

KICK-OFF MEETING – Friday 20 October 2017

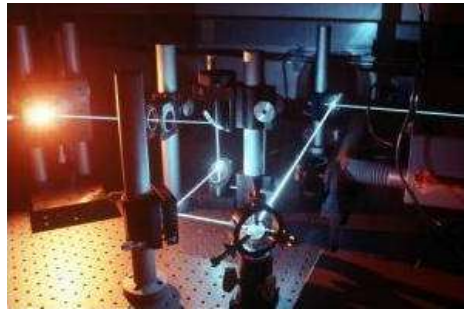
SIRTEQ

SCIENCE ET INGÉNIERIE EN RÉGION ÎLE-DE-FRANCE POUR LES TECHNOLOGIES QUANTIQUES

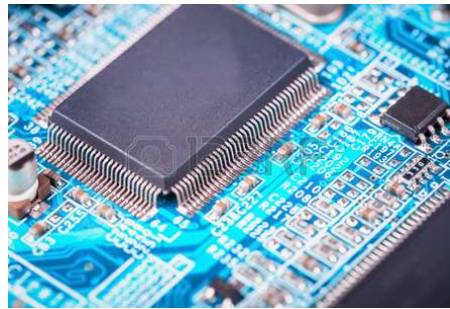
<http://www.sirteq.org>

Quantum revolutions

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



lasers

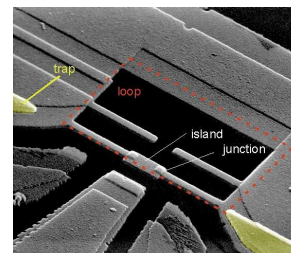
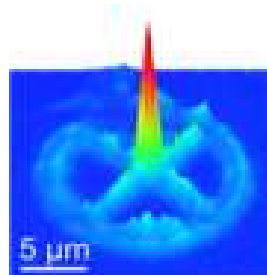


micro electronics

2^d 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 and manipulate the information carried by such objects.

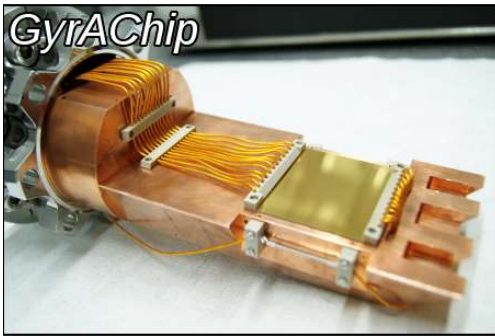
source of
individual
photons



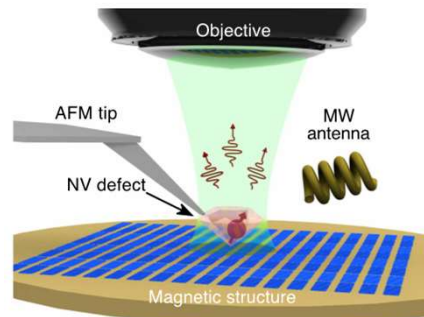
Quantum bit (qubit)
in superconductors

Quantum Technologies

1. Quantum sensors and metrology: *the ultimate physical precision*

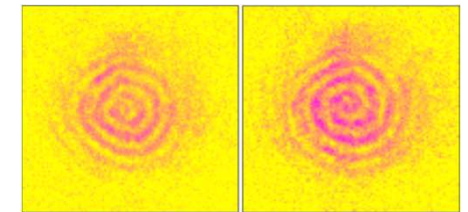
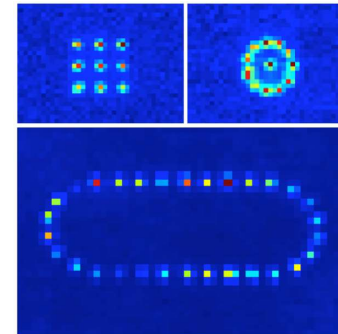


Gyrometer « on a chip »
SYRTE, Obs. Paris, Thales



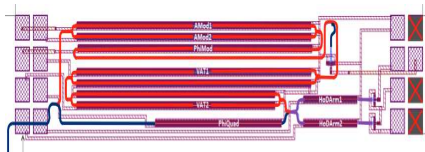
Micro-magnetometer
LAC Orsay, Thales

2. Quantum simulations: *beyond the computable.*

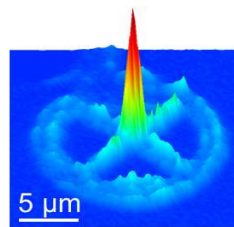
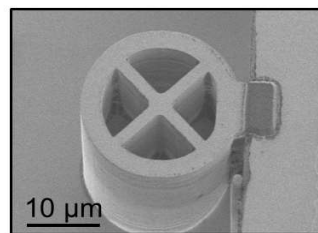
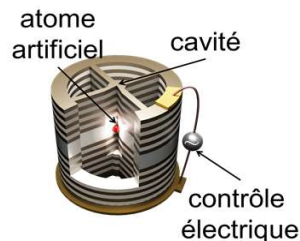


