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INNOVATIONS

# How safe is safe?

Developments and requirements from a Financial Services perspective

Dr. Edeltraud Leibrock

World of QUANTUM, Munich, 29.06.2023

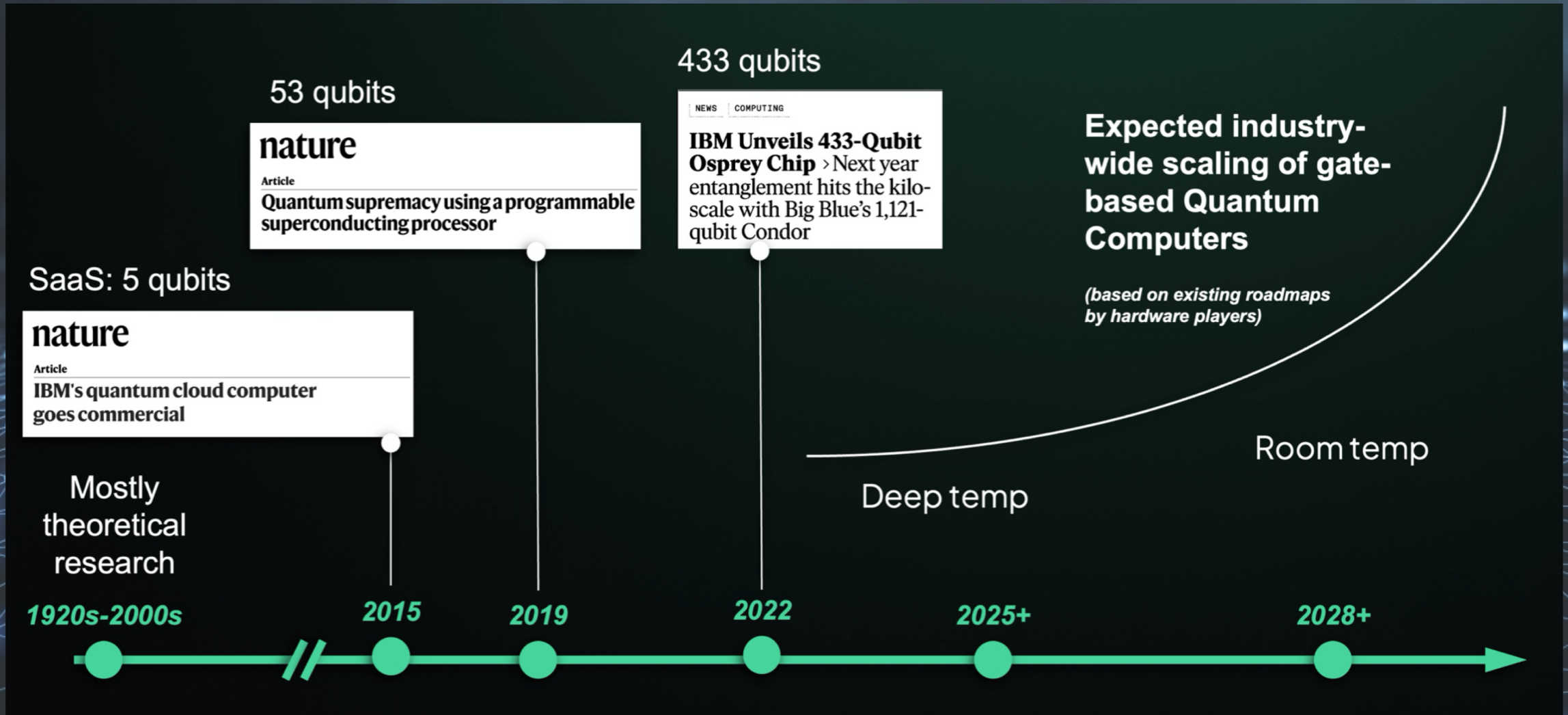


**“I know a lot of physics and a lot of math. But the one place where they put up slides and it is hieroglyphics, it's quantum.” – Bill Gates**





