



quantum *computing* this decade

how today's world will impact the quantum industry's trajectory

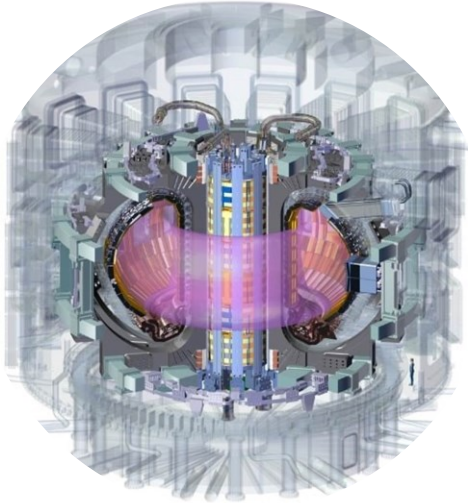
olivier ezratty

< author | ... >

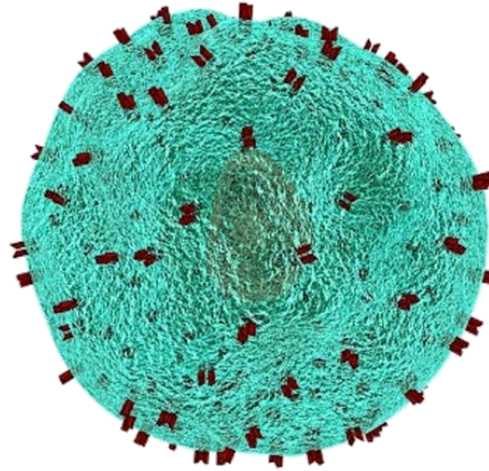
olivier@oezratty.net www.oezratty.net

Amsterdam, June 12th, 2024

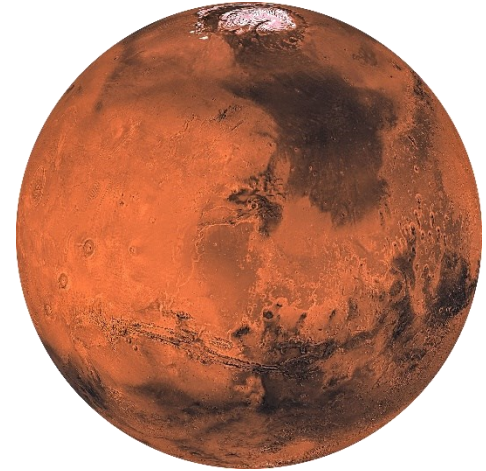
long-term scientific quests



nuclear fusion



biotechs



deep space

beware of overpromises...

BCG

Quantum Computing Is Becoming Business Ready

QUANTUM COMPUTING / ARTICLE

Quantum Computing Is Becoming Business Ready

MAY 04, 2023

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By Matt Langjone, Jean-François Bobier, Zheng Cui, Cassia Naudet-Baulieu, Amit Kumar, and Antoine Gourévitch

READING TIME: 8 MIN

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INNOVATION

Who Is Investing In The \$850 Billion Quantum Tech Market And Why

Susan Galer Brar
SAP BRANDVOICE

Eos

ABOUT SPECIAL REPORTS TOPICS PROJECTS NEWSLETTER SUBMIT TO EOS

How Quantum Computing Can Tackle Climate and Energy Challenges

The day is coming when quantum computers, once the stuff of science fiction, will help scientists solve complex, real-world problems that are proving intractable to classical computing.

