Quantum technologies and quantum computing

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Université de Montpellier

Ecole Centrale Casablanca

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General introduction - motivation of these lectures

Quantum technologies and **quantum computing** are buzzwords since few years.

General introduction - motivation of these lectures

`https://www.fraunhofer.de/en/research/fraunhofer-strategic-research-fields/quantum-technologies.html`

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Fraunhofer Strategic Research Field

Quantum Technologies

Quantum technologies open up entirely new and unexplored applications in the fields of measurement technology, imaging, secure communication and highly complex calculations. They therefore have high disruptive potential. Scientists have achieved spectacular breakthroughs in quantum research in recent years. The goal of quantum research at Fraunhofer is to transfer basic research into applications as quickly as possible, for example in the form of high-precision sensor systems and secure quantum communication.

Quantum physics forms the basis of many modern technologies. Billions of electronic transistors permeate our lives at work and at home, from computers and smartphones to the control systems of modern vehicles and seemingly simple kitchen appliances. Countless photons and optical fibers link up even the most remote corners of our planet. Scientists are already talking about a "second quantum revolution" based on the targeted

Contact

Prof. Dr. rer. nat. Oliver Ambacher
Spokesman Fraunhofer Strategic Research Field Quantum Technologies

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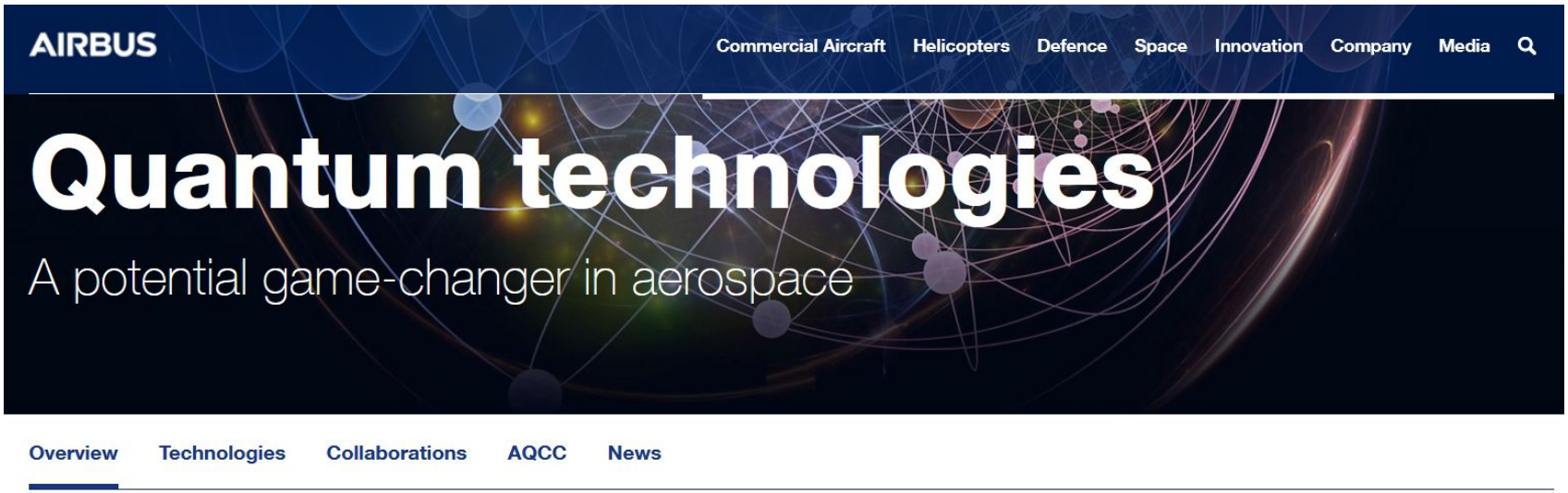
https://www.airbus.com/innovation/industry-4-0/quantum-technologies.html



Quantum technologies are expected to create a massive paradigm shift in the way aircraft are built and flown. At Airbus, we aim to be an early adopter of quantum technologies to enhance