# Quantum age is right around the corner

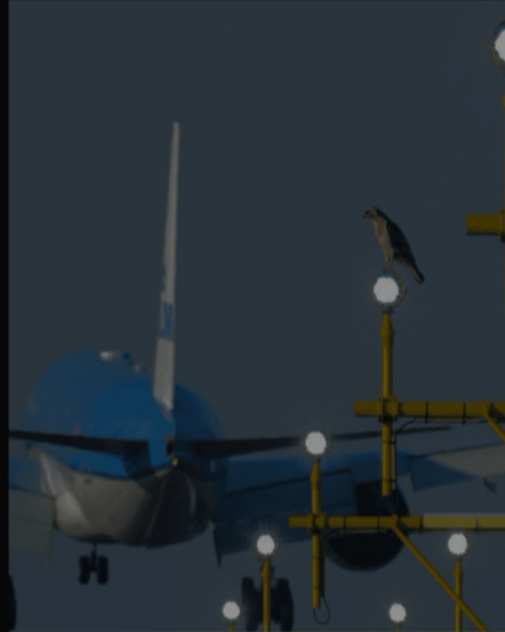


With quantum computing, we will solve complex optimization problems ...



## Completely New Applications

Simulation environments will be created at the level of realistic digital twins, which would not have even been developed before because their computing times would have been in the range of hundreds of years.



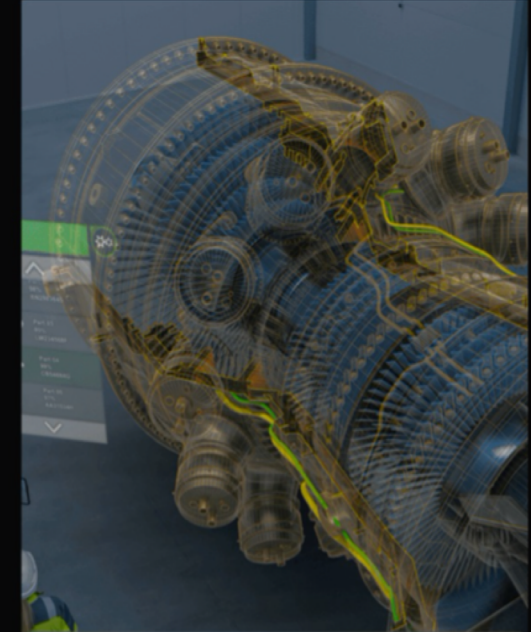
## Real-Time Capabilities

Complex planning problems, which used to take weeks to calculate, are calculated in "real time" and thus, enable short-term changes to be taken into account, especially when optimizing resources.



## Energy Efficiency

QC, through its energy efficiency (operating in kilowatt range), offers incredible opportunities for energy savings relative to traditional high performance computing, which accounts for a significant portion of the world's energy consumption.



## New Ways For Product Design

The interaction of the developer of a product with his simulation environment leads to a joint exploratory approach instead of a defined series of tests ("sequential --> parallel").





... but also require new encryption methods

## Caesar's cipher

Substitution cipher - commonly used, dated encryption techniques.



**Problem:** Key exchange mechanism needed

## Public key cryptography



**Problem:** Encryption keys based on algorithms / mathematics





# Quantum Key Distribution: From Theory to Application

Nobel Prize 2022 for quantum physics. Entangled states – from theory to technology. Alain Aspect, John Clauser and Anton Zeilinger have each conducted groundbreaking experiments using entangled quantum states, where two particles behave like a single unit even when they are separated.



