Valorization and Quantum Technologies

Valorization day – 25/01/2023

Matthieu Delbecq

Sorbonne Université – Laboratoire de Physique de l'ENS

DIM QUANTIP

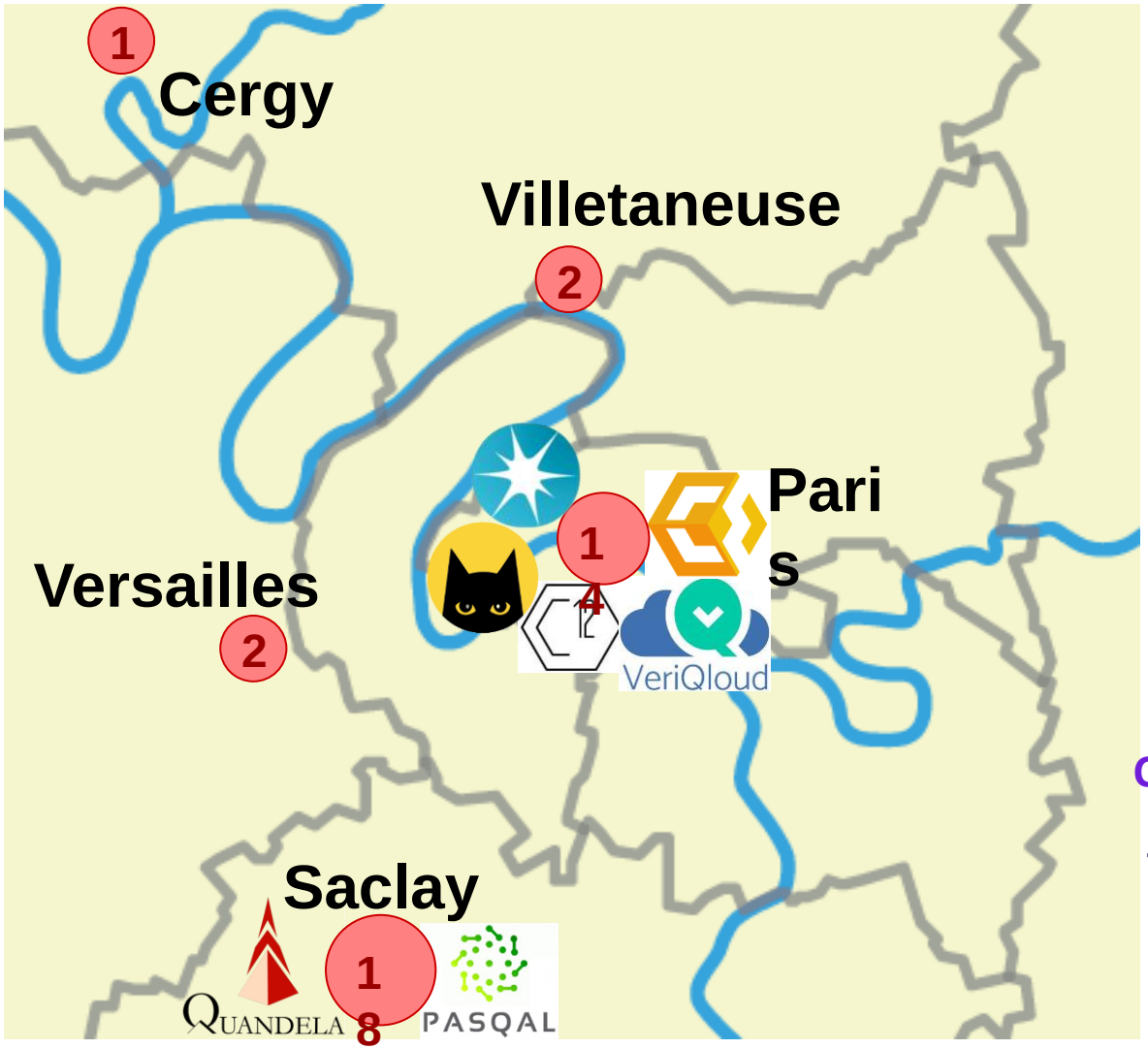
Le DIM QuanTiP en chiffres :

1100	138	38	47
CHERCHEURS	ÉQUIPES	LABORATOIRES	PARTENAIRES

Hélène Perrin

Senka Ćuk

Quantum Technologies in Paris Region



Pluridisciplinary research effort

+1000 researchers: (50% permanent 35% PhD students, 15% postdocs)

37 laboratories, 138 groups, 21 institutions, 6 scientific domains

7 startups born during SIRTEQ!

ALICE & BOB · PASQAL · LightOn · QUANDELA · VeriQloud · CRYPTONEXT SECURITY

Common projects with industry

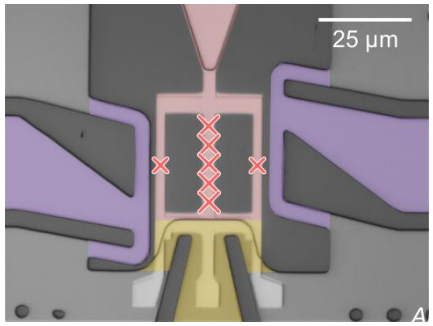
THALES · Atos · NOKIA · EDF · TOTAL · orange · Air Liquide · iXblue

MYCRYOFIRM Cryodevices & Consulting · CRYOHEMT Electronics for Scientific Research

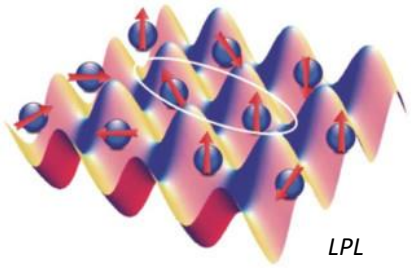
...and more

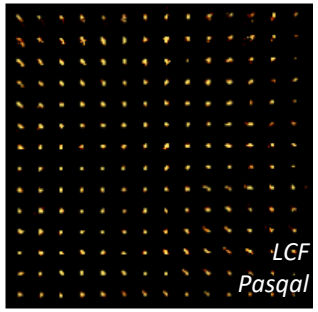
Quantum technologies: 4 ranges of application

