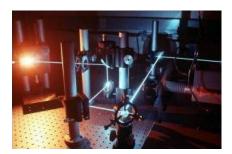
Towards the Quantum Technology Flagship: Quantum Revolutions

1st quantum revolution: quantum mechanics explains the structure and the interactions of atoms, light and matter.





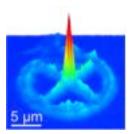


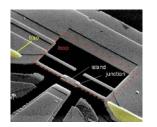
micro electronics

2nd quantum revolution: when reaching the level of individual quantum objects, the most surprising and far-reaching quantum properties (such as superpositions, entanglement) become experimental evidences.

These quantum properties open the way to revolutionary methods to process, communicate, and manipulate information carried by such objects.

source of individual photons





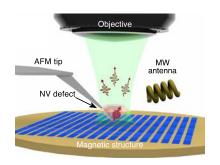
Quantum bit (qubit) in superconductors

Quantum Technologies

1. Quantum sensors and metrology: the ultimate physical precision

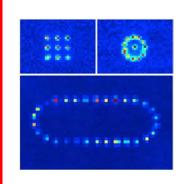


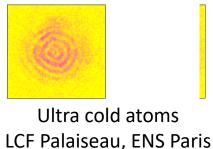
Gyrometer « on a chip » SYRTE, Obs. Paris, Thales



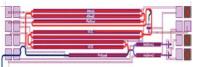
Micro-magnetometer LAC Orsay, Thales

2. Quantum simulations: beyond the computable.

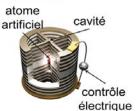


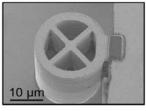


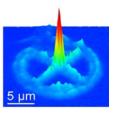
3. Quantum communications: *security of data transfer.*



Integrated quantum cryptography LIP6 Paris, LCF Palaiseau

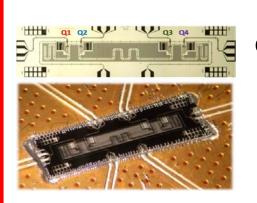






Artificial atoms and micro-cavities - C2N Palaiseau

4. Quantum computing: an algorithmic revolution.



Quantum circuits
with 4
superconducting
qubits
SPEC / CEA
Saclay

Disruptive Technologies

Investments at the international level:

* Public: Canada, USA, Australia, UK, Germany, NL, China...

* Private: IBM, Intel, Google, Microsoft, Toshiba, D-Wave...

in Europe: Bosch, Siemens, IMEC, Nokia, Airbus, IDQ...

in France: Thales, ATOS, SODERN... + PME: μQuans...



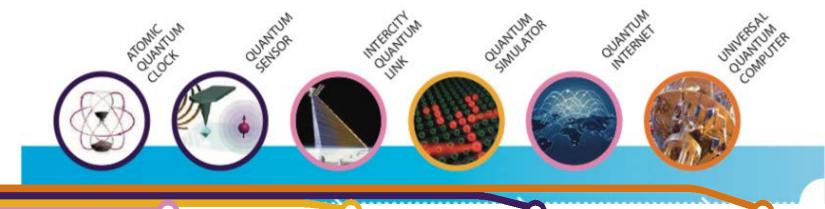
Toy quantum computer IBM (5 =>16 qubits)



European effort: "Quantum Technologies Flagship"

* D. Estève (CEA), P. Grangier (CNRS), T. Debuisschert (Thales) in the academic and industrial working group

E. Giacobino (CNRS), D. Dolfi (Thales), C. Allouche (ATOS) in the High Level Steering Committee (HLSC) for defining the « ramp-up phase » starting in 2018.



- 1. Communication
- 0-5 years -----
- A Core technology of quantum repeaters
- B Secure point-to-point quantum links

- 2. Simulators
- A Simulator of motion of electrons in materials
- B New algorithms for quantum simulators and networks

- 3. Sensors
- A Quantum sensors for niche applications (incl. gravity and magnetic sensors for health care, geosurvey and security)
- B More precise atomic clocks for synchronisation of future smart networks, incl. energy grids

- 4. Computers
- A Operation of a logical qubit protected by error correction or topologically
- B New algorithms for quantum computers
- C Small quantum processor executing technologically relevant algorithms

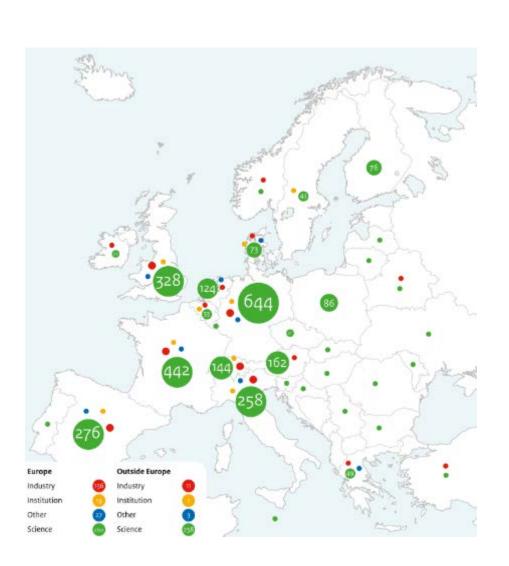
- 5 10 years
- C Quantum networks between distant cities
- D Quantum credit cards
- C Development and design of new complex materials

............