Ultra cold atoms
LCF Palaiseau, ENS Paris

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

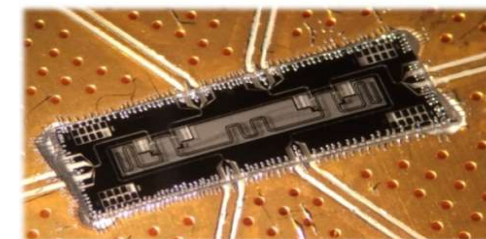
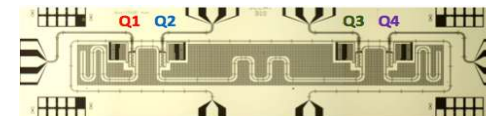


Integrated quantum cryptography
LIP6 Paris, LCF Palaiseau



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:

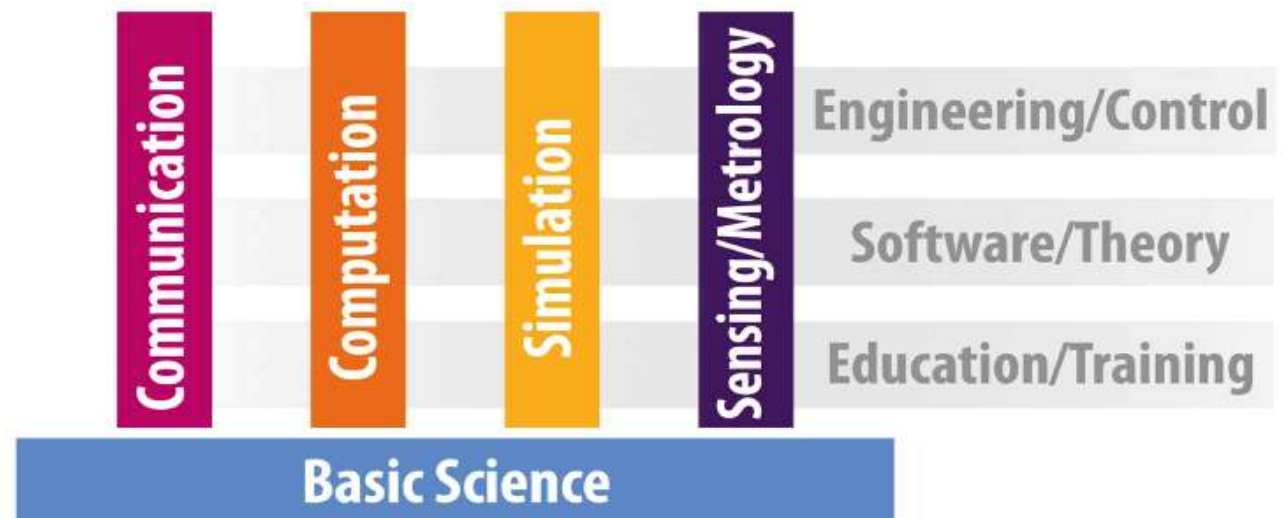
- * Public : Canada, USA, Australia, UK, Germany, Netherlands...
- * Private : IBM, Intel, Google, Microsoft, Toshiba, D-Wave...
 - in Europe : Bosch, Siemens, IMEC, Nokia, Airbus...
 - in France : Thales, ATOS, SODERN... + PME : μ Quans...



Toy quantum computer
IBM (5 => 16 qubits)



In Europe: «Quantum Technologies Flagship»