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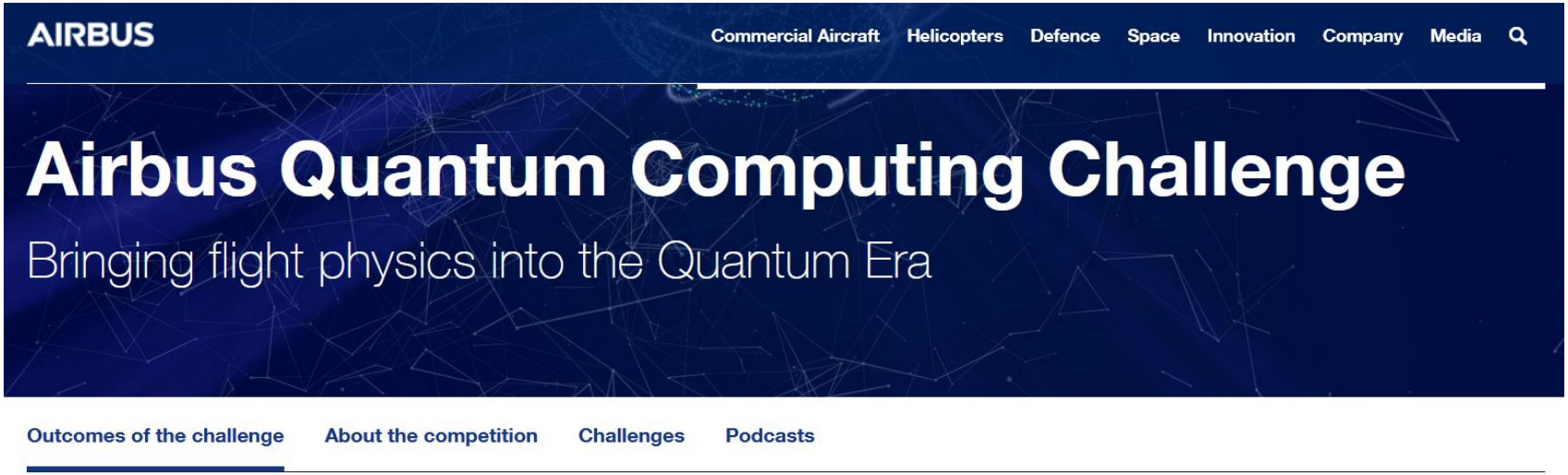
`https://www.airbus.com/innovation/industry-4-0/quantum-technologies/`

`airbus-quantum-computing-challenge.html`



The Airbus Quantum Computing challenge has ended and we are proud to announce the 2020 winner : the team Machine Learning Reply.