Quantum computing

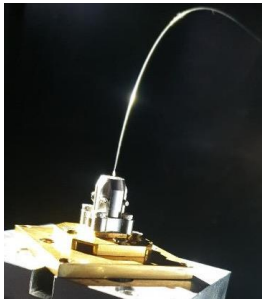


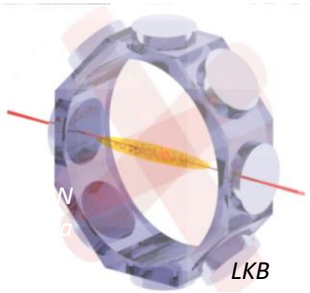
Quantum simulation



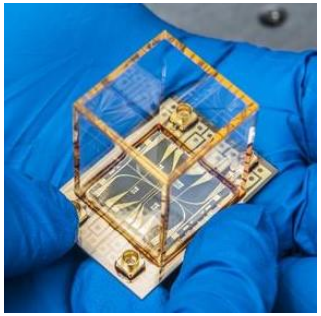


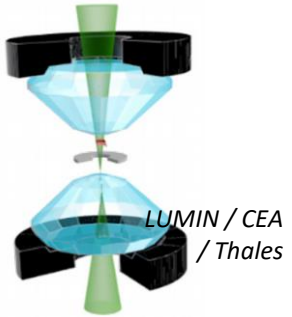
Quantum communications





Quantum sensing





Excellence in research and innovation

+200 european projects

9 Flagship among 20

7 start-ups

78 patents incl. 55 in quantum

3 Nobel prizes
4 gold medals
+100 prizes since 2015

joint projects with +20 industrials

43 ERC*

20 IUF°

~1000 international collaborations

Objectives of Quantip

Support research

collaborations

shared equipments

interdisciplinarity

reactivity

Trigger innovation

valorisation

collaborations

Club QuanTiP

meet 2 worlds training

Share

outreach

reach young people

international conference

visibility of QT

Axis B: scientific and industrial impact

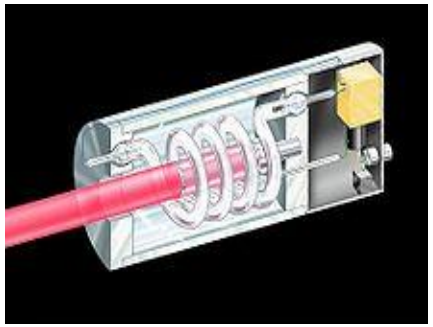
Matthieu Delbecq (LPENS)
C12

Pascale Senellart (C2N)
Quandela

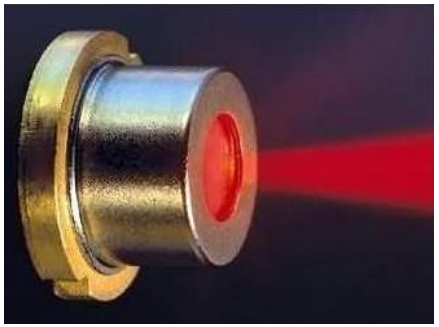
Senka Ćuk	QuanTiP	
Eleni Diamanti	LIP6	WeLinq
Sylvain Gigan	LKB	LightOn
Elvira Shishenina	Lab quantique	BMW

First Quantum Revolution

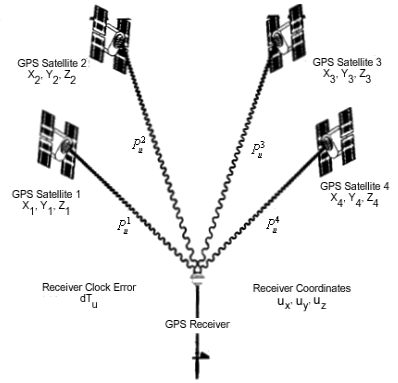
Transistor
1947



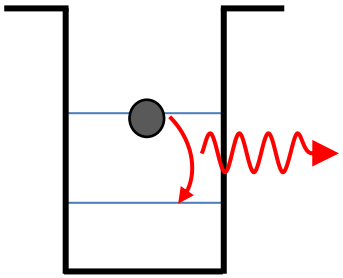
Ruby laser
1960

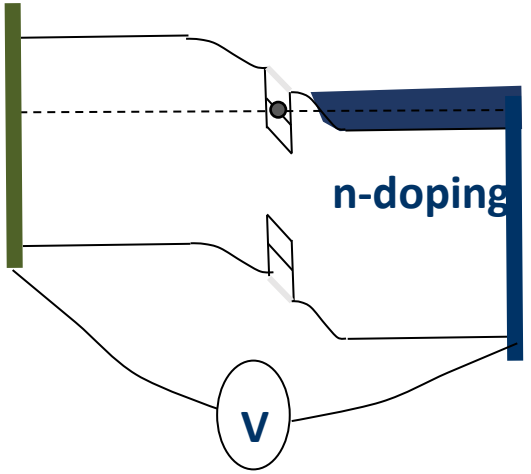


Laser diode
1962



GPS
1995

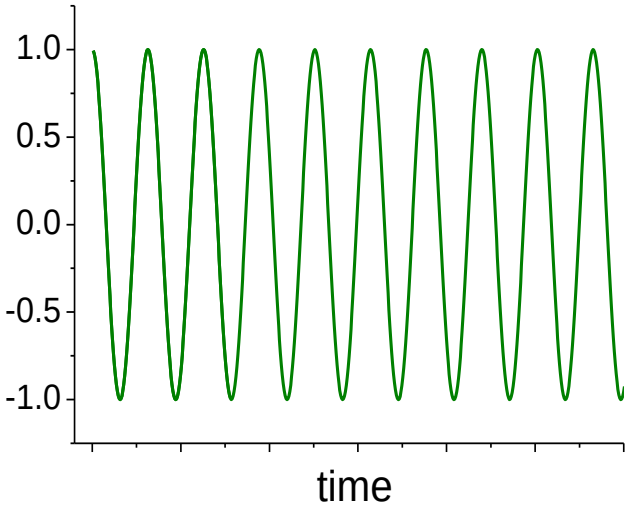


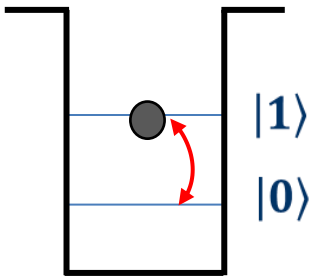


Precise knowledge and control of discrete energy levels

Dowling, J. P. & Milburn, G. J. Quantum technology: the second quantum revolution. Phil. Trans. R. Soc. A 361, 1655–1674 (2003).

1st ingredient: quantum coherence





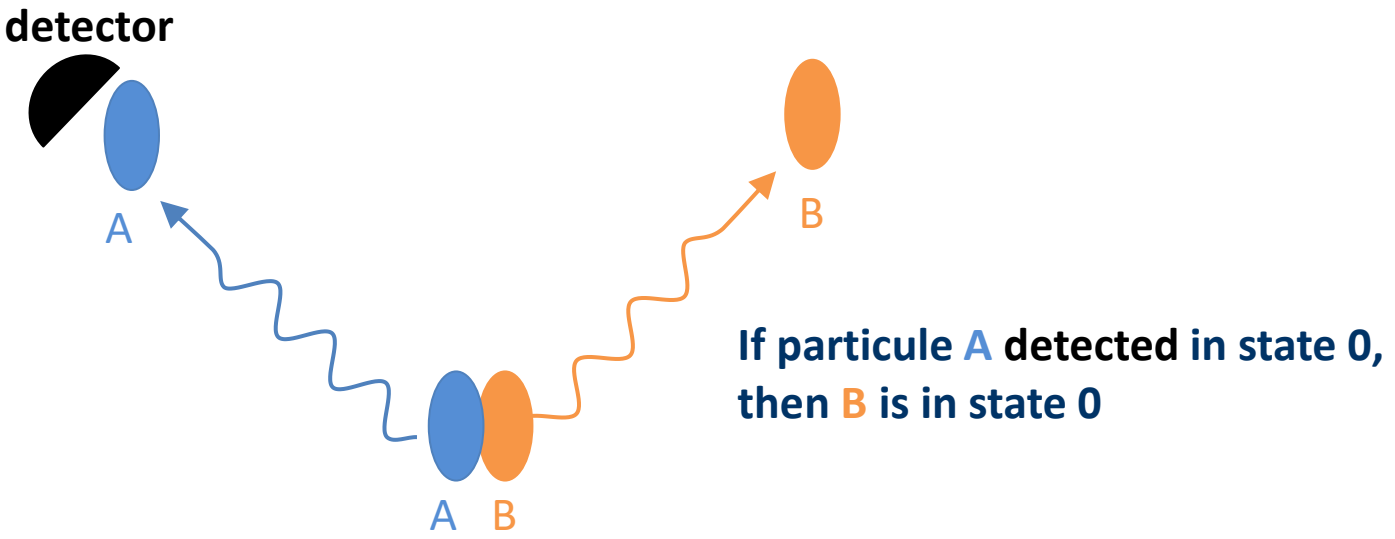
From the classical information bit $|0\rangle$ or $|1\rangle$

…to the quantum bit $|0\rangle + e^{i\phi}|1\rangle$

2nd ingredient: entanglement

Exemple: two particules A and B with a common fate:

$$|0_A, 0_B\rangle + |1_A, 1_B\rangle$$



Second quantum revolution in the media

Le Monde ACTUALITÉS ÉCONOMIE VIDÉOS DÉBATS CULTURE LE GOÛT DU MONDE SERVICES

ÉCONOMIE · TECHNOLOGIES

Les entreprises fascinées par la révolution quantique

Les Echos

Idées Économie Politique Entreprises Finance - Marchés Monde Bourse Tech-Médias Start-up Régions Patrimoine

Médias High Tech Intelligence artificielle

Quantique : trois technologies ébouriffantes à connaître, hormis l'ordinateur quantique

Les technologies quantiques, auxquelles la France va consacrer 1,8 milliard d'euros, sortent à peine du monde des laboratoires. Outre l'ordinateur quantique, elles pourraient donner naissance à des innovations bouleversantes d'ici quelques années.