By Annarita Giant and Zachary Goff Eldredge 21 October 2022

THE QUANTUM INSIDER

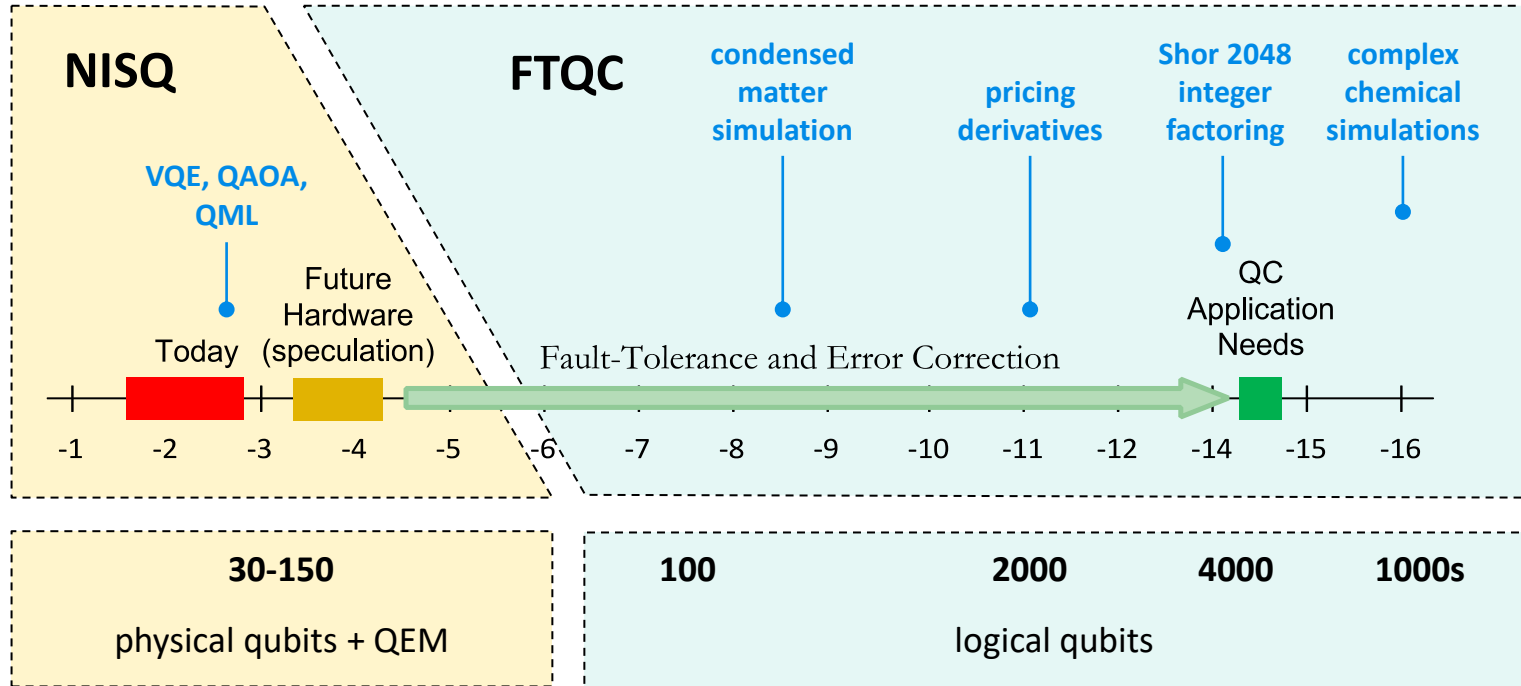
Quantum Computing Business, Research

Quantinuum's Quantum Monte Carlo Integration Engine Shows Early Stage Quantum Advantage

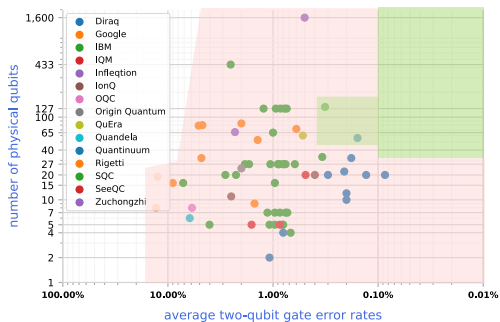
Matt Swayne • September 13, 2023

Marketing Reports

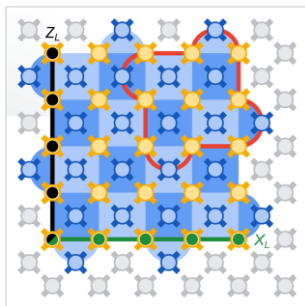
industry needs: 1,000s of logical qubits