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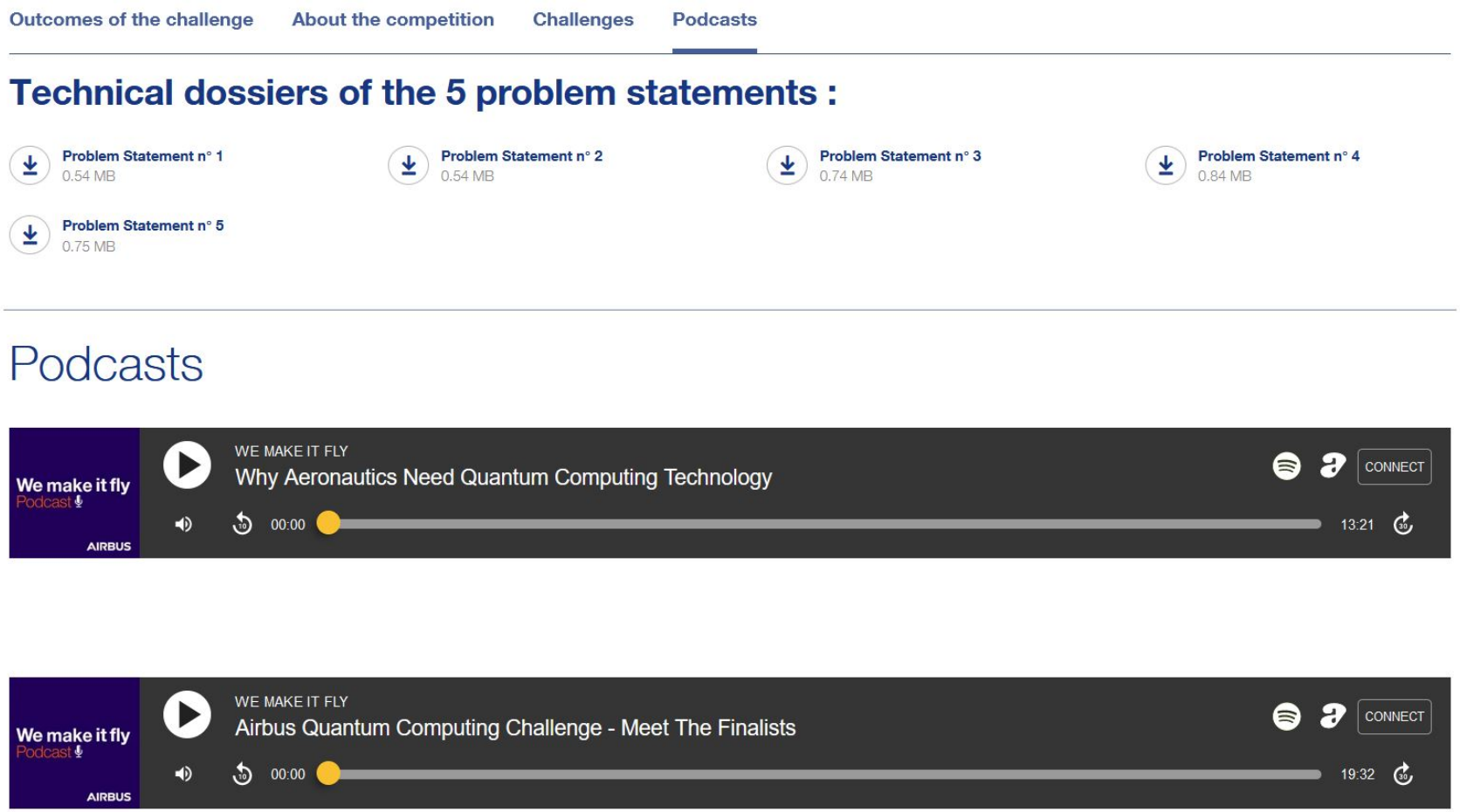