Lire plus tard Commenter Partager Emmanuel Macron Google

La révolution la plus attendue est celle de l'ordinateur quantique universel. (Getty Images)

Quantum technologies hype in the media

[L'instant tech] Quand L'Usine Nouvelle teste l'ordinateur quantique photonique de Quandela

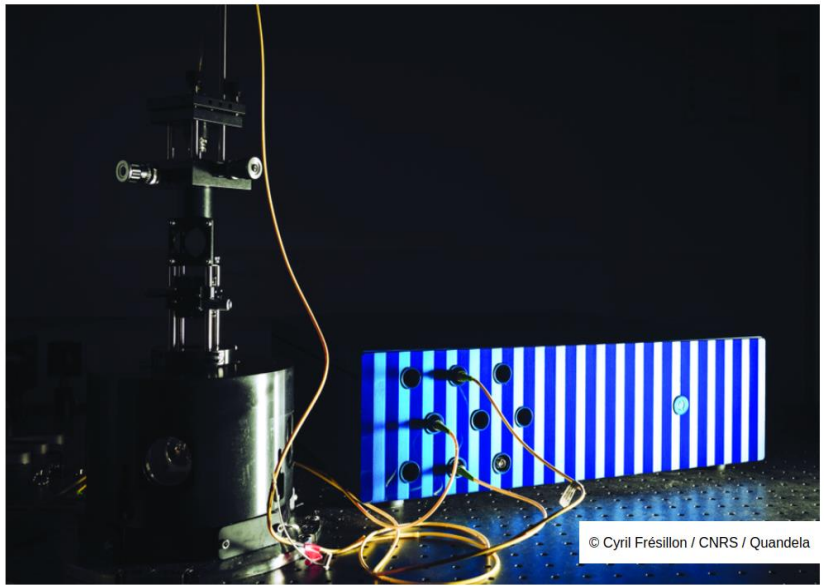
Avec l'aide de Yoann Pietri, doctorant au laboratoire d'informatique de Sorbonne Université (LIP6), L'Usine Nouvelle a pris en main l'ordinateur quantique photonique de la start-up Quandela, grâce à un accès exclusif à leur service cloud. De quoi s'offrir une petite immersion dans la programmation quantique sur le premier processeur européen accessible en ligne. Entre incompréhension et fascination.

Réservé aux abonnés

Gautier Virol

09 Janvier 2023 \
11h00

7 min. de lecture



Une installation expérimentale chez Quandela.

CC

Quantum technologies hype in the media

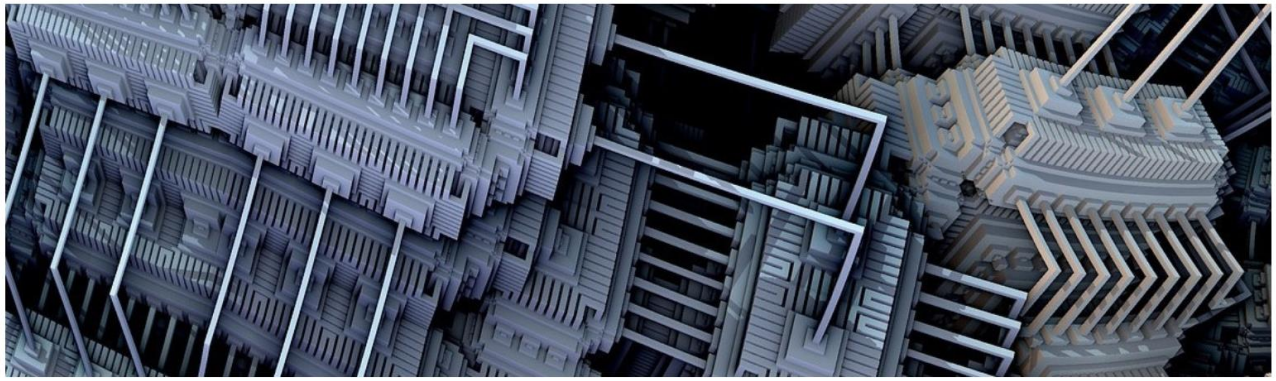
TECHNIQUES DE L'INGÉNIEUR

L'expertise technique et scientifique de référence

Tapez votre recherche ici

RESSOURCES DOCUMENTAIRES | LE MAGAZINE D'ACTUALITÉ | NOUVEAUTÉS

Accueil > Le Magazine d'Actualité > Informatique et Numérique > Siquance, la start-up française qui développe l'ordinateur quantique



EN CE MOMENT

Siquance, la start-up française qui développe l'ordinateur quantique

Quantum technologies hype in the media

Le Crédit agricole teste avec succès le quantique pour doper ses modèles prédictifs

Pour lire l'intégralité de cet article, **testez gratuitement Industrie & Technologies - édition Abonné**

La banque de financement et d'investissement du Crédit agricole boucle le premier cas d'usage réel résolu de A à Z grâce à l'informatique quantique. Un projet de quinze mois mené avec les start-up Pasqal et Multiverse.

