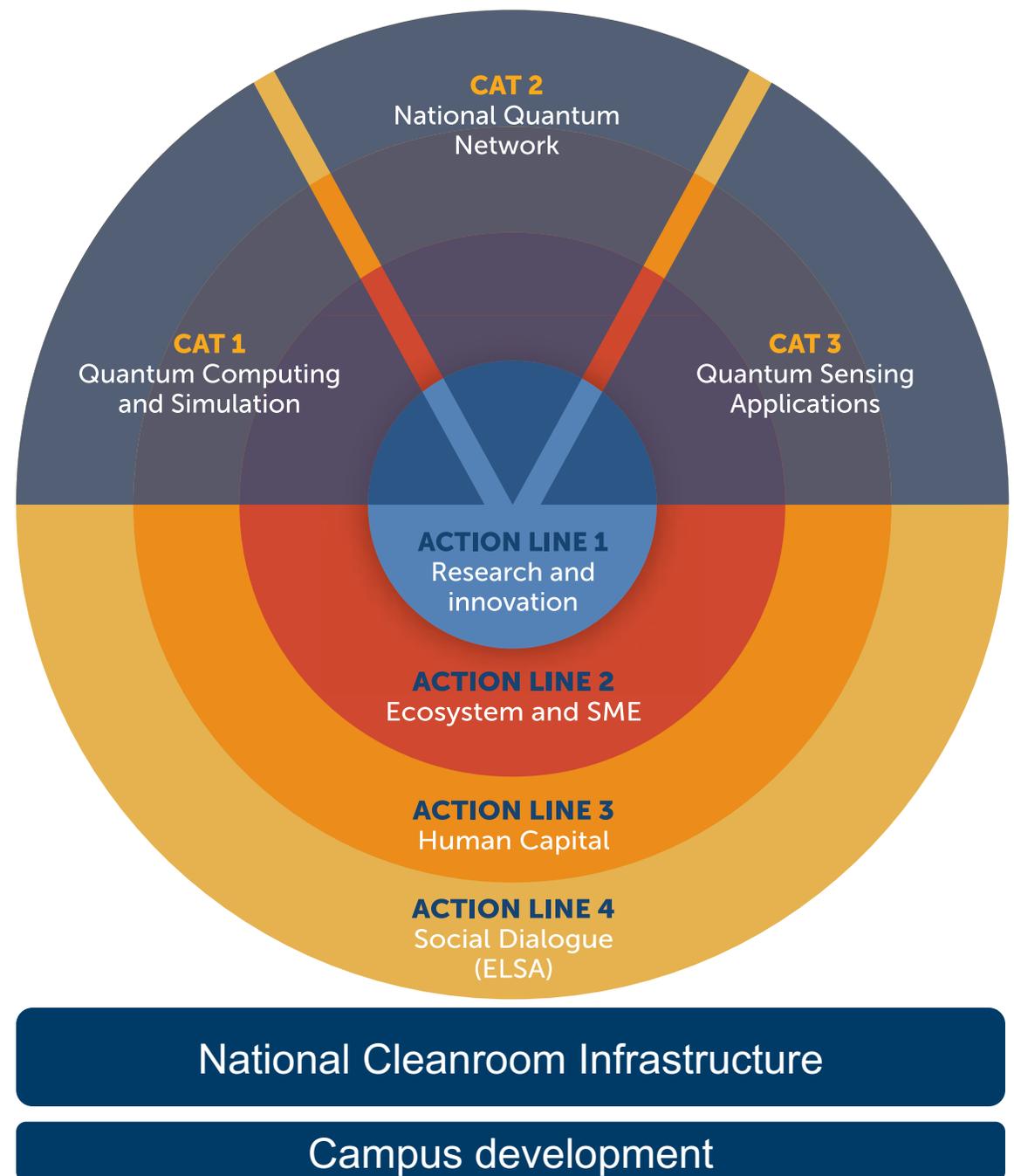
- NL globally is among the **top scientific players** on quantum technology
- The ambition for NL to develop into a Quantum Delta NL that is internationally leading
- Central is the objective to build an **'open ecosystem'**, in which all actors can easily work together to accelerate technology development and use
- From the National Growth Fund, **615 M€** was granted for carrying out the program

Strong bonds between five major quantum research hubs and affiliated universities and research centres

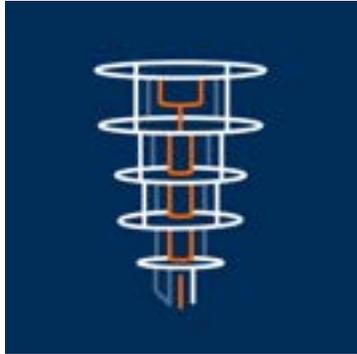
- Delft:** quantum computing, internet & network, with QuTech, Kavli Institute.
- Eindhoven:** post-quantum crypto, quantum simulation & materials.
- Leiden:** applied quantum algorithms, with aQa.
- Twente:** quantum electronics and quantum photonics, with Quant MESA+ and NanoLabNL.
- Amsterdam:** applied quantum algorithms, quantum sensing & simulation, with QuSoft, CWI, UvA, VU, SURFsara and others.