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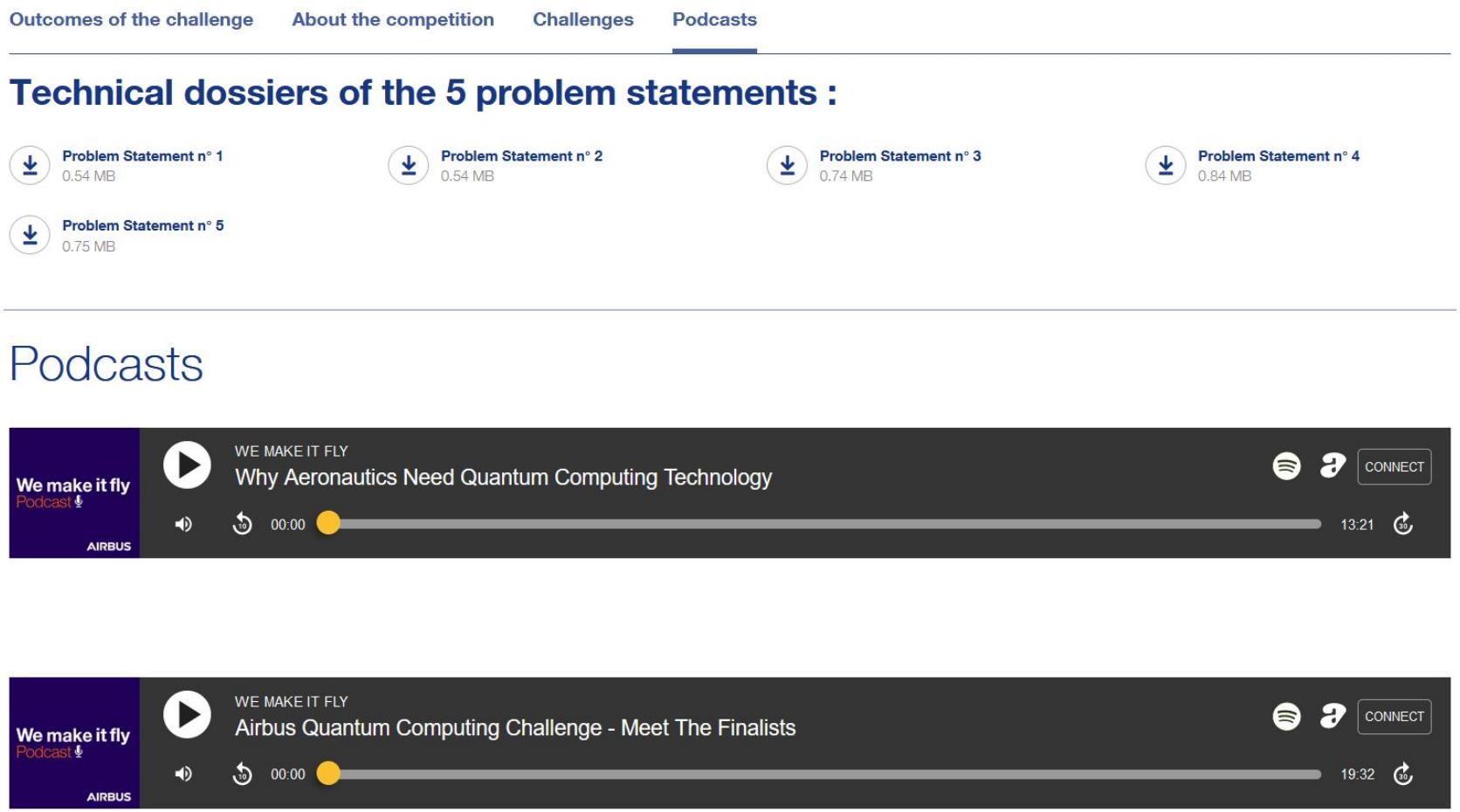

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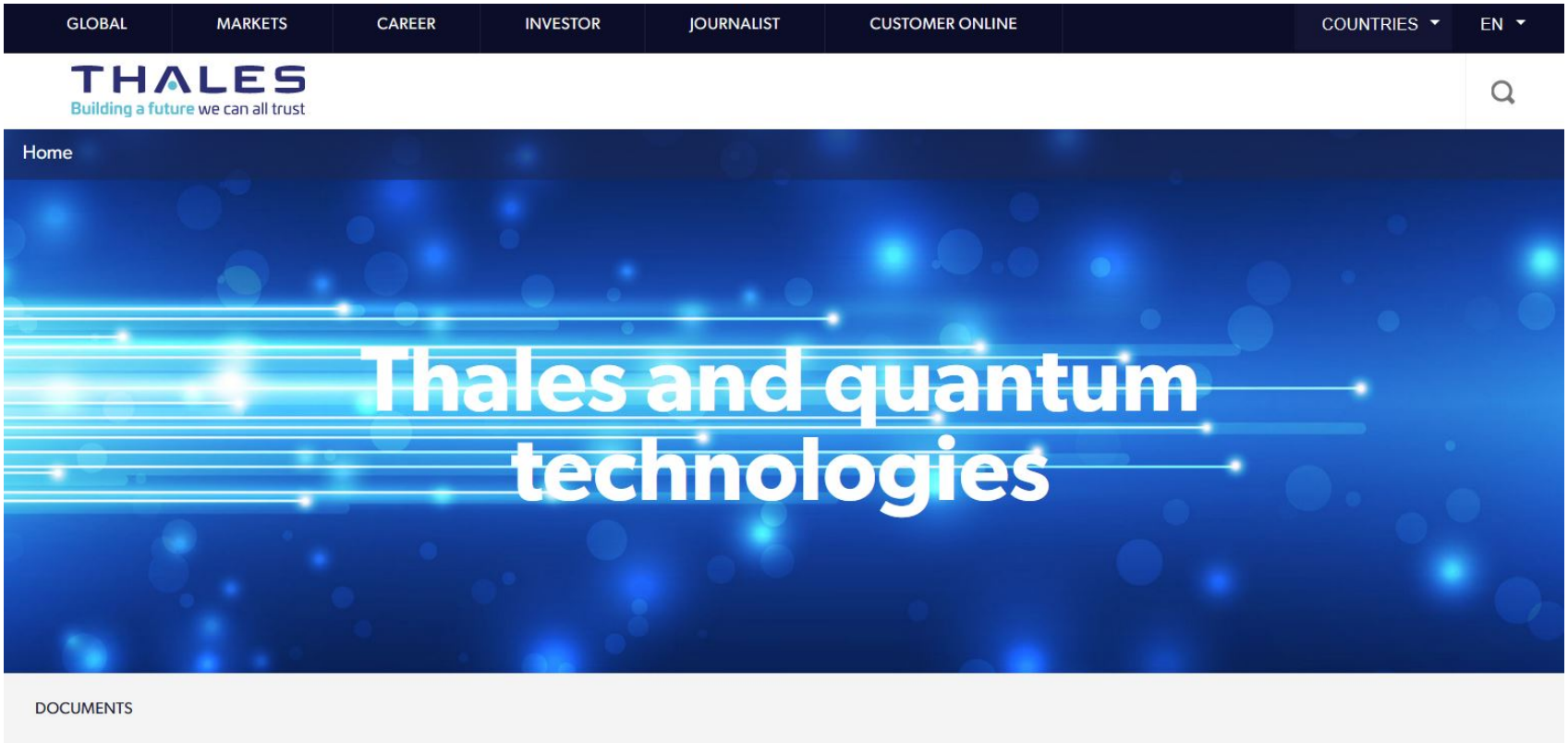
https://www.thalesgroup.com/en/thales-and-quantum-technologies