- D Versatile simulator of quantum magnetism and electricity
- C Quantum sensors for larger volume applications including automotive, construction
- D Handheld quantum navigation devices
- D Solving chemistry and materials science problems with special purpose quantum computer > 100 physical qubit

- > 10 years ------
- E Quantum repeaters with cryptography and eavesdropping detection
- Secure Europe-wide internet merging quantum and classical communication
- E Simulators of quantum dynamics and chemical reaction mechanisms to support drug design
- E Gravity imaging devices based on gravity sensors
- F Integrate quantum sensors with consumer applications including mobile devices
- E Integration of quantum circuit and cryogenic classical control hardware
- F General purpose quantum computers exceed computational power of classical computers

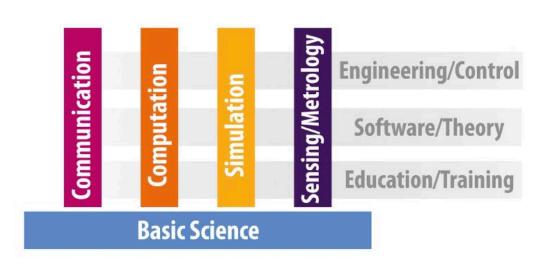
More than 3600 supporters from academia and industry





QT Flagship:

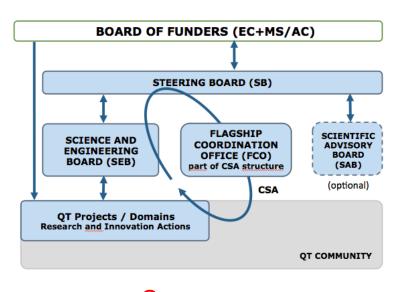
Input from the High Level Steering Committee



Strategic Research Agenda (SRA)
Implemented in the call

Quantum Technologies Flagship Intermediate Report

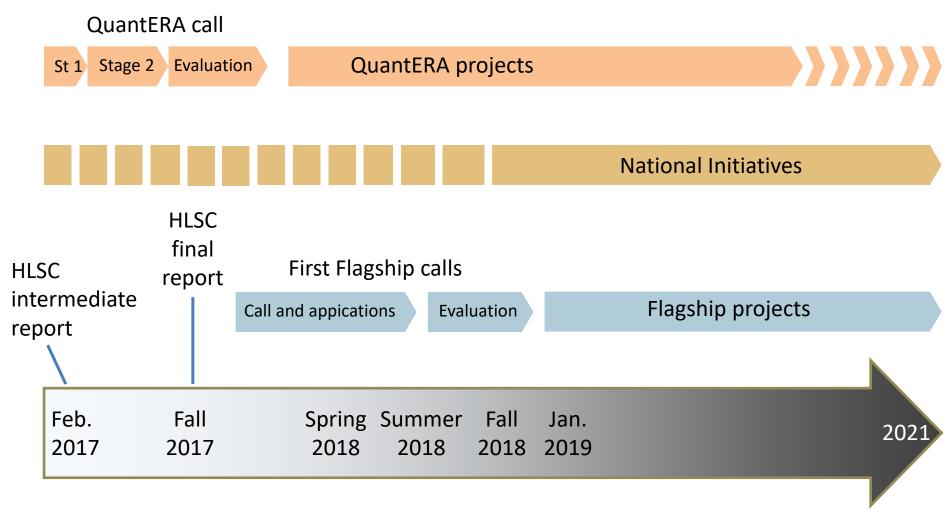
High-Level Steering Committee 16 February 2017



Governance
Still under discussion

Timeline: QT Flagship Call

Opening: 31 Oct 2017, Deadline: 20 Feb 2018



QT Flagship Call: funding

Conditions for the Call - FET FLAGSHIPS - Tackling grand interdisciplinary science and technology challenges

Opening date(s), deadline(s), indicative budget(s):²⁸

| Topics (Type of Action) | Budgets (EUR million) | Deadlines |
|--------------------------|-----------------------|-------------|
| | 2010 11 at | tention: |
| for your attention! | | |
| Thank you fo | .00 | 20 Feb 2018 |
| Thair | 130.00 | |
| Corall indicative budget | 148.00 | |

The indicative funding budget for area e. – Fundamental Science – under FETFLAG-03-2018 (RIA) is up to EUR 20 million.