CERN Quantum Technology Initiative
CERN

International organisation for fundamental research in particle physics

23 member states,
1.2 B CHF budget
> 3000 staff, fellows, apprentices, ...
> 13000 associates

> 400 PB of stored data
The Standard Model explains only about 5% of our Universe.
What is the remaining 95% made of?
How does gravity really work?
Why there is no antimatter in nature?
Quantum Revolutions

First Quantum Revolution
Max Planck black-body radiation paper
Particle-Wave duality
Transistor, laser, atomic clock, computers, optical fibre communication, GPS system

Second Quantum Revolution
Use quantum mechanics principles to develop new technology
“Artificial” quantum states

Now

1900
2002
29.09.22
CERN Quantum Technology Initiative

- What **realistic applications** profit from quantum technologies?
  - **Representative use cases**
  - Understand **challenges and limitations** (on NISQ and fault tolerant hardware)
  - **Optimize** quantum algorithms
- **Focus on practical advantage**
- **Collaboration** with industry and other sciences

2021 CERN QTI Roadmap: https://doi.org/10.5281/zenodo.5553774
AI enhanced Quantum Computing for Earth Observation

QC4EO is a recent ESA Initiative established in collaboration with CERN. Quantum computing has the potential to improve performance, decrease computational costs and solve previously intractable problems in EO by exploiting quantum phenomena such as superposition, entanglement and tunnelling.

The initiative involves creating a quantum capability in ESA-ESRIN (Frascati) which will have the ability to solve the most computationally demanding Earth-observation problems by using Quantum Computing to support programmes such as Sentinel and Copernicus. This collaboration will be extended to link the CERN Quantum Technology Initiative, which was announced in June 2020 by the CERN Director General, Fabiola Gianotti. Through this partnership, ESA and CERN will create new synergies, building on their common experience in big data, data mining and pattern recognition.