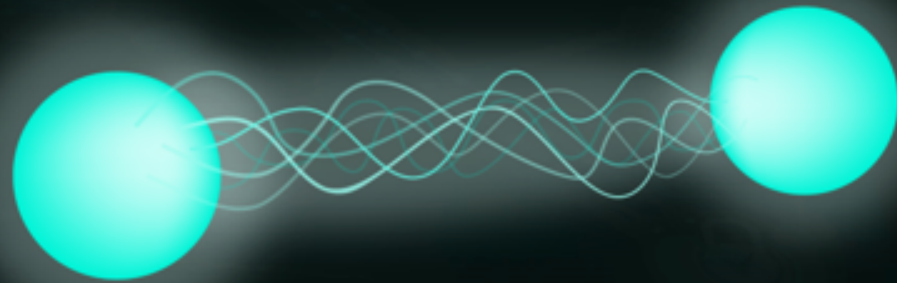
Aspect



Clauser



Zeilinger



Two entangled photons





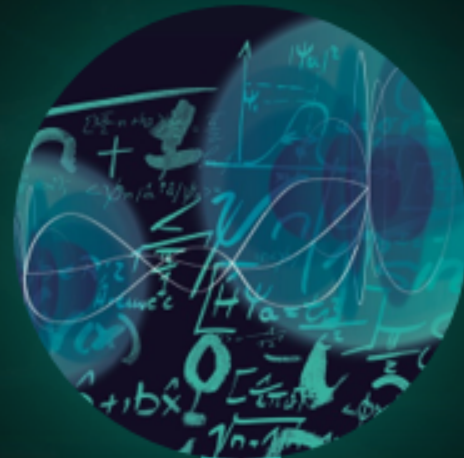
# QKD enables secure key generation and exchange

Use quantum mechanical processes with laser – material interaction to create keys



Symmetric keys, no algorithms,  
Quantum-Safe

Exchange keys with / by entangled photon pairs



Tap-proofed key exchange



# Secure communication channels are essential for all industries already today – some examples from FS

Authentication and identity management

Secure payments

Secure cloud computing

(Digital) asset custody

High frequency trading

Blockchain and smart contracts

Regulatory compliance, data privacy


...







# FS is a global sector, QKD adoption needs to be a collaborative effort

NEWS  
**JPMorgan Chase, Toshiba and Ciena Build the First Quantum Key Distribution Network Used to Secure Mission-Critical Blockchain Application**   
*Proof of Concept Showed Ability to Detect and Defend Against Potential Threats and*  
 Feb 2022

The Quantum Communications Hub, funded through the UK National Quantum Technologies Programme, is a major collaboration of universities, numerous private sector companies and public sector bodies brought together to accelerate the development and commercialisation of quantum secure communications technologies and services at all distance scales. 

**Driving international and local standardisation of QKD Technologies**   
 Internationally, NQSN is co-leading the first standardisation of the QKD protocol framework at the International Telecommunication Union (the United Nations specialized agency for ICT). Domestically, NQSN-led Singapore's first local Standard (Reference Specification) on QKD Networks is now published under ITU-T Recommendation Y.3801.

HEFEI, Jan. 7 (Xinhua) -- Chinese scientists have set up an integrated quantum network that combines 700 fiber and two ground-to-satellite links and realized quantum key distribution between more than 150 users over a combined distance of 4,600 km.   
 Led by Pan Jianwei from the University of Science and Technology of China, the research scientists over the past few years. The research paper has been published in the journal Nature. Jan 2021

**ID Quantique and Mt Pelerin start testing their quantum-safe digital asset custody solution in Geneva**   
 Mar 2022  
 A Quantum Key Distribution (QKD) network has been deployed and is live in Geneva as a testing environment for the Quantum Vault, the ultra-secure digital asset custody project designed by Mt Pelerin in cooperation with ID Quantique for financial institutions.

# FTTF: from Research to Capital Market

- Independent EUR 60m VC fund with capital from EIF and Fraunhofer
- Standardized EUR 250k pre-seed investment (convertible loan) for max. acceleration and product- market-fit, up to EUR 5m total invest per start-up
- Deal source: 76 Fraunhofer institutes + external start-ups using Fraunhofer technologies
- Investments covering a vast variety of technologies and verticals, e.g. **Quantum**, Space, Agri-, Clean-, Media- and Prop-Tech, Blockchain, Energy, Robotics, Logistics, Manufacturing, and Materials
- FTTF continues their mission with a EUR 90m successor fund and invites new investors to join the initial LPs EIF and Fraunhofer



Dr. Edeltraud Leibrock  
Partner & Managing Director Connected Innovations GmbH  
Advisor, introduced two portfolio companies to FTTF

*"As Fraunhofer Alumna with a background in quantum physics, the FTTF for me is THE go-to early-stage VC fund in deep tech whenever I spot a promising tech startup.*

*The FTTF colleagues have a profound understanding of technology and feasibility, relevance and market opportunities – a unique and powerful combination.*