Structure of the QDNL programme



Three catalyst (CAT) programs to accelerate developments in three key areas



CAT-1
Quantum Computing and Simulation

- Quantum Inspire
- Technology development
- Use case development, in application hubs and fieldlabs
- Economic development
- Talent development, education and training



CAT-2
National Quantum Network

- NL Quantum Network
- Development and integration of key components
- Setup and simulation of quantum ecosystems
- Support and construction of other quantum networks



CAT-3
Quantum Sensing Applications

- Different Quantum sensing testbeds
- Connect developers, industry and users to create new sensing applications
- Open calls for new quantum sensor components and wider range of sensors

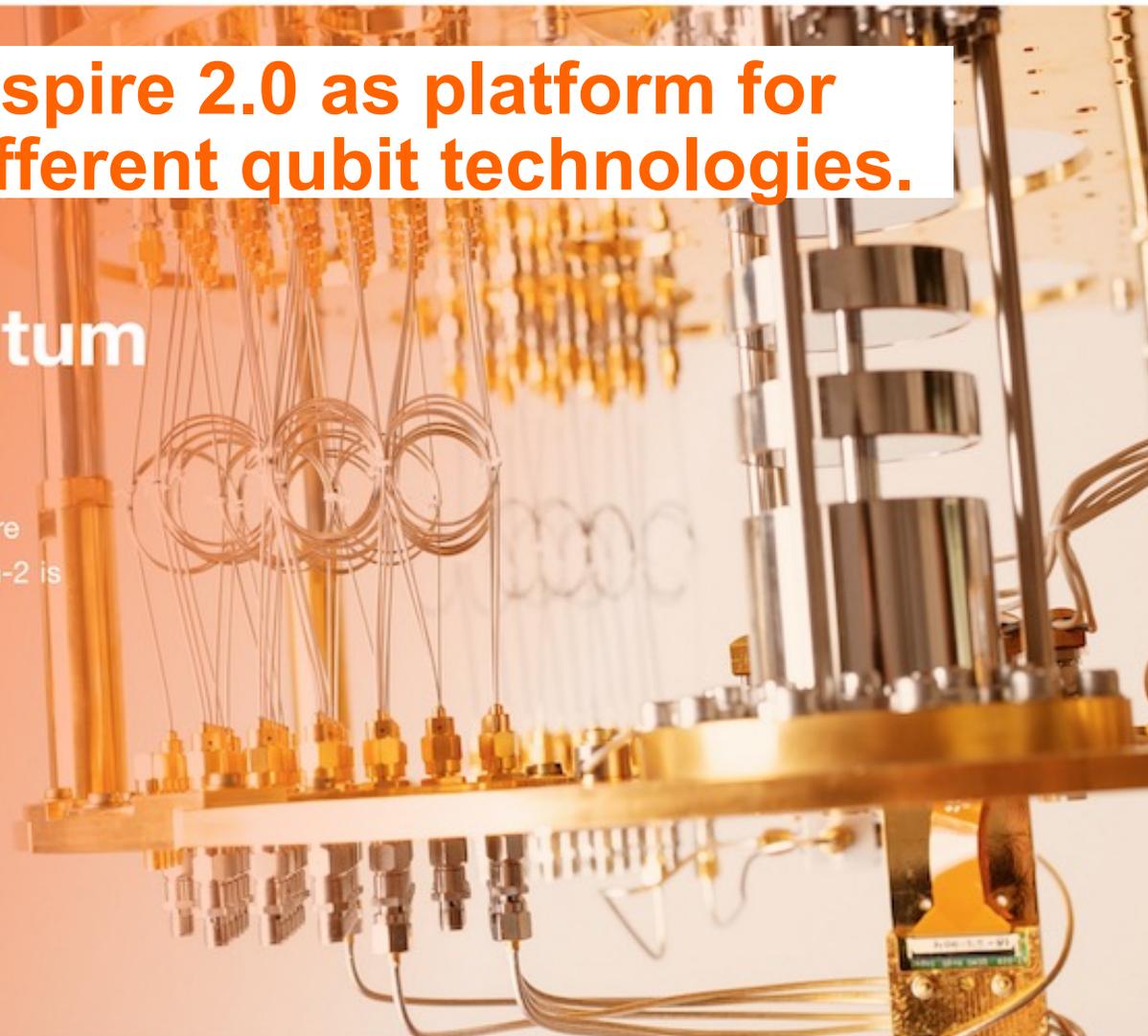


CAT1: Quantum Inspire 2.0 as platform for development of different qubit technologies.