Réservé aux abonnés

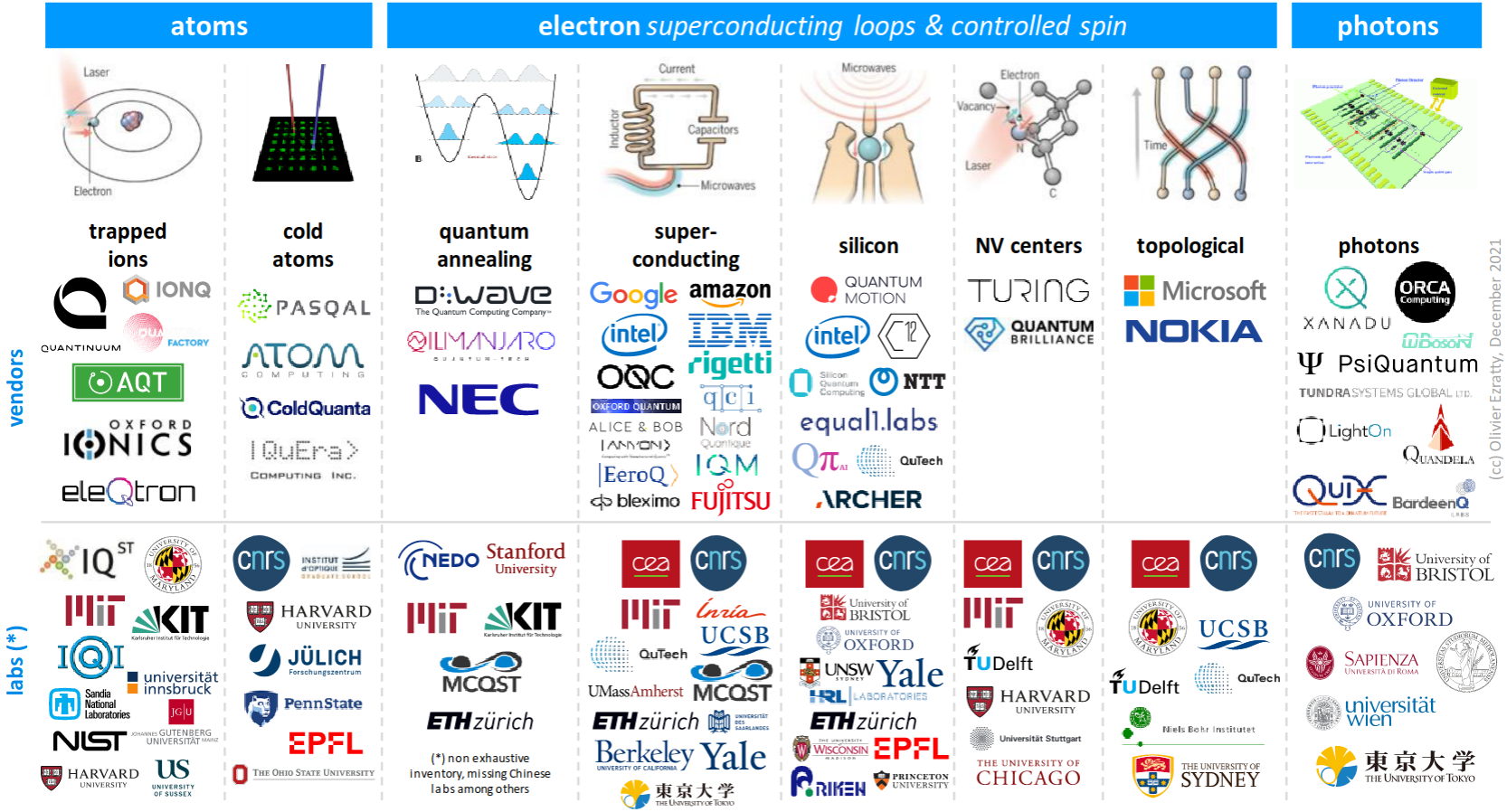
Kevin Poireault

05 Octobre 2022 \
10h00

5 min. de lecture

Le calculateur quantique de la deeptech Pasqal a été utilisé pour entraîner un modèle de machine learning.

Many actors in QC



O. Ezratty, Mitigating the Quantum Hype, arXiv:2202.01925.

Evolution of patenting in QT

Source : *Quantum Technologies Patents, Publications & Investments*, by Michel Kurek (QuantX, Le Lab Quantique)

Patents by countries and fields

	CN	US	JP	GB	KR	DE	RU	FR
2010	110	107	79	24	25	18	5	10
2011	128	145	87	33	26	26	6	6
2012	155	147	77	16	28	19	5	3
2013	231	185	93	46	26	20	10	4
2014	313	171	89	54	36	20	3	8
2015	385	214	82	31	38	36	7	9
2016	588	245	72	29	40	41	13	6
2017	885	280	67	29	82	19	8	10
2018	1 157	363	53	29	60	23	11	9

	CN	US	WO	JP	EP	KR	CA	GB	DE	AU	TW	IN	RU	BR	SG	IL	ES	FR
DIGITAL COMMUNICATION	2 010	400	332	216	170	192	39	55	17	38	41	45	19	19	14	14	15	5
MEASUREMENT	1 280	833	668	527	500	132	195	162	147	97	36	80	34	28	19	35	25	29
COMPUTER TECHNOLOGY	902	1 106	810	324	375	224	188	85	78	140	71	66	32	30	34	17	11	14
ELECTRICAL MACHINERY, APPARATUS...	775	853	656	418	455	136	166	231	161	35	67	61	22	19	26	8	10	10
SEMICONDUCTORS	482	616	509	357	226	202	88	54	60	71	142	32	16	7	32	3	3	14
OPTICS	421	353	268	259	147	98	36	41	43	21	65	23	18	10	9	6	7	10
TELECOMMUNICATIONS	354	226	173	100	88	60	42	39	28	21	18	23	11	13	13	6	6	2
MICRO/NANO STRUCTURE	169	361	310	136	169	106	73	33	35	66	30	27	12	5	16	4	3	8
ANALYSIS OF BIOLOGICAL MATERIALS	140	249	227	131	179	70	110	21	25	90	15	39	18	31	11	44	24	6
BASIC COMMUNICATION PROCESSES	136	254	179	118	96	51	53	25	30	48	14	14	10	10	13	5	7	2

France needs to step up in patenting !

Source : *Quantum Technologies Patents, Publications & Investments*, by Michel Kurek (QuantX, Le Lab Quantique)

Investments in QT

Les Echos

Idées Économie Politique Entreprises Finance - Marchés Monde Bourse Tech-Médias Start-up Régions Patrimoine

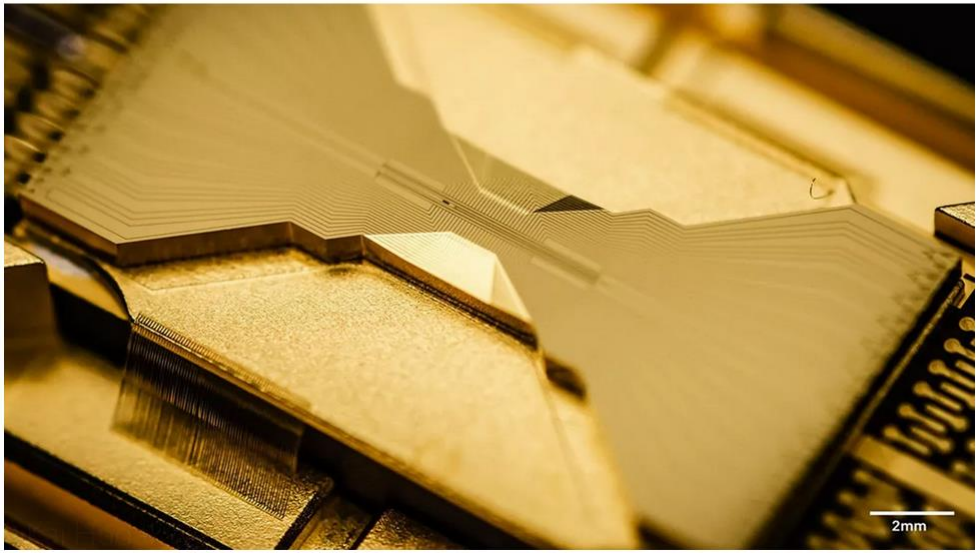
Médias High Tech Intelligence artificielle

Quantique : le réveil des investisseurs

05/11/2021

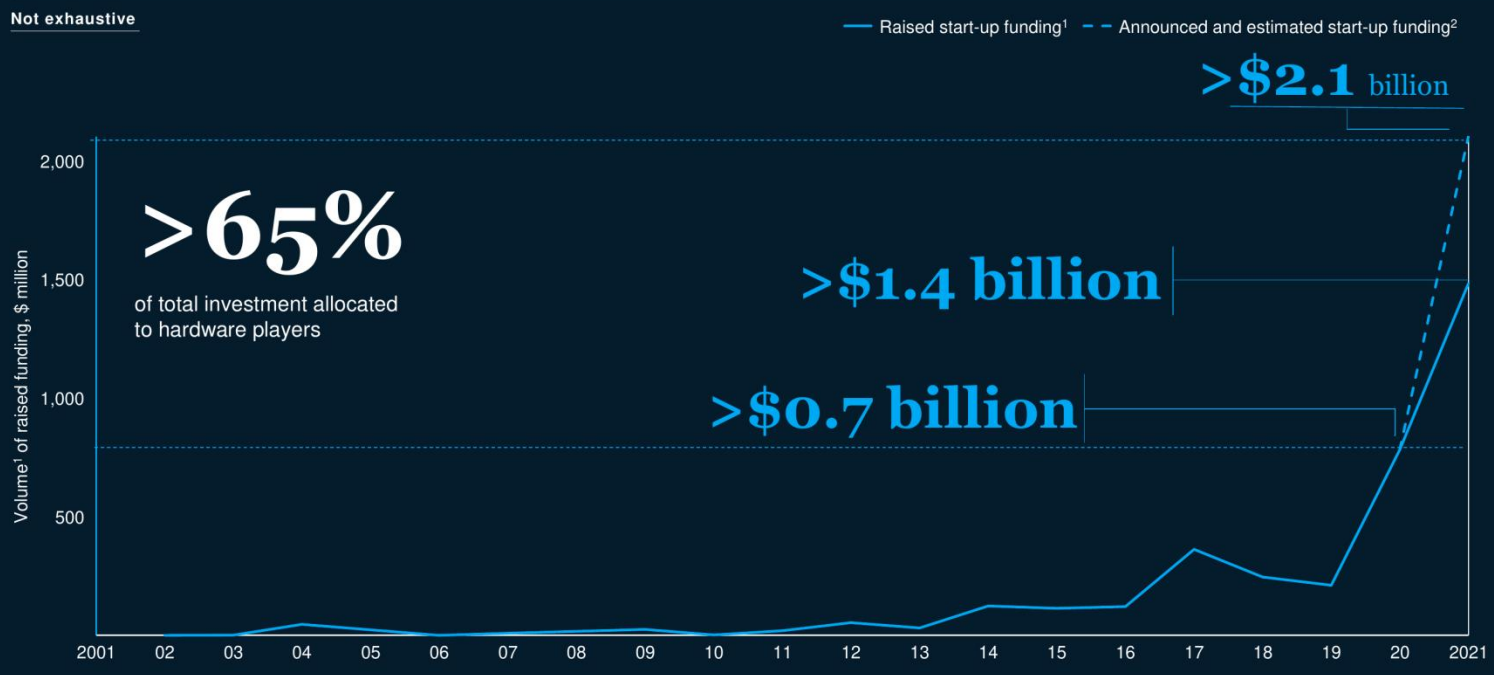
Les investissements privés dans les start-up qui développent des ordinateurs quantiques s'envolent. Les premières introductions en Bourse arrivent. La disponibilité des capitaux, les promesses de la technologie et la levée des premiers obstacles techniques ont ouvert au secteur les vannes de la finance.