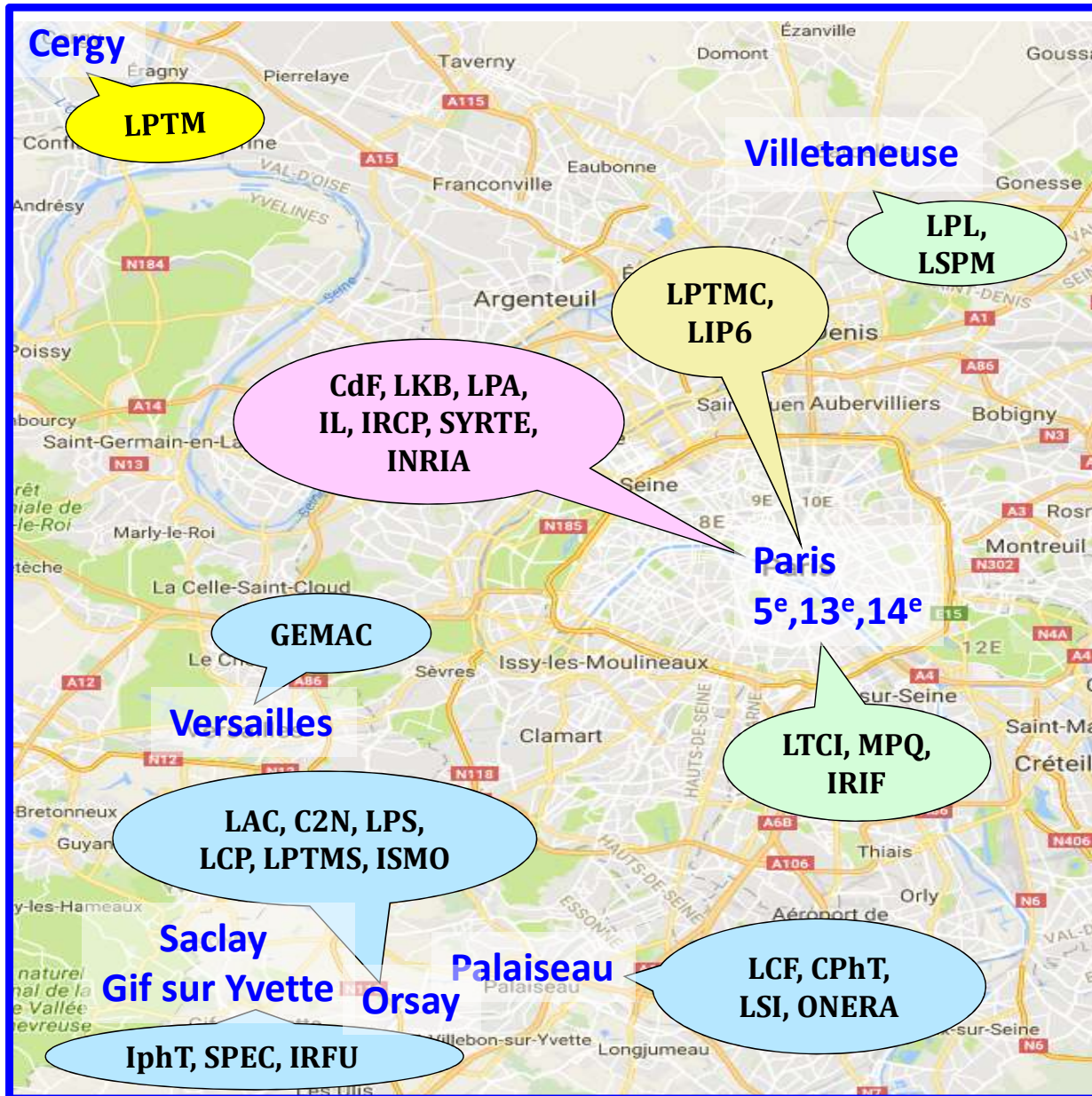
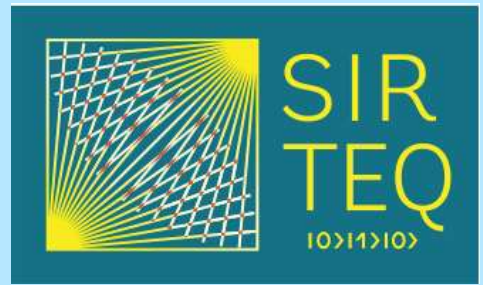


**In Ile-de-France (broad Paris area) selection of
« Domaines d'Interêt Majeur » (DIM), 4 years duration**

SIRTEQ

SCIENCE ET INGÉNIERIE EN RÉGION ÎLE-DE-FRANCE POUR LES TECHNOLOGIES QUANTIQUES

SIRTEQ : LABS AND TEAMS



Some numbers:

- * 300 CNRS, CEA or Univ. staff,
- * 250 doctoral students
- * 100 post-doctoral students,
- * **650 researchers total**
- * **>100 teams, 30 laboratories**

* 5 COMUE

U. Paris
Seine

U. Sorbonne
Paris Cité

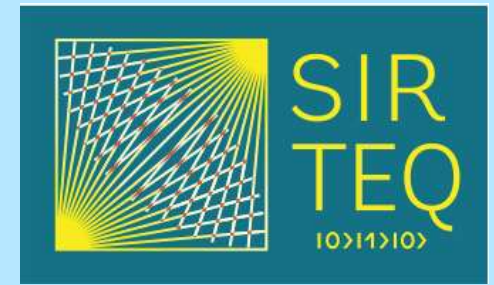
Paris
Sciences
et Lettres

Sorbonne
Universités

Université
Paris Saclay

- * gathers computer scientists and physicists from condensed matter, cold atoms, quantum optics, metrology, material science...