key hardware challenges



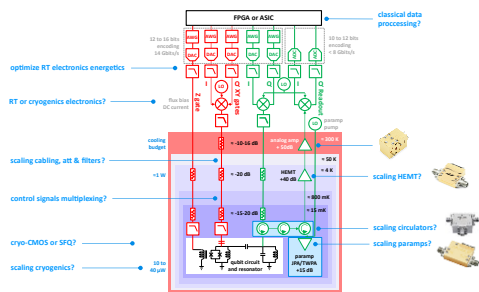
qubits fidelities



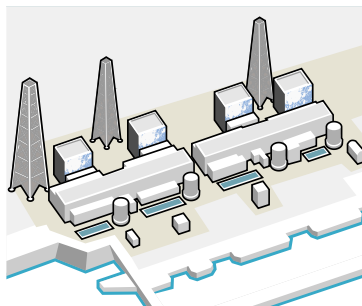
errors mitigation and correction



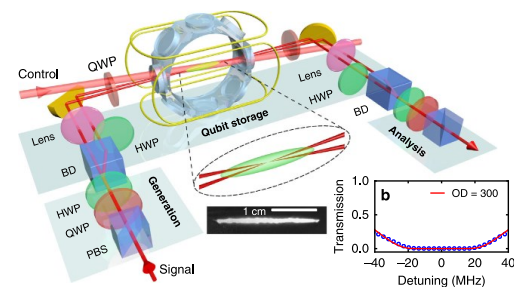
quantum interconnect



enabling technologies scalability

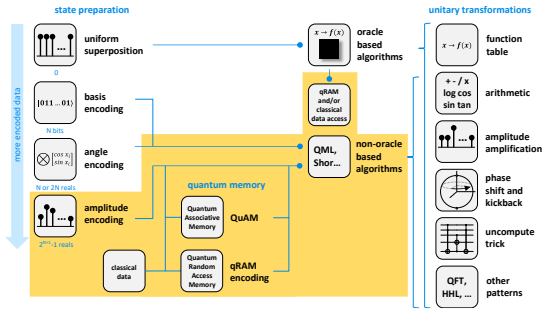


energy consumption

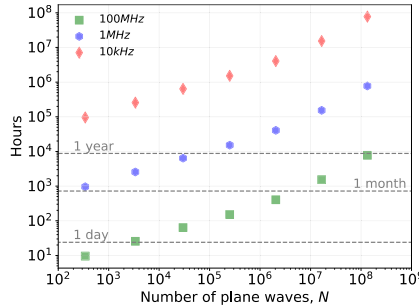


quantum memory

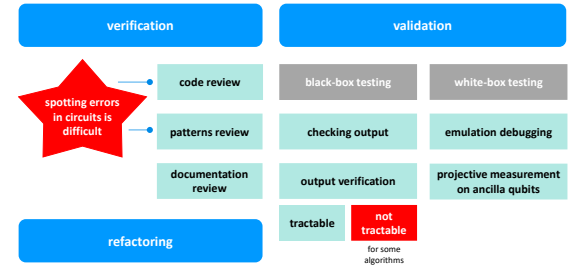
key software challenges



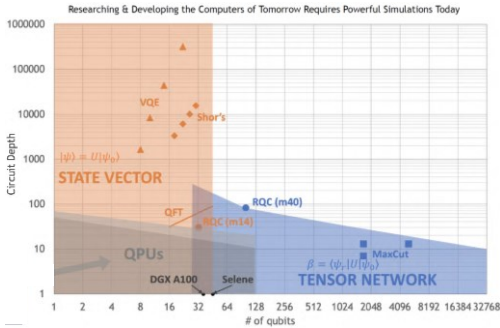
data loading



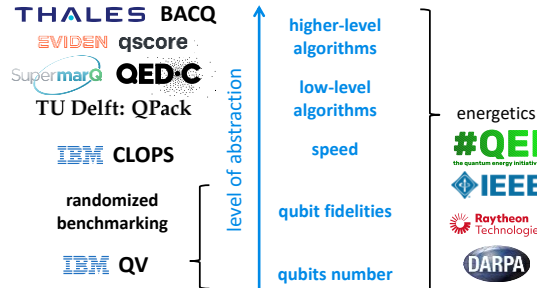
actual speedups and computing times



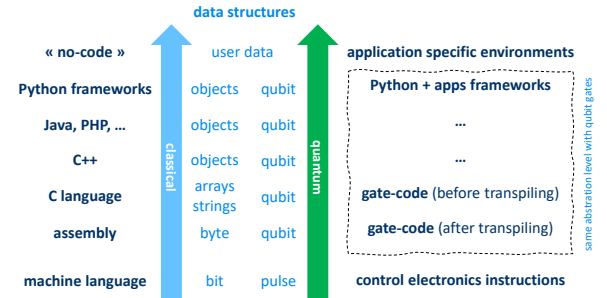
debugging, verification and certification