Lire plus tard Commenter Partager Goldman Sachs Google



Une première start-up du quantique s'est introduite en Bourse début octobre avec une valorisation de 1,8 milliard de dollars. (IonQ)

QT start-up investment activity surpassed $1.4 billion in 2021, more than double that of 2020...



1. Based on public investment data recorded in PitchBook; actual investment is likely higher.
2. Public announcements of major deals; actual investment is likely higher as for 7 out of 20 deals done in 2H2021 the deal size was not disclosed.

Source: PitchBook; McKinsey analysis

Some recent fund raisings in quantum computing deeptech

- PsyQuantum raises **$450m** (2021); valuation of ~**$3.15b**
- ionQ raises **$350m** (2021); valuation of ~**$2b**
- Xanadu closes **$100m** deal; valuation **> $1b**

“Qunicorns”

- ColdQuanta announces **$110m**
- China’s Origin Quantum secures **$140m**
- Finnish Startup IQM raises **€128m**
- Atom Computing raises **$60m**
- Terra Quantum AG extends series A funding to **$75m**
- German-Based EleQtron Raises **€50m**
- D-Wave begins trading, secures **$150m** in long-term funding
- Silicon Quantum Computing , prepares For a **$91m** funding round

- Quantonation Ventures announces the final closing of its **€91m** Quantum Technologies Fund
- QBN and CM-Equity sets up **€100m** Quantum Technologies Fund

“Qfunds”

Some consultants' projections

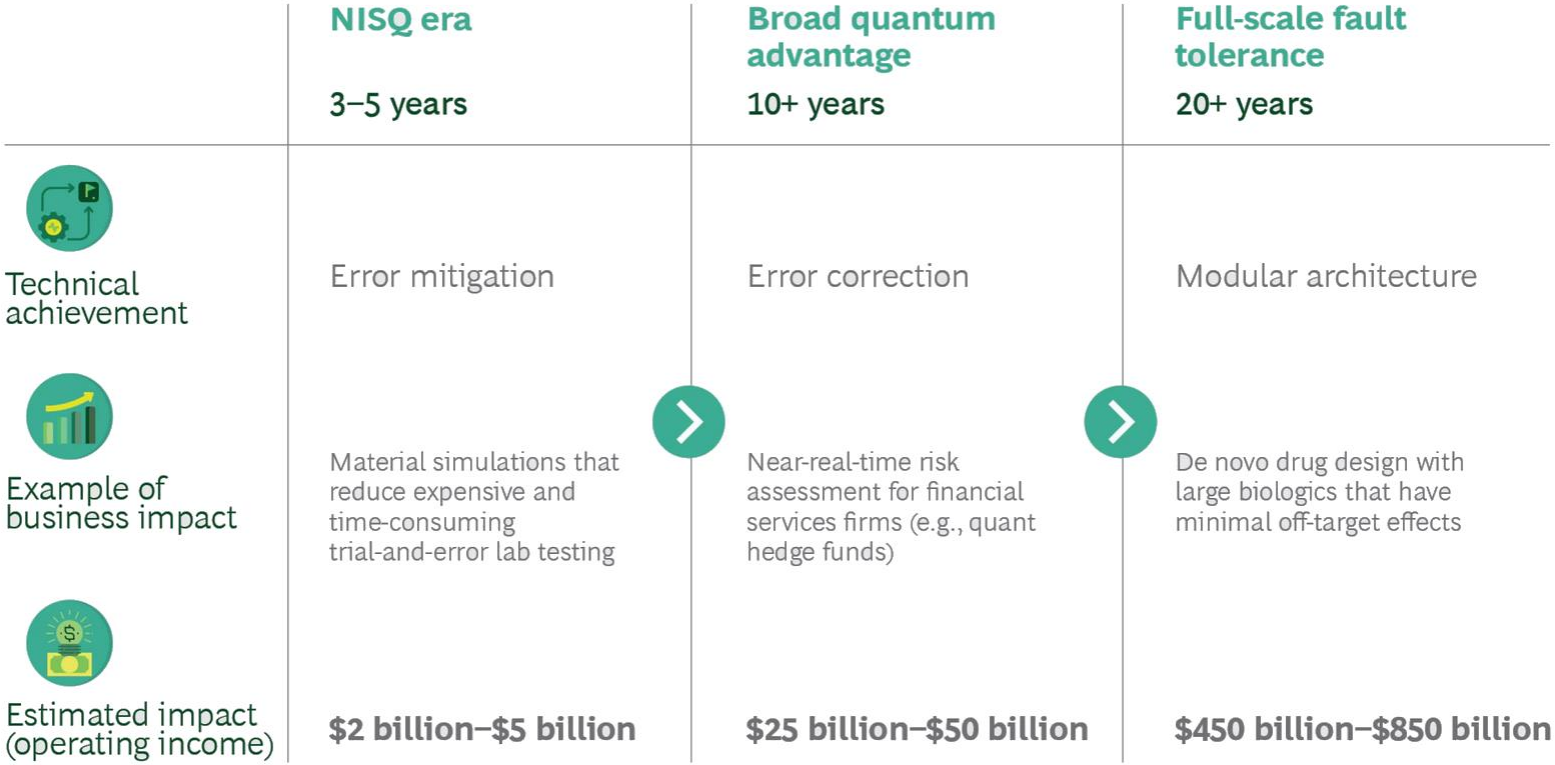
An equity market analyst firm estimates that **Quantinuum** could offer a significant return for **Honeywell investors**, with a valuation that could reach well into the billions. In a paper acquired by The Quantum Insider, Vertical Research Partners reported that, based on their assumptions and projections, the discounted equity value of Quantinuum could reach circa **$37 billion within a decade.**

QUANTINUUM

"THE VALUATIONS ARE HEADY BUT THE PROJECTIONS ARE BASED ON WHAT COULD BE AN ADDRESSABLE MARKET THAT WOULD BE WORTH TRILLIONS SPREAD OVER A NUMBER OF INDUSTRIES. BY 2050, HONEYWELL EXPECTS A $1 TRILLION IN USE CASES FOR QUANTUM AND QUANTINUUM COULD ADDRESS MORE THAN HALF — $550 BILLION — OF THAT TOTAL ADDRESSABLE MARKET."