The multi hardware Quantum Technology platform

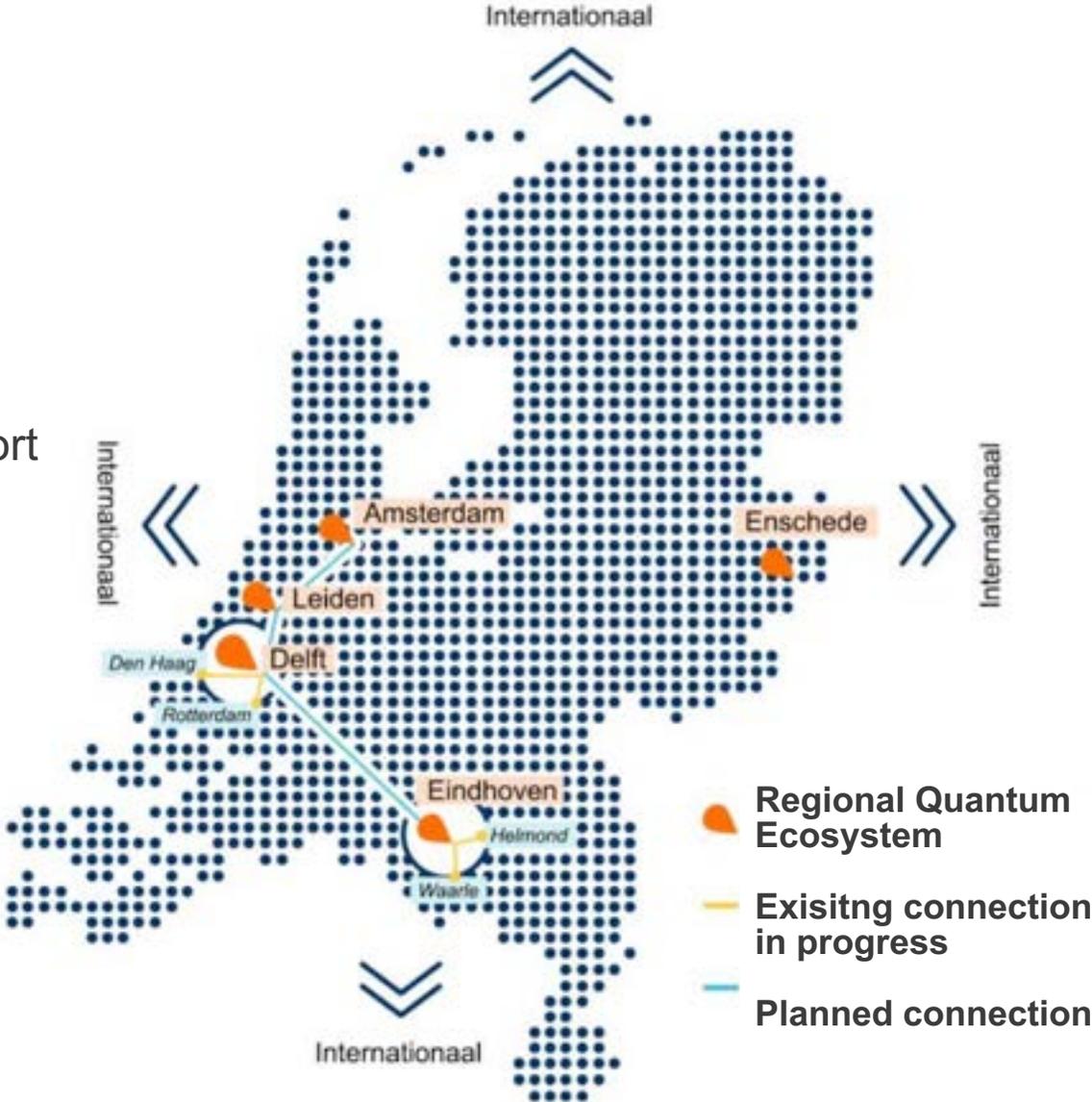
Run your own quantum algorithms on one of our simulators or hardware backends and experience the possibilities of quantum computing. Spin-2 is currently being upgraded and will be offline until September 15.

[Get started](#)



QDNL CAT-2 | NL Quantum Staging Network

- 1. Quantum R&D Network
- 2. National Quantum Staging Network
- 3. Quantum Network Construction support



The New York Times

'Quantum Internet' Inches Closer With Advance in Data Teleportation

Scientists have improved their ability to send quantum information across distant computers — and have taken another step toward the network of the future.