tensor networks competition

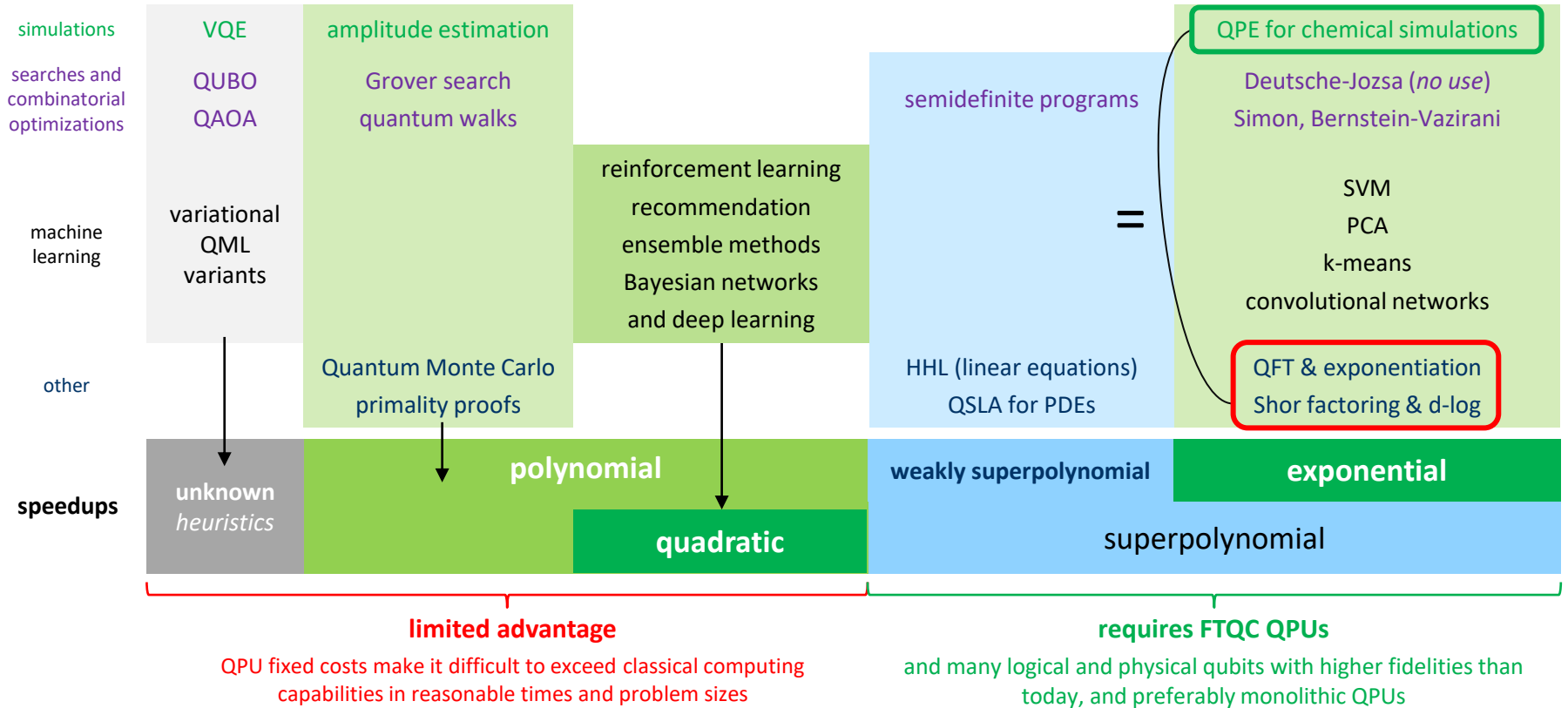


benchmarking



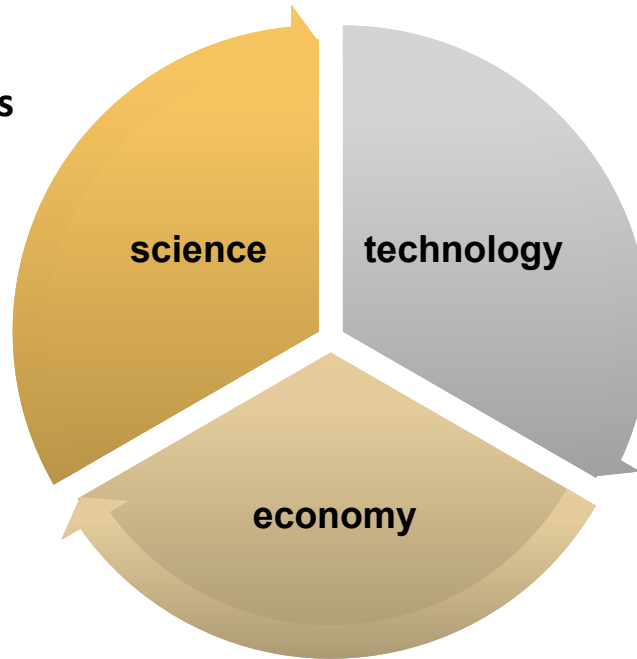
coding abstraction level

potential quantum speedups



quantum computing challenges types