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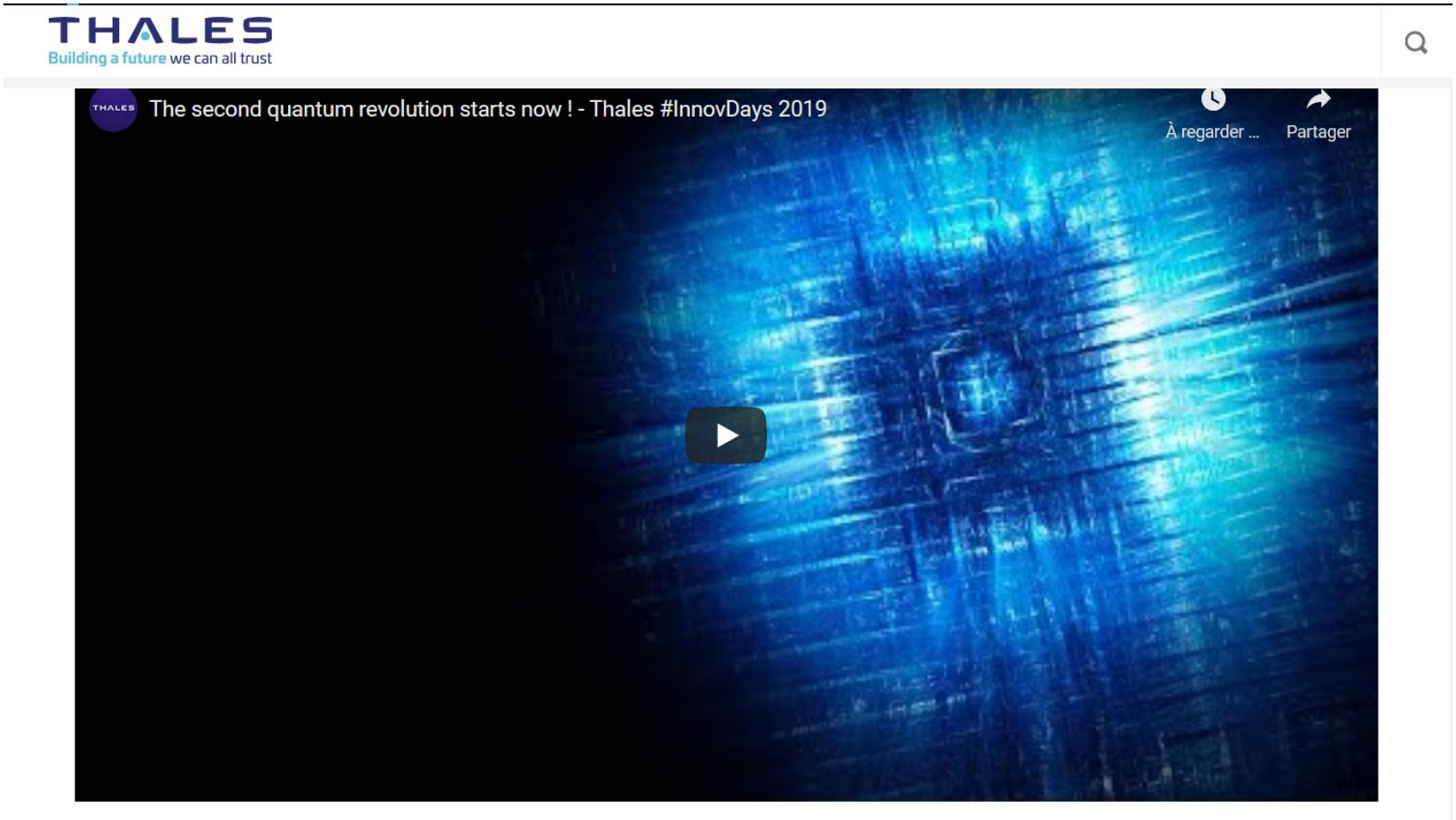