Give this article 471

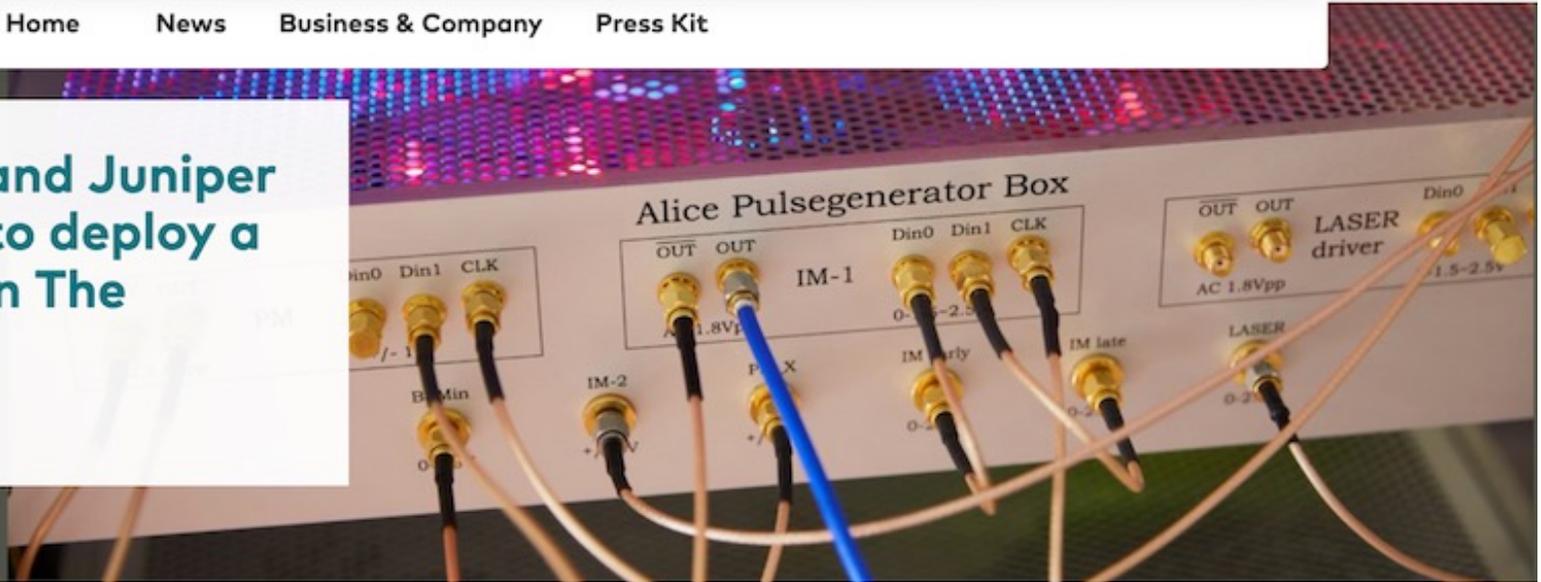


Researchers at the Delft University of Technology with one of the three nodes in a quantum computing network, which uses mirrors, filters and lasers to guide electrons into a synthetic diamond. Mariëke de Larijn for QuTech



QuTech, Eurofiber and Juniper Networks partner to deploy a Quantum testbed in The Netherlands

Delft, The Netherlands, 05 July 2022



QuTech, Eurofiber and Juniper Networks have launched a Quantum testbed connecting several datacenter locations in The Netherlands. This testbed enables, amongst others, applications of quantum cryptography, a way for partners to explore secure communications based on the fundamental laws of quantum physics. The testbed is open for new partners to join and co-explore quantum technology's possibilities.

Securing communication with quantum technology

As the number of cyber-crime incidents is increasing, concern has risen fuelled by the advent of quantum computing, data that is secured with today's standard cryptography methods are potentially under threat. Quantum Key Distribution (QKD) is a technology that distributes a data encryption key by using quantum effects in such a way that it is more secure against wiretapping attacks. Today and in the future, QKD helps protect data



CAT 3 Quantum sensors

A **quantum sensor** is device able to measure a physical quantity (sometimes beyond what is classically possible), by using:

- A physical system with (a few) quantized levels of energy
- (Quantum) coherence
- Quantum correlations such as entanglement