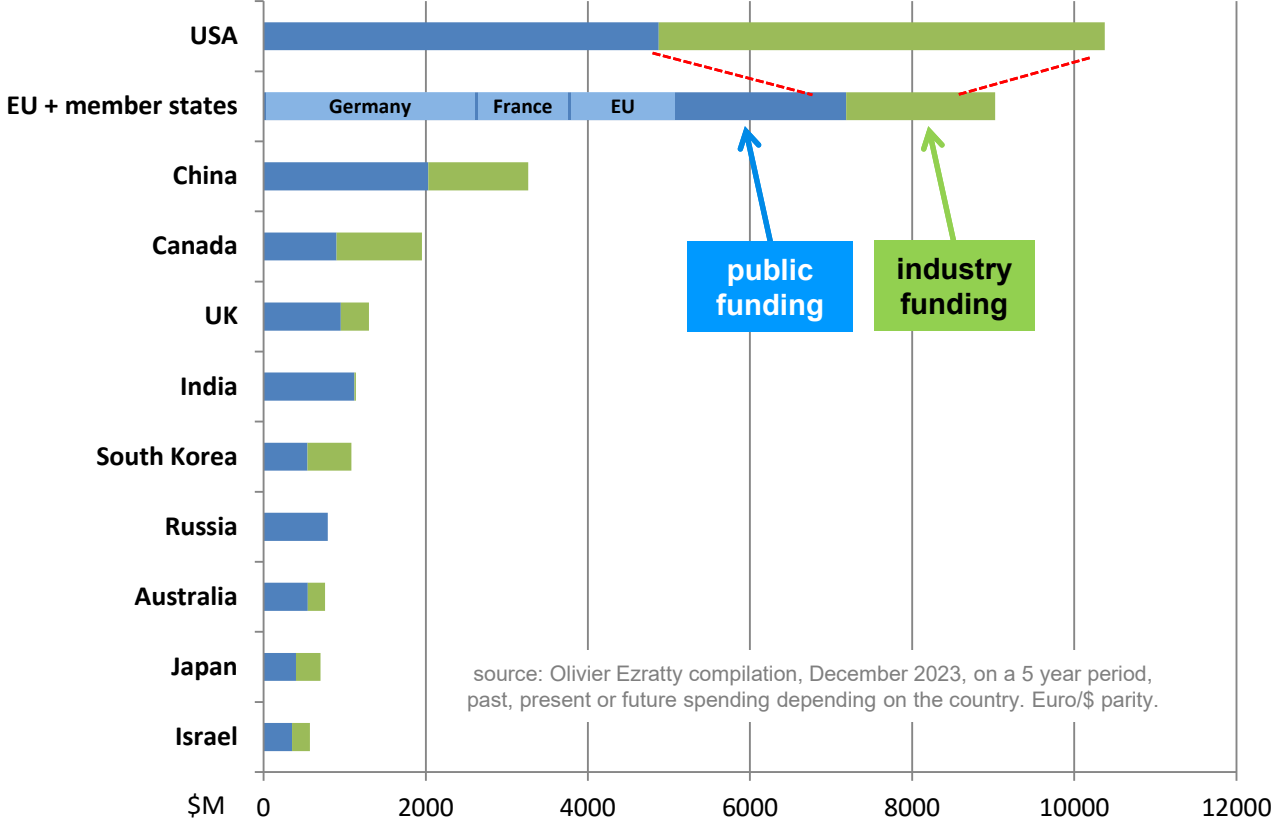
- noise models and budgets
- materials designs
- quantum control
- more efficient QEC
- cluster states generation
- quantum memory
- QPU interconnect
- algorithms speedups