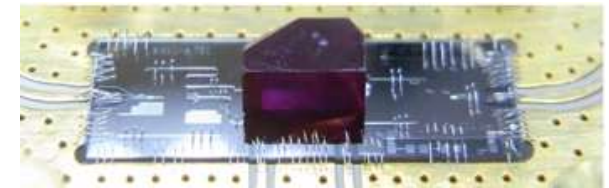
SIRTEQ : ORGANIZATION



Four pillars already quoted : sensing, simulations, communications, computing and two transverse axis :

A – Scientific and technological resources

- **identify and control** les relevant physical systems
- **stimulate technological innovations** required to exploit them.



Hybrid quantum circuit
diamond-superconductor.

B - Animation, training, valorisation.

- **communication** : web site, actions for visibility, dissemination
- **training** : basic and advanced science, entrepreneurship, international
- **valorisation** : intellectual property, startup incubation and creation



Governance and coordination

Three levels :

- **Scientific Committee:** 10 personalities external to the DIM (6 acad. and 4 ind.)
- **Steering Committee (COPIL):** initiates and validates all relevant actions for the DIM : internal call for proposals, events, funding management.
- **Six offices, one for each vertical or transverse axis:** animates the project's life, helps to manage the calls : choice of experts, first ranking of projects.

The committees warrant a good representation from the scientific, institutional, socio-economical point of views, taking also into account gender, age and careers.

Responsibilities :

COPIL : coordinator, project manager, thematic direction

Finance and administration : CNRS (DR4), accord INP.

Institutional agreement : Groupement d'Intérêt Scientifique (GIS).

Members of the Scientific Committee

- Jean-Michel Gérard CEA Grenoble, France
 - Anna Minguzzi CNRS Grenoble, France
 - Hans Mooij University of Delft, The Netherlands
 - Silke Ospelkaus University of Hannover, Germany (not here today)
 - Sébastien Tanzilli CNRS Nice, France (not here, but online !)
 - Jörg Wrachtrup University of Stuttgart, Germany
-
- Cyril Allouche ATOS-Bull, Paris, France
 - Thierry Debuisschert Thales Research and Technology, Palaiseau, France
 - Bruno Desruelle Muquans, Bordeaux, France
 - Khaled Karrai attocube, Munich, Germany

Members of the Steering Committee (COFIL)

Coordination : Philippe Grangier (LCF, IOGS) & Yara Hodroj (LCF, IOGS)

Thematic axis (pillars) :

1 - Quantum sensors and metrology :

Franck Pereira (SYRTE, Obs. P.) & Ivan Favero (MPQ, P7)

2 - Quantum simulations :

Hélène Perrin (LPL, P13) & Pascal Simon (LPS, P11)

3 - Quantum communications :

Eleni Diamanti (LIP6, P6) & Anthony Leverrier (INRIA)

4 - Quantum computation and algorithms :

Patrice Bertet (SPEC, CEA) & Iordanis Kerenidis (IRIF, P7)

Transverse axis (enabling) :

A - Scientific and technological resources :

Jean-François Roch (LAC, P11) & Takis Kontos (LPA, ENS)

B - Animation, training and valorization :

Michèle Leduc (LKB, ENS) & Pascale Senellart (C2N, P11)

Balanced for science (atoms : 4, solids : 7, comp. : 1), localisation (4 COMUE), gender (5 women, 9 men)

Industrial involvement



1. Collaborations for research and development on a medium-long term.

Implementation: research projects / contracts from ANR or Europe, fellowships, chairs...

Ex. : *Thales* (sensors), *ATOS* (computing), *SODERN* (clocks, sensors), *Plassys* (sensors) *iXSea* (accelerometers), *NOKIA* (crypto)...

3. Development & sale of enabling tools and equipments for quantum technologies.

Implementation: new dedicated products for vacuum, epitaxy, cryogenics, integration, optics, lers, optoelectronics...

Ex. (IdF) : *Astemec*, *Fichou*, *Quantel*, *MyCryoFirm*, *Plassys*, *Precisoud*, *Systrel*...

2. Scientific / industrial back-up : follow and help the development of future technologies.

Implementation: chairs, involvement in meetings or training, in dissemination actions, in experts discussion...

Ex. : *SAFRAN*, *SYSTRAN*...

4. Companies or start-ups directly exploiting quantum technologies.

Implementation : selling quantum sensors (gravimeters, magnetometers), quantum sources, detectors, cryptographic devices...

Ex. : *Muquans*, *Quandela*, *IDQuantique*...