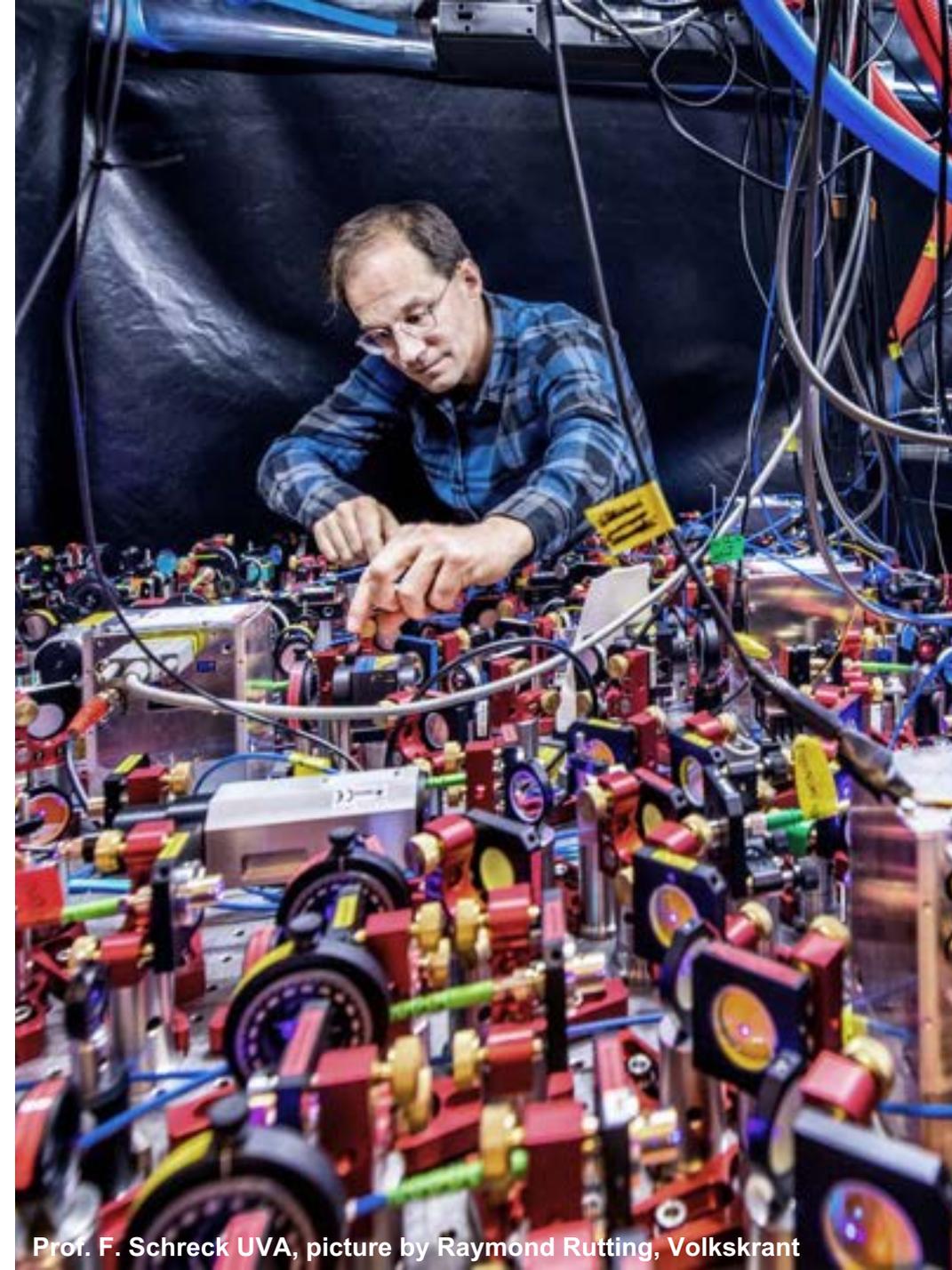
What can you expect?

In general

- High sensitivity

For some sensors

- High resolution (e.g. nano scale)
- Small footprint
- Low dynamic range



Prof. F. Schreck UVA, picture by Raymond Rutting, Volkskrant

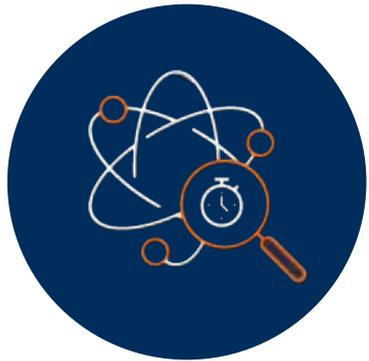
CAT 3 Quantum sensors

What?

- To accelerate the industrialization of quantum sensors
- To provide industry with affordable access to infrastructure, tools and expertise
- To identify potential partners for supply chain

How?