- control electronics
- manufacturing
- cryogeny yield and power
- quantum emulators
- software engineering
- distributed quantum computing
- cloud infrastructure
- hybrid architectures
- benchmarking

- FPGA->ASIC
- VC, customer and governments funding
- fab investments
- other topics influences (LLMs, ...)

public vs private global investments

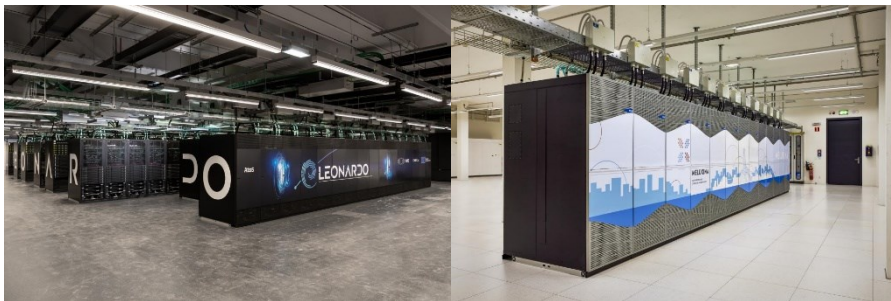


source: Olivier Ezratty compilation, December 2023, on a 5 year period, past, present or future spending depending on the country. Euro/\$ parity.