*In addition, they make a great sparring partner and provide an ecosystem for young companies without limiting them in their own entrepreneurship. For Fund 2, I wish them an equally great impact and success!"*



# „Spooky action in Thüringen“ on May 26, 2023: 56 km dark fiber City Link Erfurt – Ilmenau

In 24 h

- 20 bn entangled photons sent
- 100 mn pairs measured
- 11,84 mn secure bits generated
- equals 46.260 x 256 bit keys
- average key rate 137 bit/s
- about 1.500 keys (1x min) used – ca. 3% utilization



Optical loss 13 dB @ 1.550 nm

May 26, 2023

## Cyber Security – made in Germany

The world's first integration and demonstration of a city link using entangled photons for encryption of communication data

Congratulations!



Kevin Füchsel • 1st

CEO bei Quantum Optics Jena GmbH

Reshared from Quantum Optics Jena GmbH • 5d • 🌐

A big thank you to the Thuringian Ministry of Finance and the Thüringer LandesRechenZentrum for their great support! Many thanks also to Dr. Edeltraud Leibrock and the team from envia TEL GmbH - one year ago we were still talking about the idea at the IQ Innovationspreis Mitteldeutschland. We are glad that you were there for the field test.

Last but not least, a big thank you to the team of Adva Network Security GmbH and Quantum Optics Jena GmbH colleagues!

#team #thankyou

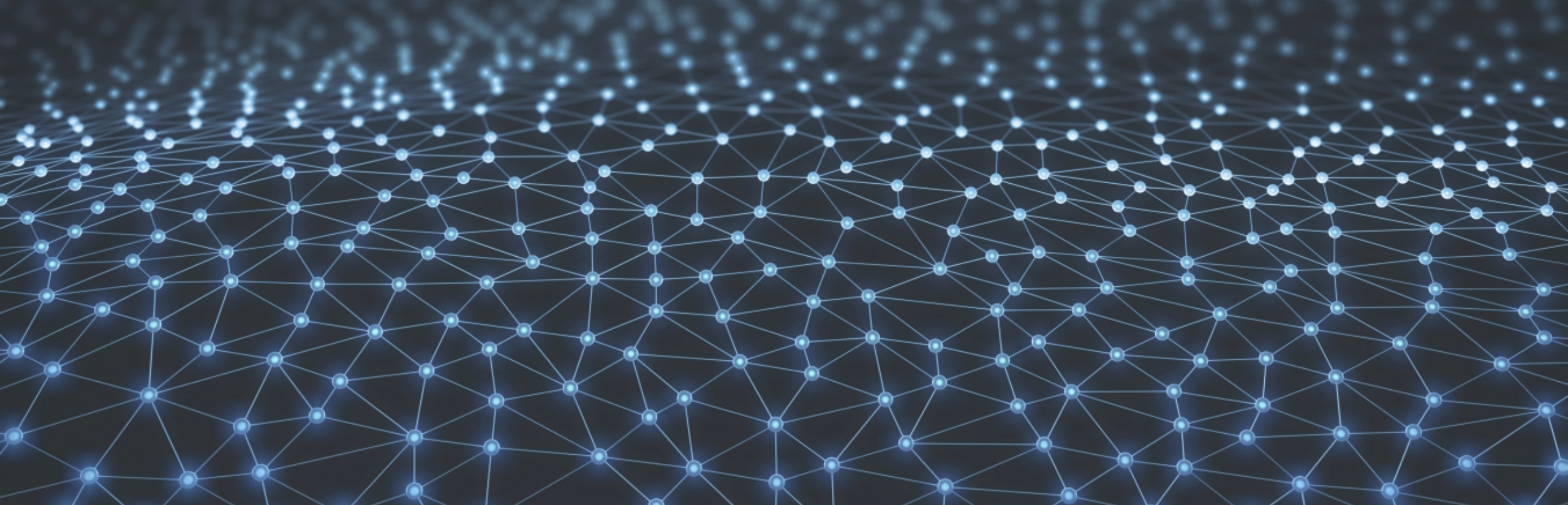


Thuringian QKD Demonstration  
Erfurt - Ilmenau  
IT-Security »Made in Germany«





**There's great potential in quantum computing and communication –  
let's make it happen!**





# Kontakt

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