- Developing testbed facilities for different technologies
- Developing subsystems and systems via industrial tenders



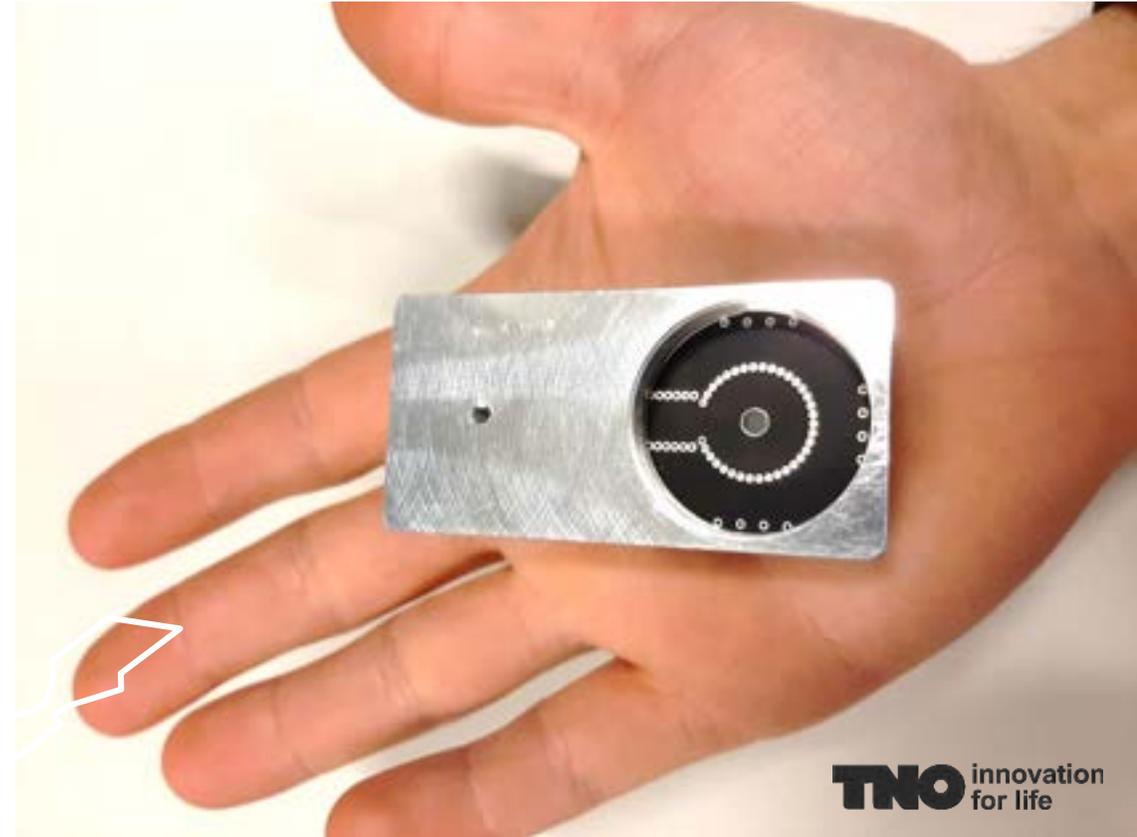
**Ultracold
quantum sensors**



**Mechanical
quantum sensors**



**NV-based
quantum sensors**



TNO innovation
for life



Four action programs to facilitate research and cooperation and to boost social readiness levels