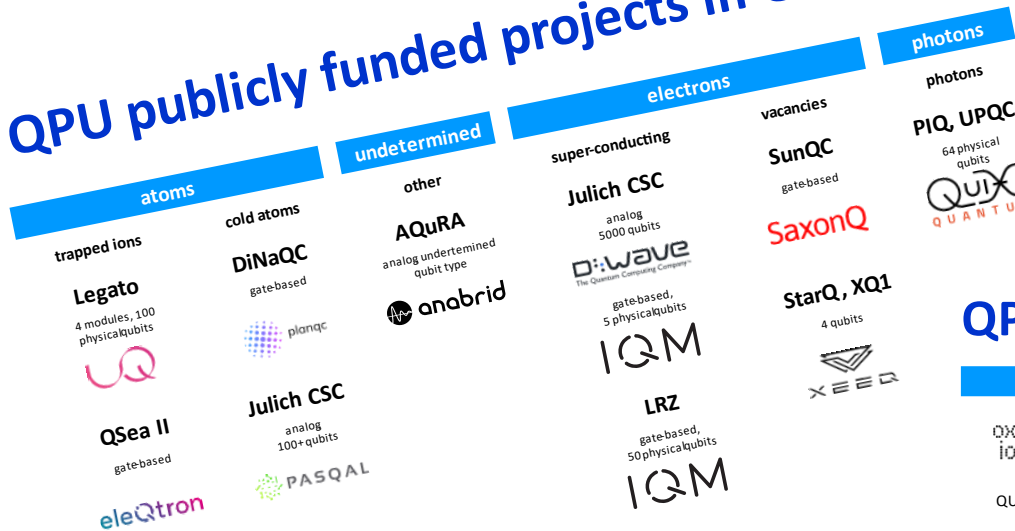


EuroHPC
Joint Undertaking

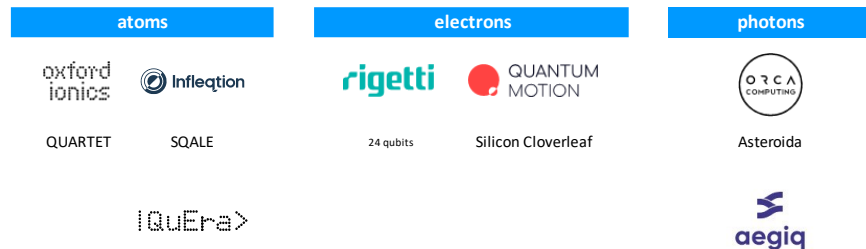
<HPC|O.S>



QPU publicly funded projects in Germany



QPU projects in the UK



QPU projects in France





OE You

would it make sense for a western country government to invest \$600M in a US quantum computing company to have them install one of their offices in there, when their own quantum investment has been of about \$600M in 20 years ? how about their local startups?

ChatGPT

Investing \$600 million in a U.S. quantum computing company to establish an office in a Western country can be seen as a strategic move, depending on several factors such as the country's long-term technology goals, the current state of its local quantum ecosystem, and the expected economic and technological returns from such an investment.

From an economic and technological standpoint, inviting a major U.S. quantum computing firm to set up an office could have significant advantages:

- 1. Technology Transfer and Skill Development:** The presence of a leading quantum computing company could facilitate the transfer of advanced technologies and know-how to the local workforce. This can enhance the skills of local engineers and scientists, contributing to the country's quantum technology capabilities.
- 2. Stimulation of Local Ecosystem:** The entry of a major player can stimulate the local quantum ecosystem by creating a competitive environment that might attract further investments and encourage innovation among local startups. It can also lead to the formation of partnerships and collaborations between the U.S. company and local entities.
- 3. Economic Benefits:** The investment could lead to direct economic benefits such as job creation, increased tax revenues, and potential growth in ancillary industries. These benefits may justify the substantial investment.
- 4. Global Positioning:** Establishing a partnership with a leading international company can position the country as a significant player in the global quantum technology market, potentially attracting further international investments.

However, there are also potential downsides and risks to consider:

- 1. Neglect of Local Startups:** A large focus on a foreign company might overshadow local startups, potentially depriving them of needed resources and attention. This could stifle local innovation and may result in a dependency on foreign technology.
- 2. Cost vs. Benefit:** The return on investment needs careful consideration, especially when the investment amount matches the total invested in the field over two decades. The outcomes should justify the allocation of such a significant portion of public funds.
- 3. Strategic Dependency:** Relying on a foreign company for advancements in critical technology like quantum computing might lead to strategic dependencies which could be unfavorable in long-term geopolitical scenarios.

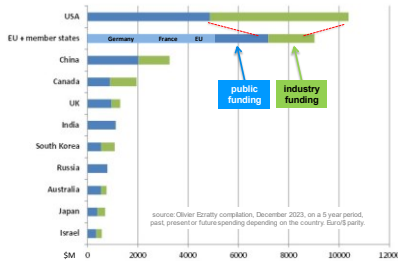
Given these points, it would be wise for the government to consider a balanced approach that not only fosters international collaboration but also robustly supports local enterprises. This could include matching investments in local startups, providing grants for research and development, and creating incentives for collaboration between the U.S. company and local entities. Such a dual approach could maximize the benefits while mitigating the risks associated with high dependency on a foreign entity.



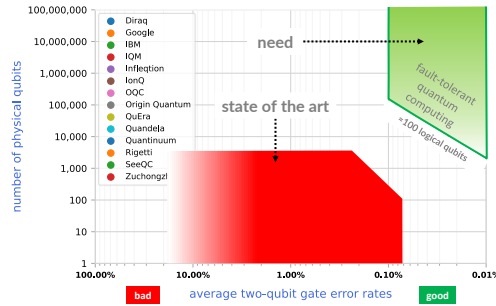
food for thought



build a dream
but not oversell it



sustain the current public /
private funding balance



understand the scientific and
technology challenges



plan for the upcoming
software battles



accept the long term and
build for the long term



prepare
for some consolidation

thank you!



get the slides

