

CERN Quantum Technology Initiative



QUANTUM
TECHNOLOGY
INITIATIVE

Sofia Vallecorsa

AI and Quantum Research - CERN IT

CERN

CERN

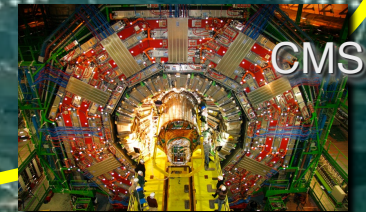
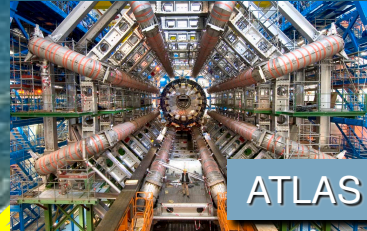
International organisation for
fundamental research in
particle physics

23 member states,

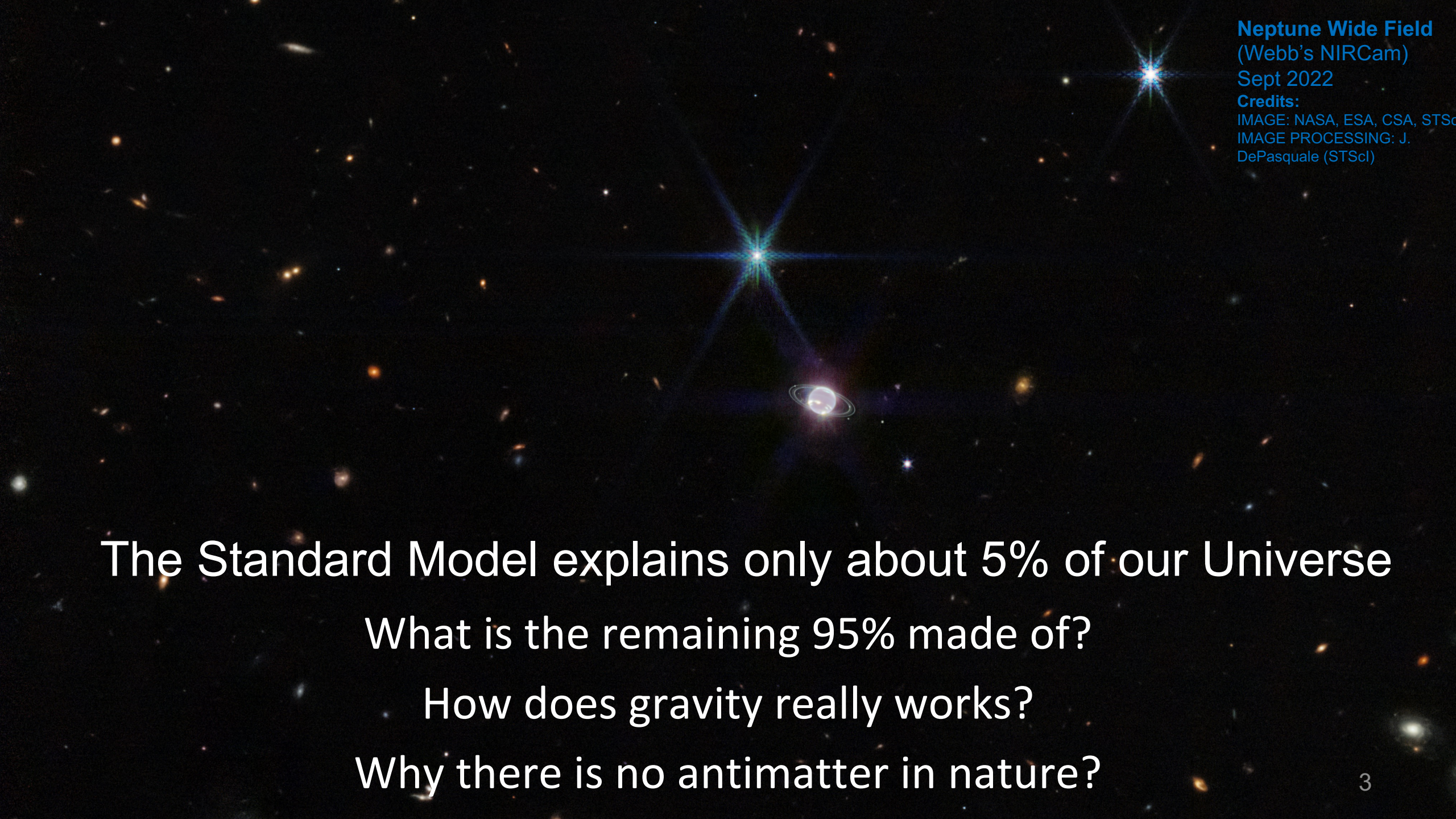
1.2 B CHF budget

> 3000 staff, fellows,
apprentices, ...