ACTION LINE 1

Research and innovation



ACTION LINE 2

Quantum ecosystem and market development



ACTION LINE 3

Human capital



ACTION LINE 4

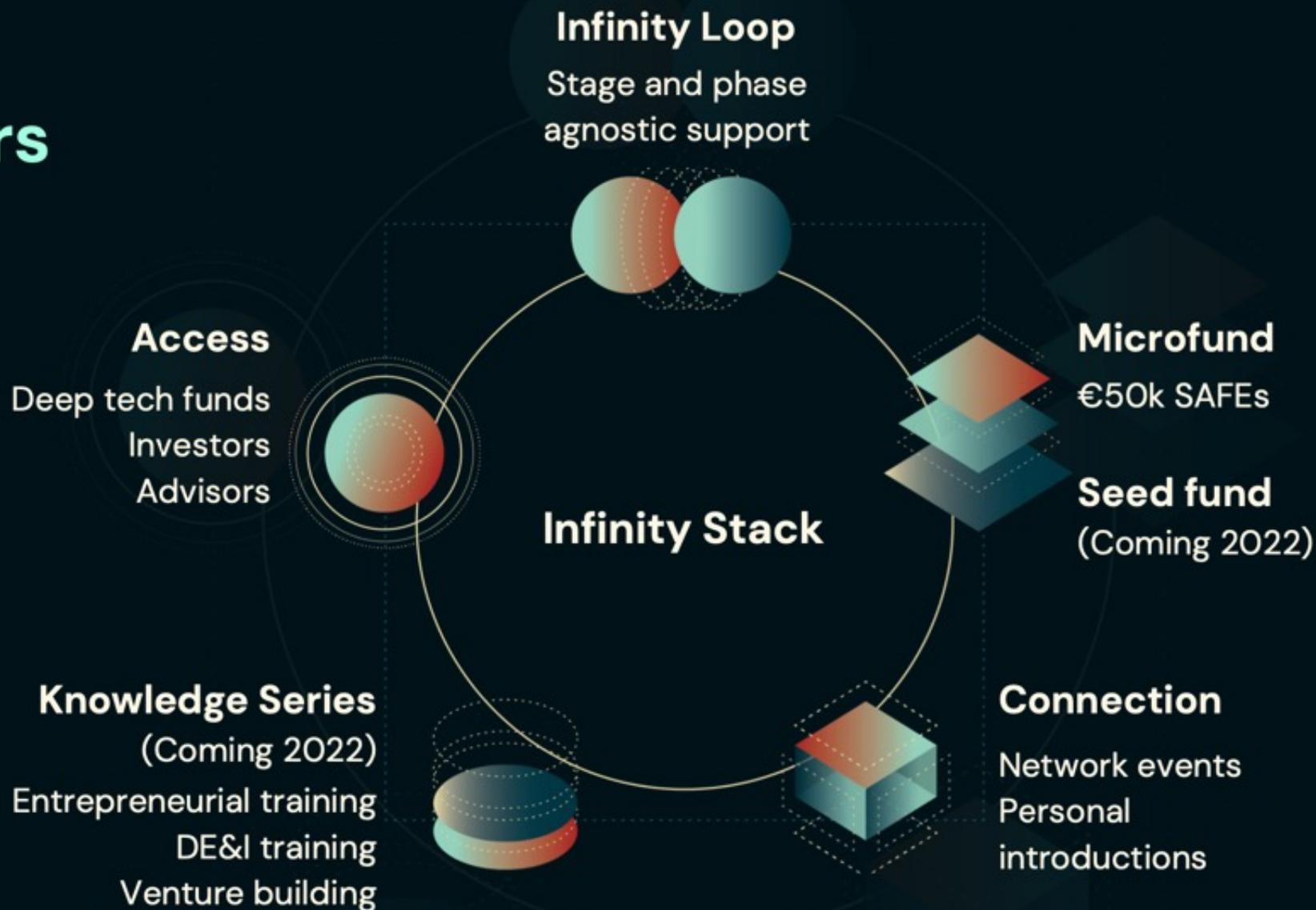
Social impact (ELSA)

Covering:

- International collaborations
 - IP Framework development
 - Ways to attract international talent
 - Fieldlabs and application hubs
 - Quantum-tracks for education
 - Support for initiatives like WIQD
 - Covenant for sustainable and safe use of QT
 - Funding mechanisms for industry, SMEs and startups
 - House of Quantum
- ... And many more

The Infinity Model:

Giving researchers unparalleled access to opportunities without intermediaries.



Quantum Delta NL

Visitor's programme

For sabbaticals, exchange visits, workshops and (summer) schools

[Apply here](#)



The Quantum Delta NL visitor programme is designed to support the exchange of people, ideas and knowledge in the field of quantum technology within the domains of science, education, market and society. The visitor programme has the ambition to strengthen our ecosystem and appeal of Quantum Delta NL. The programme is open to applications across the breadth of the Quantum Delta NL programme – science, education and Industry.

SME call 2022



Strengthening large-scale facilities for nanotechnological research in a National Cleanroom Infrastructure program

Large re-investment program to continue current service levels:

- Replacement investments
- Upgrades of existing equipment
- New capabilities

Impulse investment in high TRL infra



Strengthening large-scale cleanroom facilities in five locations across the country



Quantum Delta NL: (some of the) ways to engage

QDNL Hubs D-E-L-T-A

- TLC: talent and learning centers
- Workshops and events
- Business meet-ups, alliances

QDNL Fieldlabs

- Local initiatives to engage industry
- Call announced next week
- The first fieldlabs are:
 - Quantum Application Lab (Amsterdam)
 - Quantum for Business (Delft)

Centre for Quantum & Society

- Quantum Impact Assessment
- Societal Impact: Quantum for good
- Quantum Governance
- Quantum Communications

NWO open calls

- Current call being finalised (decision NWO board in ca. 2 weeks)
- New call next year