Some consultants' projections

EXHIBIT 2 | The Expected Phases of Quantum Computing Maturity



Source: BCG analysis.

SiecleDigital

Économie Technologie Marketing Retail Cybersécurité Médias Réseaux sociaux Outils

TECHNOLOGIE

L'informatique quantique en passe de vivre une traversée du désert ?

Il semblerait que l'informatique quantique ne permettra pas de changer notre quotidien... Pour l'instant.

Par Zacharie Tazrout - @Zach_Tzt
Publié le 10 janvier 2023 à 17h41 - Mis à jour le 10 janvier 2023 à 18h00

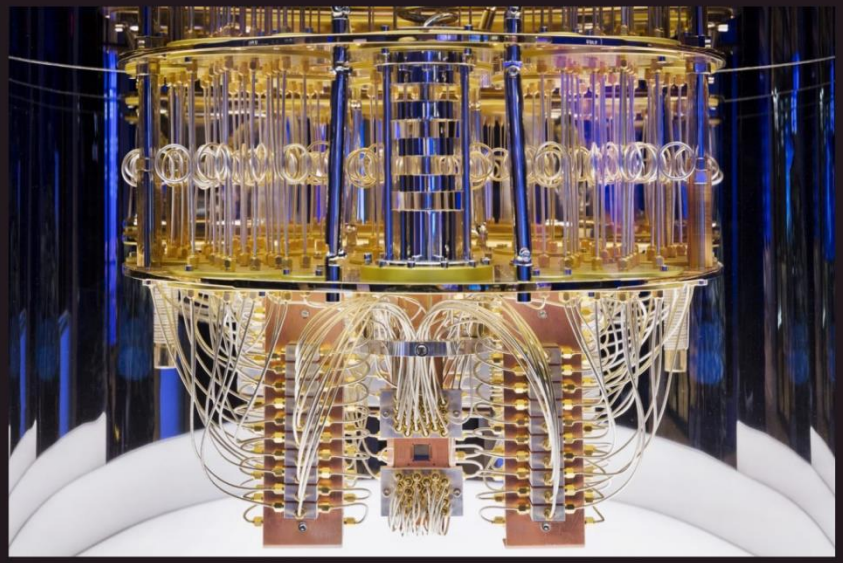


Image : IBM Research / FlickR.

À lire aussi

Des artistes portent plainte contre une IA génératrice d'images

LIRE L'ARTICLE

Les applications de Google bientôt dans les voitures Porsche ?

LIRE L'ARTICLE

Microsoft annonce l'arrivée de ChatGPT dans Azure OpenAI Service

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Docaposte, filiale de La Poste, s'installe un peu plus dans le secteur de la santé

The Guardian

The Observer
Technology

Computers need to make a quantum leap before they can crack encrypted messages

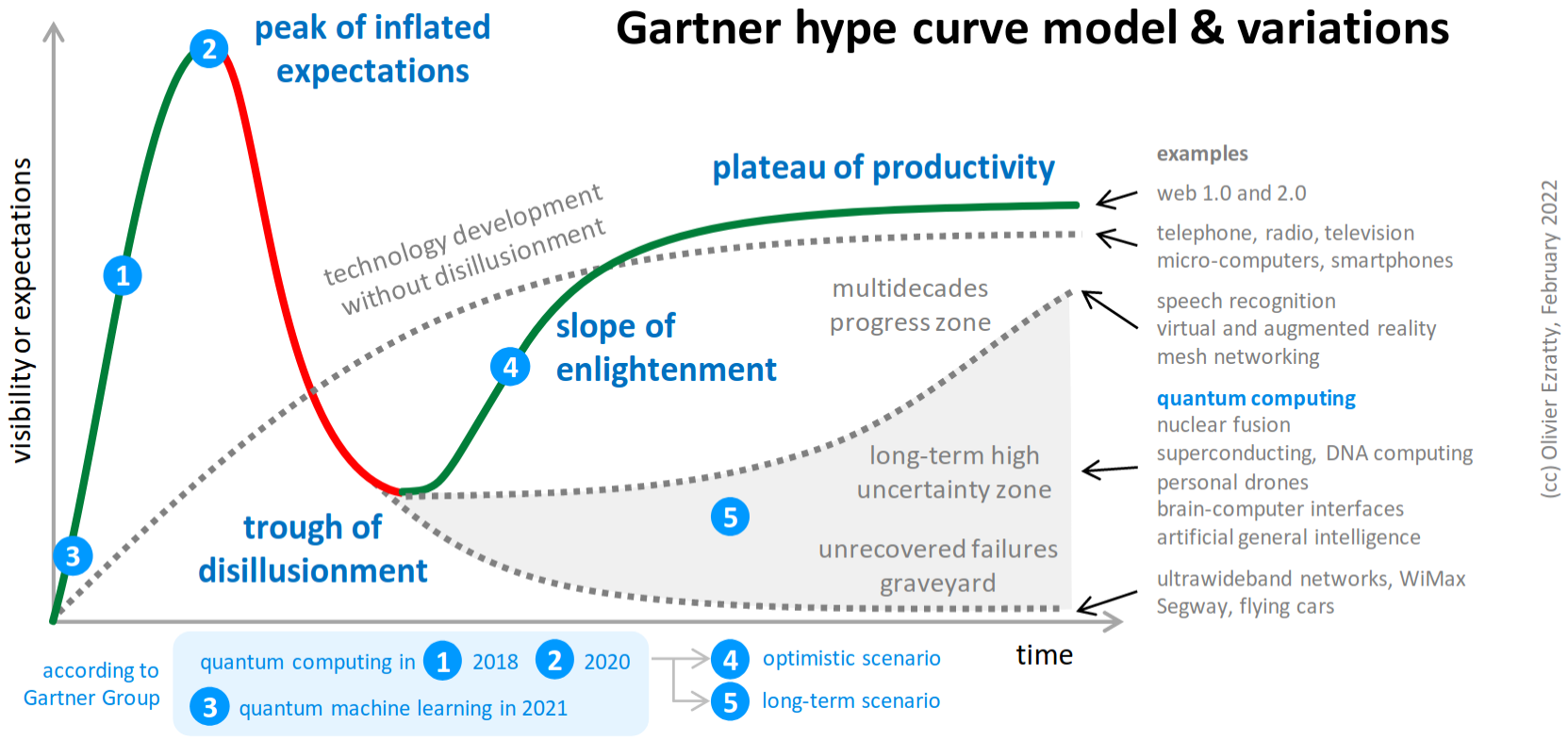
John Naughton

Sat 14 Jan 2023 16.00 GMT

The latest claims by scientists that they are able to break the most common digital encryption system are far-fetched