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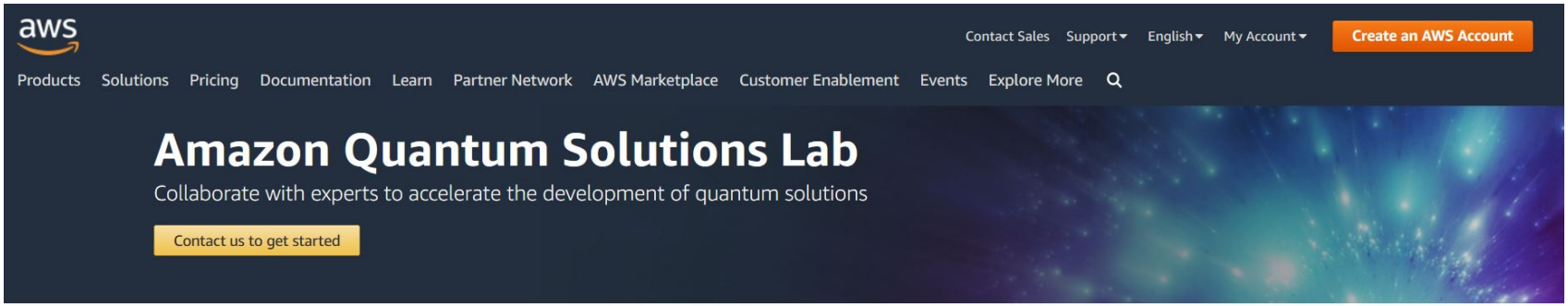
`https://aws.amazon.com/fr/quantum-solutions-lab/`



The Amazon Quantum Solutions Lab will help you get ready for quantum computing.