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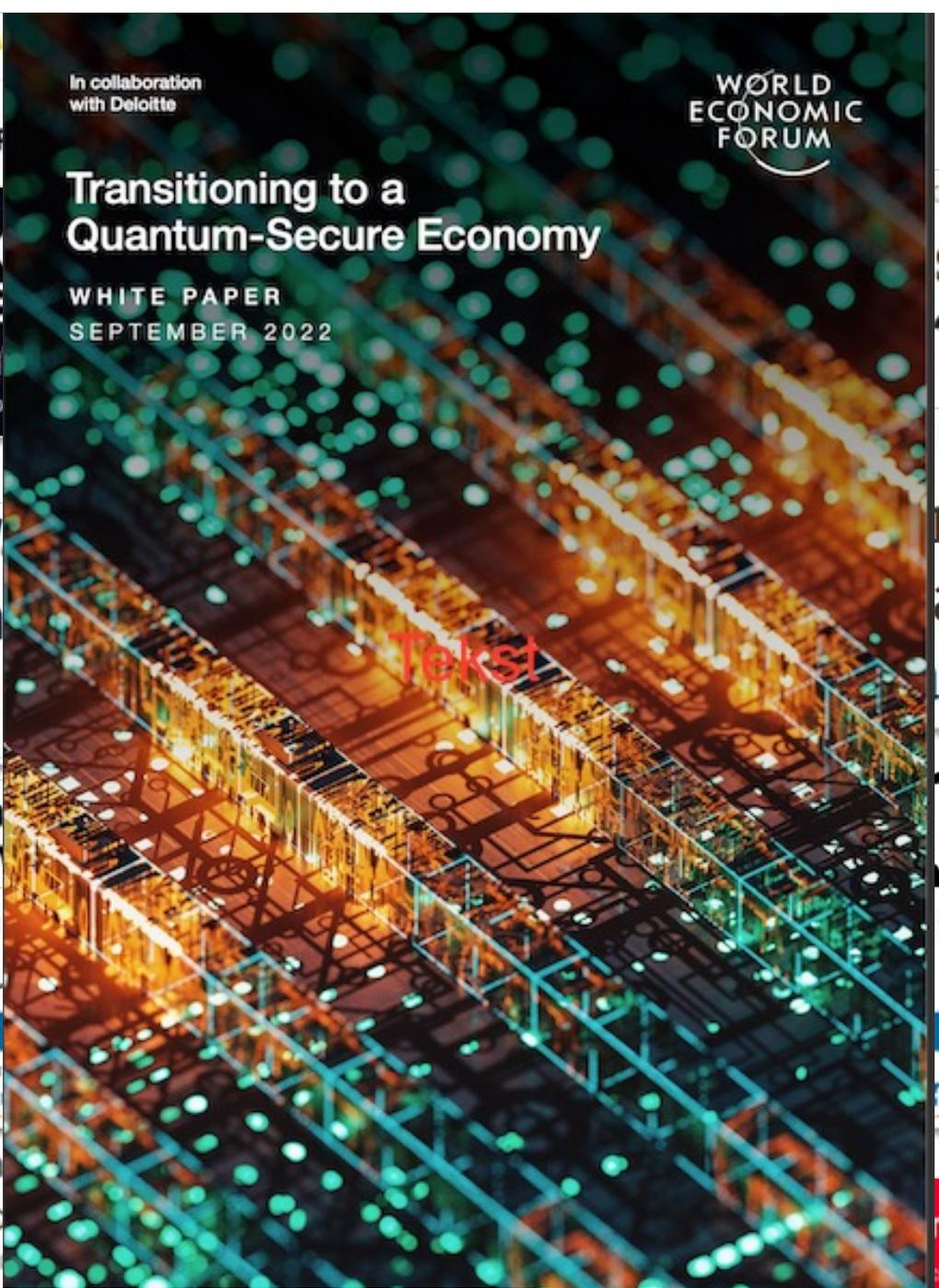
Quantum
Processo
Wednesday,

In collaboration
with Deloitte



Transitioning to a Quantum-Secure Economy

WHITE PAPER
SEPTEMBER 2022



Tekst



State of Quantum Computing: Building a Quantum Economy

INSIGHT REPORT
SEPTEMBER 2022



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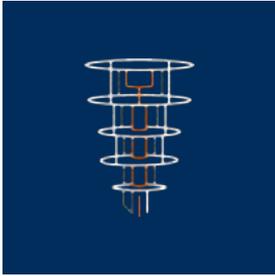
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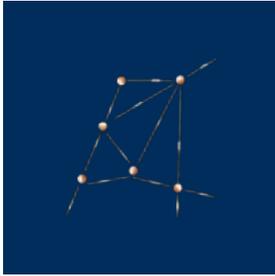


CAT 1

Quantum Computing and Simulation



Lieven Vandersypen



CAT 2

National Quantum Network



Jesse Robbers



CAT 3

Quantum Sensing Applications



Philippe Bouyer



ACTION LINE 1

Research and innovation



Servaas Kokkelmans



ACTION LINE 2

Quantum ecosystem



Freeke Heijman



ACTION LINE 3

Human capital



Miriam Blaauboer

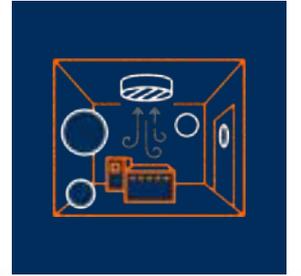


ACTION LINE 4

Societal impact (ELSA)



Victor Land



NANO LAB



Guus Rijnders

Thank you