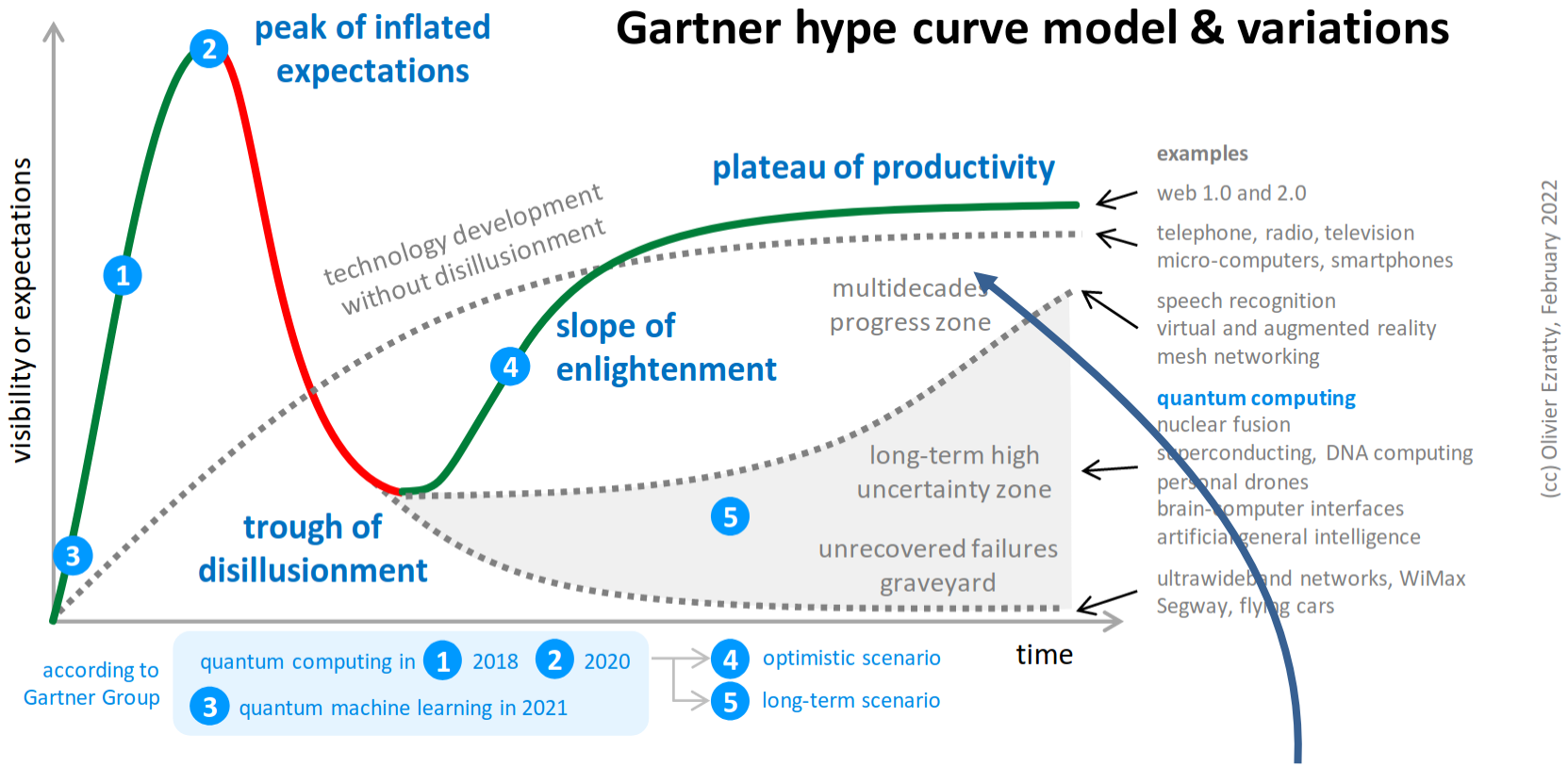
There will be more where that came from. So it's time for a reality check. Quantum computers are interesting, but experience so far suggests they are exceedingly tricky to build and even harder to scale up. There are now about 50 working machines, most of them minuscule in terms of qubits. The biggest is one of IBM's, which has - wait for it - 433 qubits, which means scaling up to 20m qubits might, er, take a while. This will lead realists to conclude that RSA encryption is safe for the time being and critics to say that it's like nuclear fusion and artificial general intelligence - always 50 years in the future. That doubtless will not prevent Rishi Sunak from declaring his intention to make the UK "a world leader in quantum" but my money is on RSA being secure for my lifetime - and possibly even Sunak's.

Quantum overhype?



O. Ezratty, Mitigating the Quantum Hype, arXiv:2202.01925.

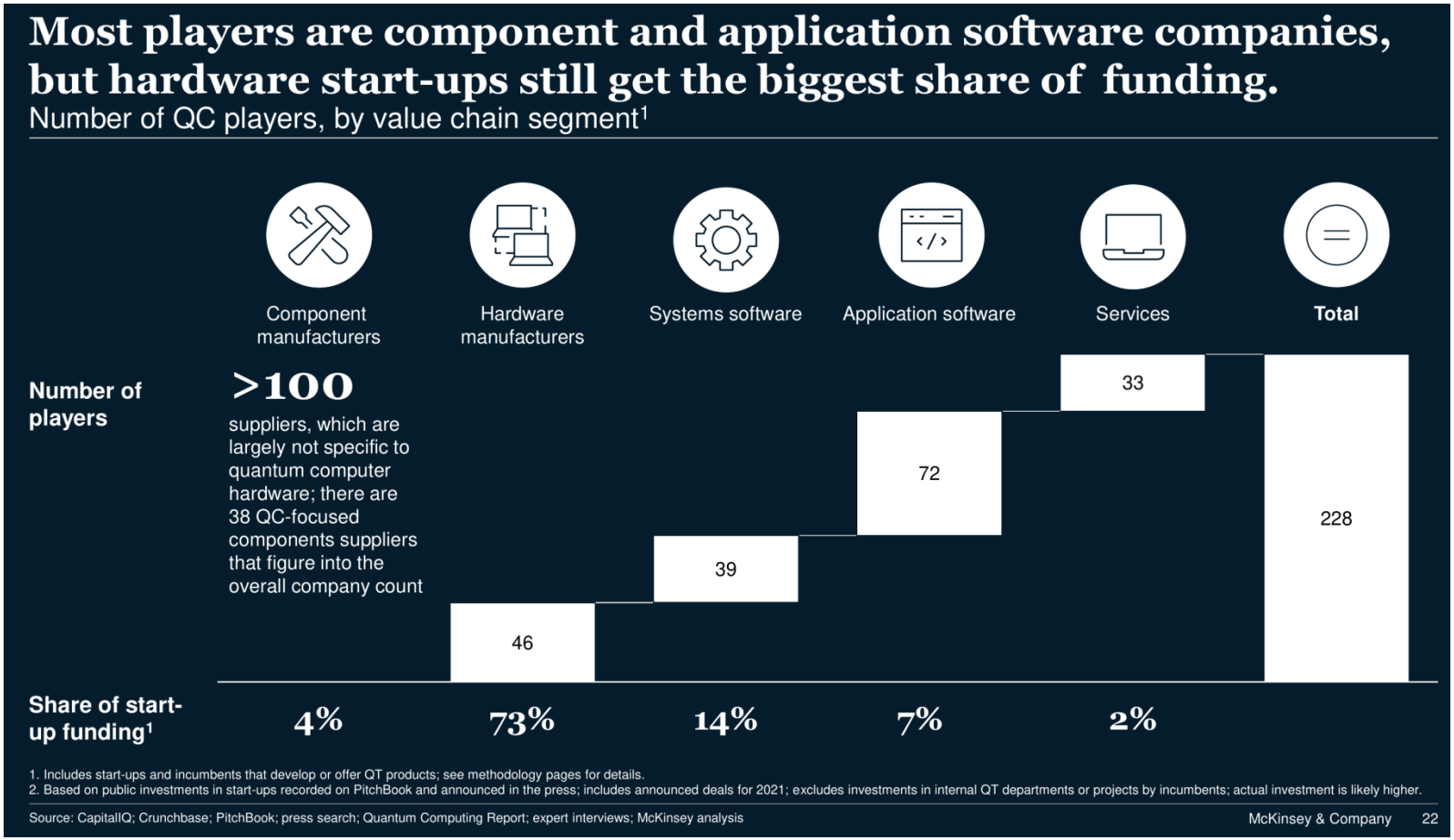
Quantum overhype?



We need to promote innovation and entrepreneurship to take the optimistic road

O. Ezratty, Mitigating the Quantum Hype, arXiv:2202.01925.

QC is more than “just qubits”



QC is more than “just qubits”

Most players are component and application software companies, but hardware start-ups still get the biggest share of funding.