> 13000 associates



> 400 PB of stored data



Neptune Wide Field
(Webb's NIRCam)
Sept 2022
Credits:
IMAGE: NASA, ESA, CSA, STScI
IMAGE PROCESSING: J.
DePasquale (STScI)

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

Now

2002

Second Quantum Revolution

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

1900

First Quantum Revolution

Max Planck black-body radiation paper
Particle-Wave duality

Transistor, laser, atomic clock, computers,
optical fibre communication, GPS system

QUANTUM TECHNOLOGY: THE SECOND QUANTUM REVOLUTION.

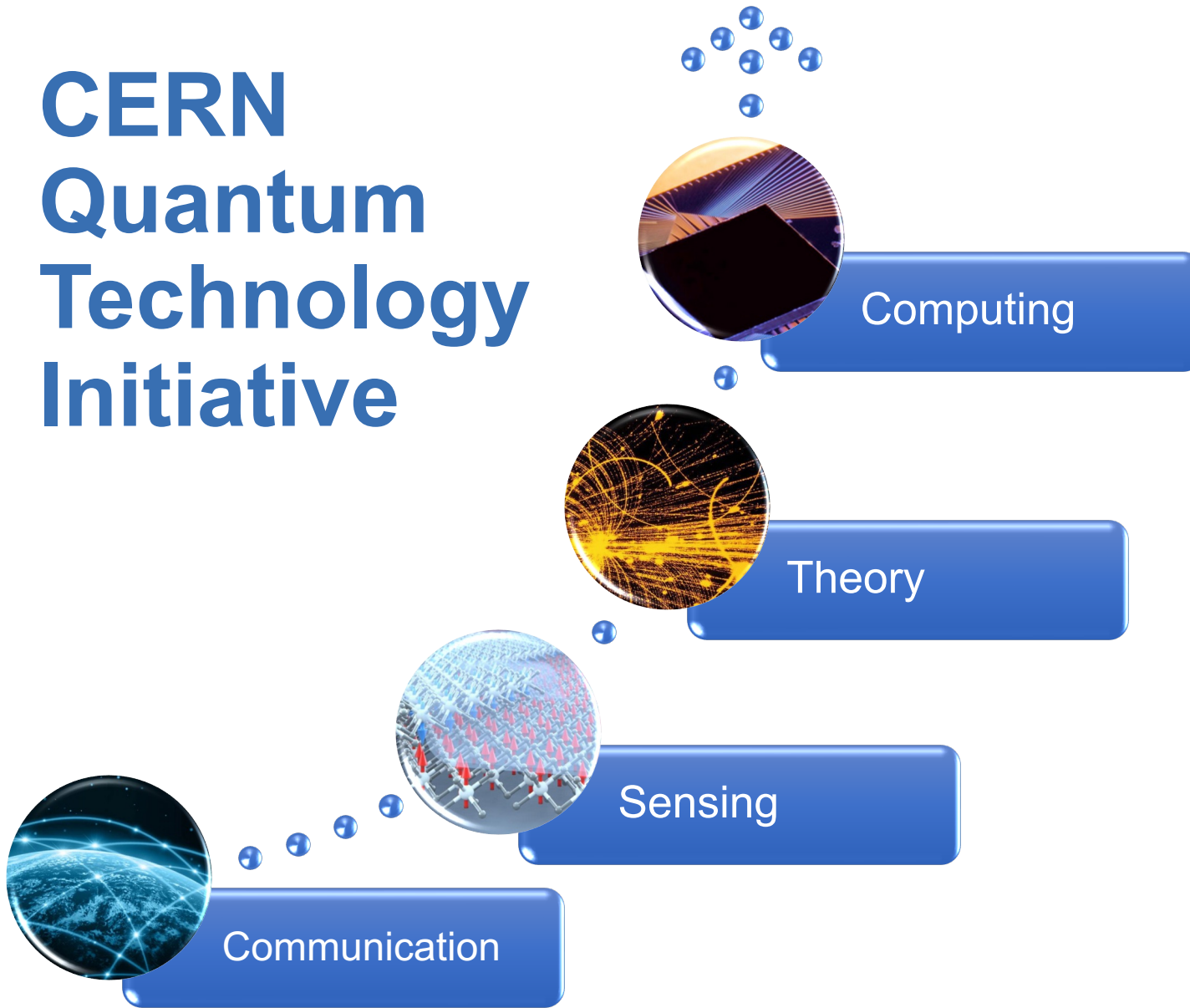
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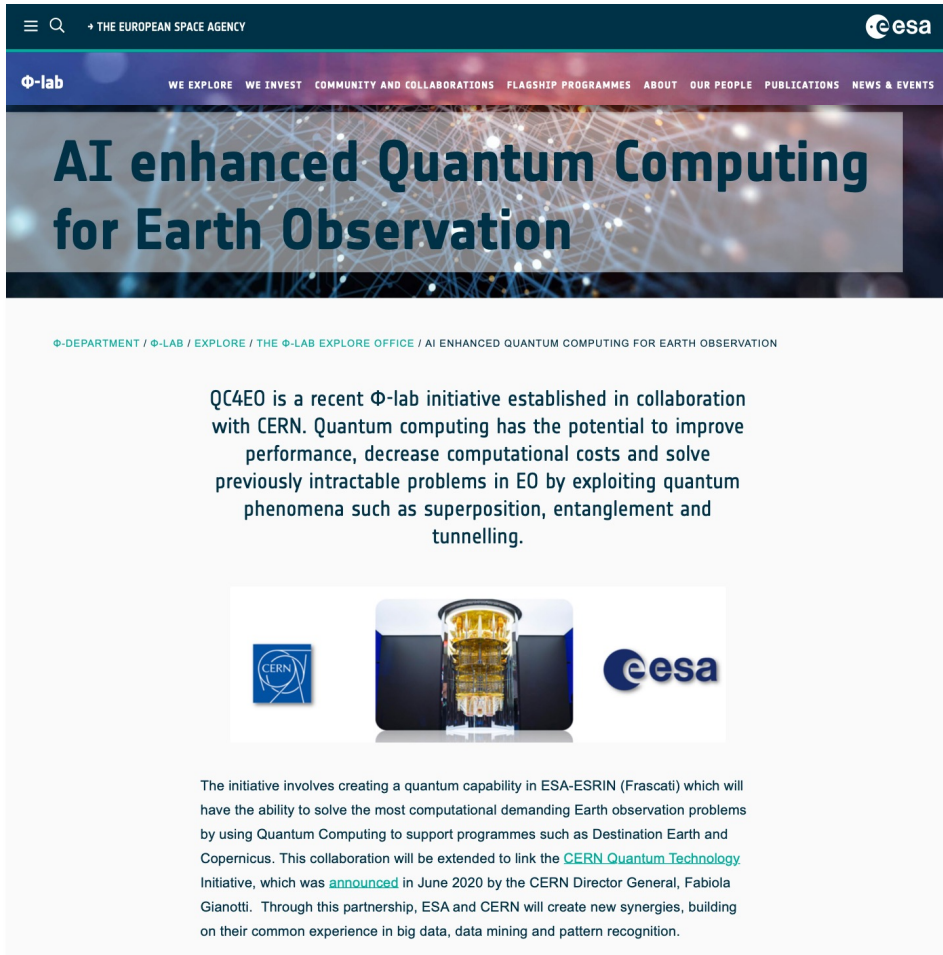
CERN Quantum Technology Initiative




- 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>

The ESA-CERN Joint Announcement at Phi-Week 2020




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Φ-lab WE EXPLORE WE INVEST COMMUNITY AND COLLABORATIONS FLAGSHIP PROGRAMMES ABOUT OUR PEOPLE PUBLICATIONS NEWS & EVENTS

AI enhanced Quantum Computing for Earth Observation

Φ-DEPARTMENT / Φ-LAB / EXPLORE / THE Φ-LAB EXPLORE OFFICE / AI ENHANCED QUANTUM COMPUTING FOR EARTH OBSERVATION

QC4EO is a recent Φ-lab 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 computational demanding Earth observation problems by using Quantum Computing to support programmes such as Destination Earth 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.



Special announcement

Exploring the next frontiers of disruptive innovation



AI-enhanced Quantum Computing for EO

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