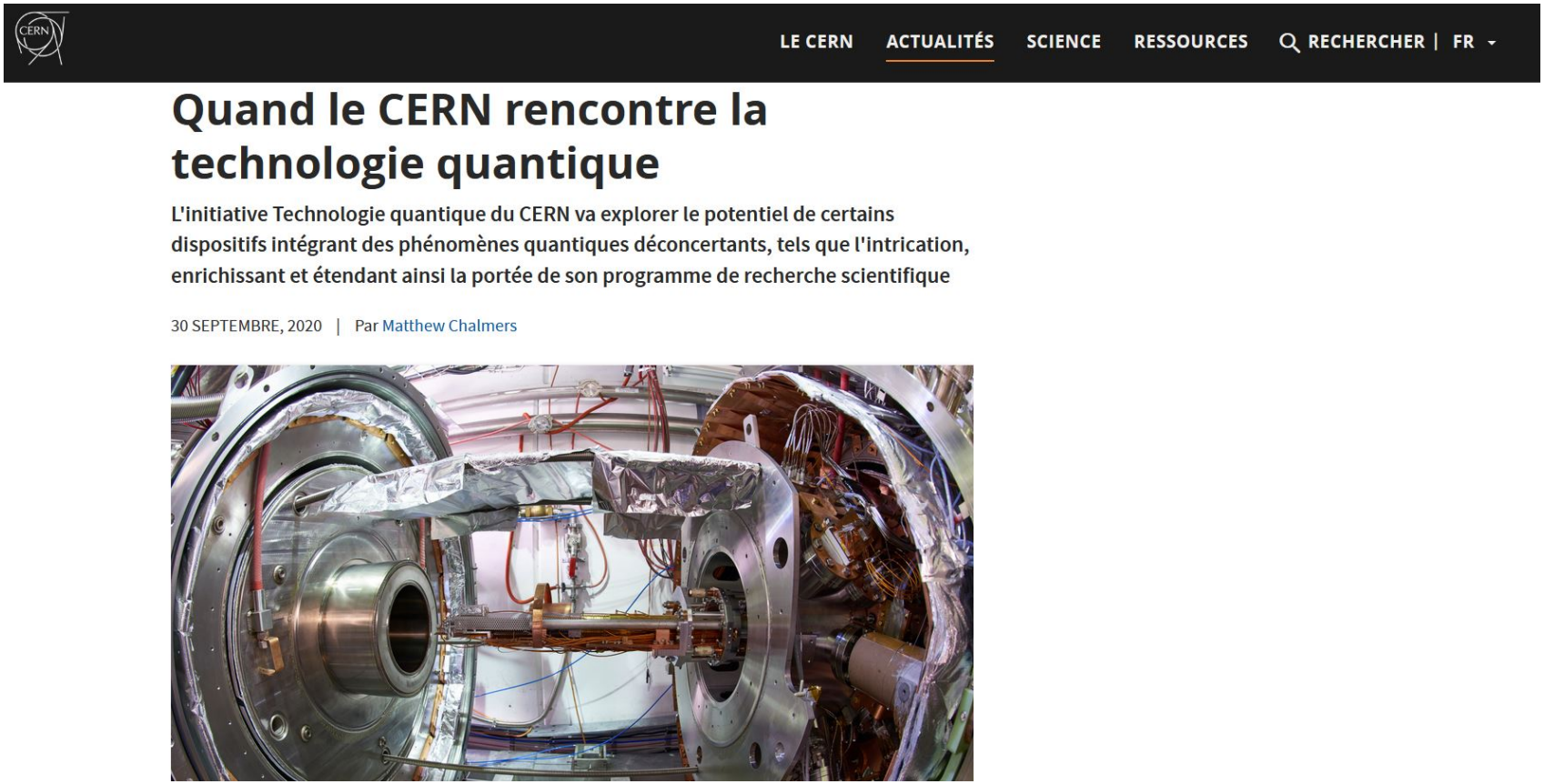
Amazon Quantum Solutions Lab engagements are collaborative research programs that allow you to work with leading experts in quantum computing, machine learning, and high-performance computing. The programs help you research and identify the most promising applications of quantum computing for your business and get quantum ready. Amazon Quantum Solution Lab experts will “work backwards” with you to dive deep and learn about the science of quantum computing, develop and benchmark new algorithms and solutions, and build the internal expertise and strategies required to prepare your organization for the future of quantum computing.

General introduction - motivation of these lectures

https://www.esa.int/Enabling_Support/Space_Engineering_Technology/Space_Optoelectronics/Quantum_Technologies

General introduction - motivation of these lectures

https://home.cern/fr/news/news/computing/cern-meets-quantum-technology



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https://iopscience.iop.org/article/10.1088/1367-2630/aad1ea

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ROADMAP • OPEN ACCESS

The quantum technologies roadmap: a European community view

Antonio Acín[1,2], Immanuel Bloch[3,4], Harry Buhrman[5], Tommaso Calarco[6], Christopher Eichler[7], Jens Eisert[8], Daniel Esteve[9], Nicolas Gisin[10], Steffen J Glaser[11], Fedor Jelezko[6] + Show full author list

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General introduction - motivation of these lectures

Two lectures:

- Introduction to Quantum computing ;
- Quantum technologies and industry.