Number of QC players, by value chain segm

Component manufacturers

>100

suppliers, which are largely not specific to quantum computer hardware; there are 38 QC-focused components suppliers that figure into the overall company count

Number of players

Share of start-up funding[1]

4%

Total

228

39

46

1. Includes start-ups and incumbents that develop or offer QT products;
2. Based on public investments in start-ups recorded on PitchBook and

Source: CapitalIQ; Crunchbase; PitchBook; press search; Quantum Com

Success Story at 10h

Zurich Instruments

Romain Stomp

Applications

Quantum Technologies

Optics & Photonics

Impedance Measurements

Scanning Probe Microscopy

Nanotechnology & Materials Science

Sensors

And QT is more than QC

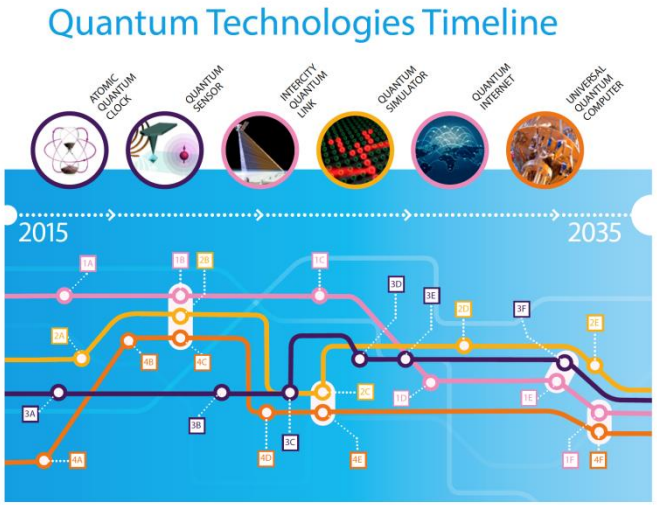
Success Story at 15h30

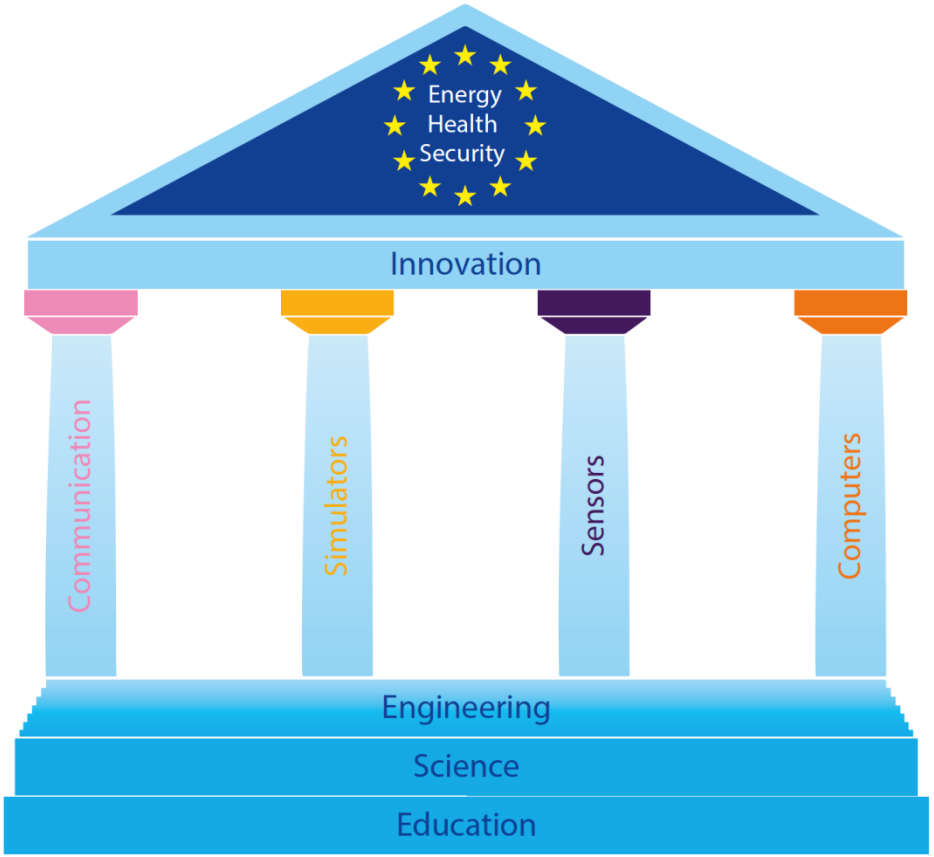
Chipiron startup

Dimitri Labat

European flagship for QT

An inclusive European programme will see excellent research teams and relevant industry actors collaborating on an ambitious roadmap towards a common set of goals, while balancing long-term quantum technology research with complementary investment in shorter-term programmes. Public support for innovation must be made available for companies to kick-start the supply chain for these new technologies and to translate laboratory demonstrators into commercial products. Elements of a European programme are shown in the diagram below.





A new jargon to learn

Do you know these ?

TRL

Know-how

Innovative activity

Claims

Love Money

Licensing

Homme de métier

Challenge+

Scientipole

INPI

Pre-maturation

Statut JEI

BPI

Maturation

SATT

ASTRID

Incubateur

FIST

Centrale-Supelec Entrepeneur

Technology Readiness level

TRL

- TRL 1 – basic principles observed
- TRL 2 – technology concept formulated
- TRL 3 – experimental proof of concept
- TRL 4 – technology validated in lab
- TRL 5 – technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6 – technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 7 – system prototype demonstration in operational environment
- TRL 8 – system complete and qualified
- TRL 9 – actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

A new jargon to learn

Do you know these ?

TRL

Know-how

Innovative activity

Claims

Love Money

Licensing

Homme de métier

Challenge+

Scientipole

INPI

Statut JEI

Pre-maturation

BPI

Maturation

SATT

ASTRID

Incubateur

FIST

Centrale-Supelec Entrepeneur

Key principles for scientist aiming to found a start-up

Eric Langrognet
at 11h

- Engineer – Ecole Centrale
- CEO and founder of several companies
- Coach for entrepreneurs

A new jargon to learn

Protecting your ideas

Do you know these ?

TRL

Know-how

Innovative activity

Claims

Love Money

Licensing

Homme de métier

Challenge+

Scientipole

INPI

Statut JEI

Pre-maturation

BPI

Maturation

SATT

ASTRID

Incubateur

FIST

Centrale-Supelec Entrepeneur

Patent: a tool for innovation

Enrico Priori

at 14h30

ATOUT [PI]
LAPLACE
GROUPE VIDON

- PhD in laser physics.
- 20 years of experience in industrial property
- Expert in
  - drafting patent applications and defending them during examination procedures;
  - patentability, freedom to operate and infringement studies;
  - infringement litigation and patent validity.

A new jargon to learn

Financing your first steps

Do you know these ?

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Funding your first steps

16:50 - 17:40

Programme de prématuration du CNRS, Patrick MOREAU, INP CNRS

Activités & Programme de maturation, Yann GERARD, SATT Erganeo

Financing pre-matured – matured projects, Xavier FANTON, SATT Lutech

A new program for accelerating your innovation within Sorbonne University Alliance, Olivia LEROY, Faculté des sciences et ingénierie, Sorbonne Université

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"AAP 2022 Valorisation" of the DIM QuanTiP, Pascale SENELLART, C2N, DIM QuanTiP

Today's program

Program of the day

09:00 - 09:30
Welcome coffee, instalation of posters

09:30 - 10:00
Valorization and quantum technologies, Matthieu DELBECQ, LPENS, DIM QuanTiP

10:00 - 11:00
SUCCESS STORY: Zurich Instruments, Romain STOMP

11:00 - 12:00
Key principles for scientists aiming to found a start-up,
Eric LANGROGNET, Limpidea Management

12:00 - 13:00
Lunch break

13:00 - 14:30
Poster session in parallel with Technological contest

14:30 - 15:30
Patent - a tool for innovation, Enrico PRIORI, Atout[PI] Laplace

15:30 - 16:30
SUCCESS STORY: Chipiron, Dimitri LABAT

16:30 - 16:50
Coffe break

16:50 - 17:40
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17:40
Technological contest winner announcement
Poster prize announcement