Slides available online:

- `https://github.com/kmaussang/ECC-Quantum-computing`
- `https://github.com/kmaussang/ECC-Quantum-Technologies`

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General introduction - motivation of these lectures

Goal of these lectures:

- better understanding of what are exactly quantum technologies ;
- which physics and research behind it ;
- real opportunities vs oversold perspectives ;
- basics of quantum computing algorithms ;
- example of real quantum computer accessible online (IBM-Q) ;
- expected impact for industry.

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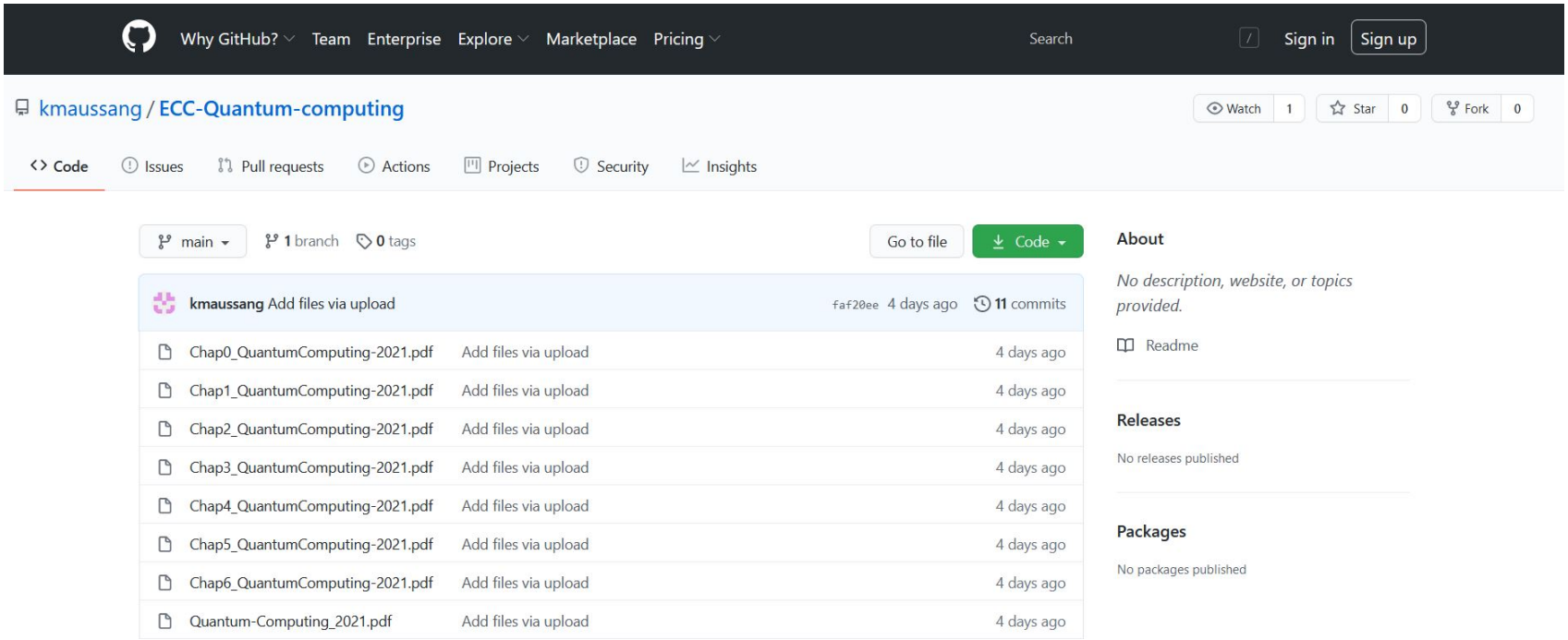

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