

# THE QUANTUM ANNUAL

2022

Welcome to the Quantum  
Annual Review.

Here we cover the biggest  
commercial news in the  
Quantum Technology  
industry over the last 12  
months.

---

THE QUANTUM ANNUAL

# 2022: THE YEAR IN QUANTUM

At the end of 2021, considerable apprehension swirled around about the quantum technology industry about 2022.

The economy was showing signs that the economic stimulus that governments had pumped into the international markets would dry up. Innovation is perpetually fickle and experts were unsure whether the terrific scientific progress in quantum that had been prevalent would fall off, or disappear altogether. There was also the general assumption that the breakneck investments in quantum that peaked in 2021 couldn't continue.

As it turns out, 2022 was a mixed bag, but mostly positive. As far as investments, fundraising just failed to top the flood of money that poured into quantum companies in 2021. But, compared to other industries, quantum had a banner year. In research, no Google Quantum Supremacy moment emerged (though Xanadu captured headlines with quantum computational advantage over the summer), but researchers made significant advances -- and quantum researcher was recognized by both a Breakthrough Prize and the Noble Prize. No small feat that.

In this report, we will look at several of these highlights.



*Click this icon throughout this press to see the full stories behind the brief*

## CONTENTS

---

The Big News  
Capital markets  
About TQI

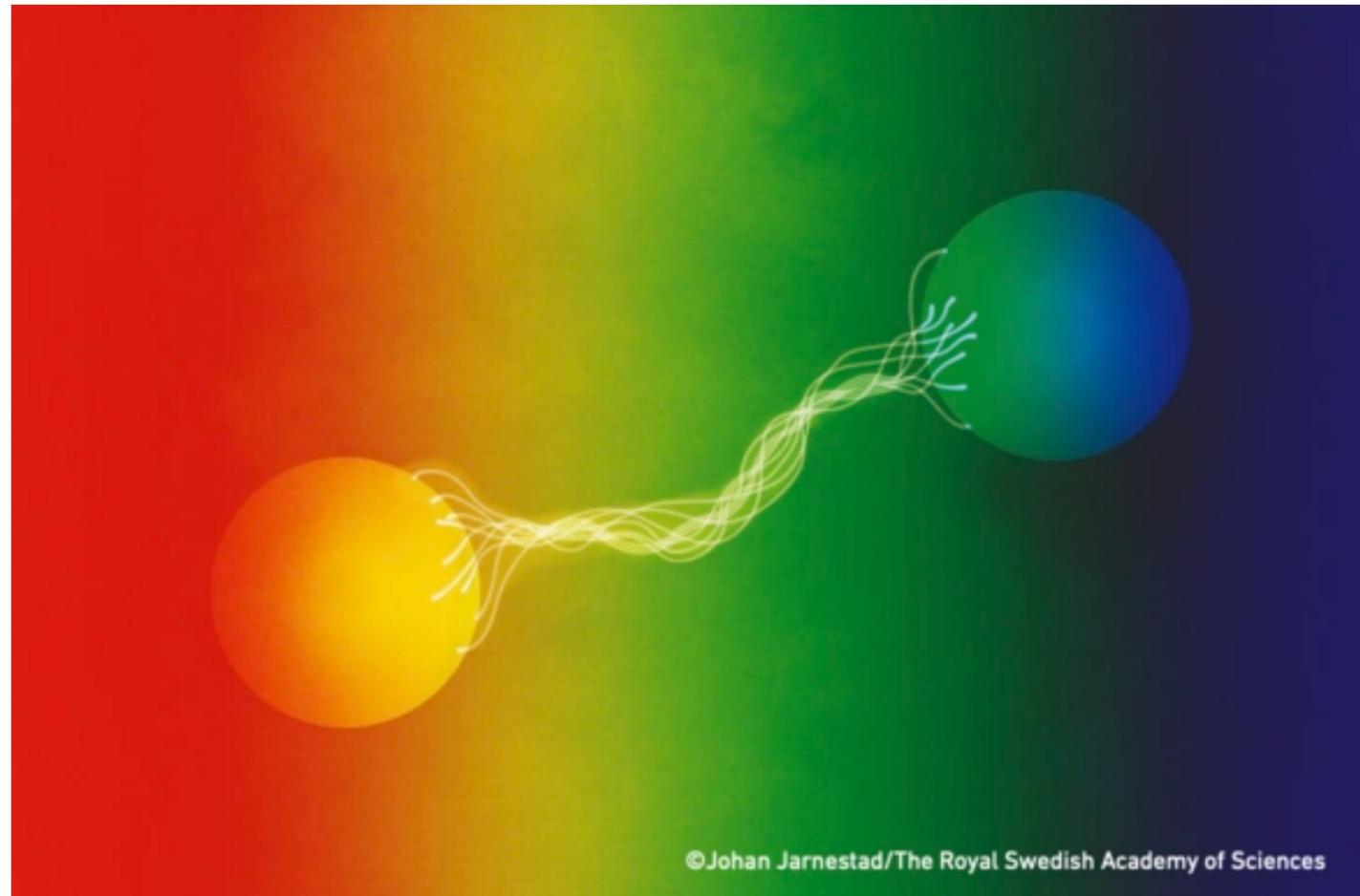
THE QUANTUM ANNUAL



# THE BIG NEWS



## RESEARCH: NOBEL PRIZE IN PHYSICS GOES TO PIONEERING QUANTUM ENTANGLEMENT RESEARCHERS



The 2022 Noble Prize in Physics was awarded to Alain Aspect, John F. Clauser and Anton Zeilinger, three pioneers who conducted experiments on quantum entanglement. The prize also recognizes that this once esoteric-sounding — and acting — quantum phenomena is becoming the backbone of a rapidly emerging quantum industry.



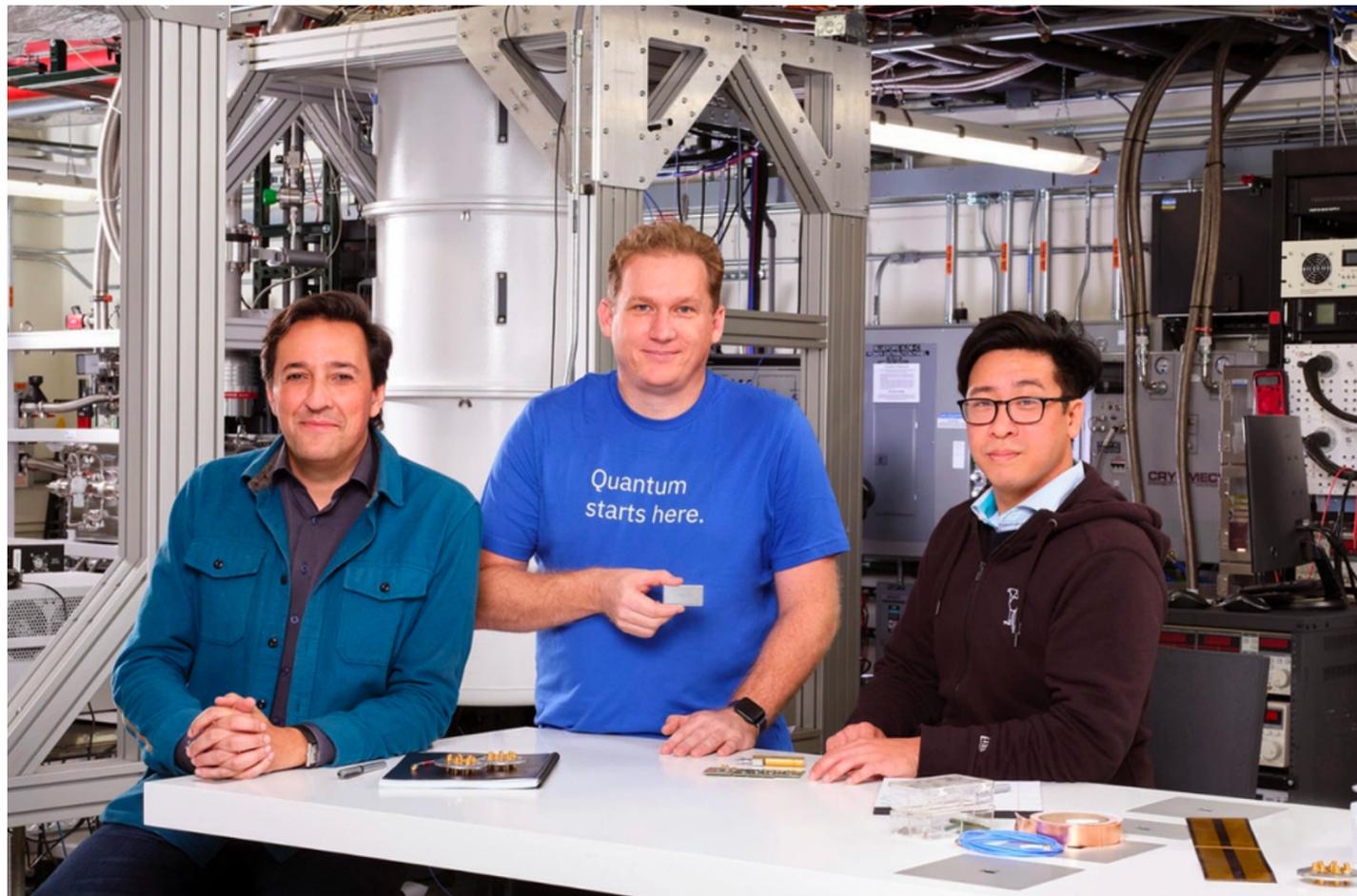
## RESEARCH: FOUR QUANTUM PIONEERS SHARE THE BREAKTHROUGH PRIZE



Four pioneers in the field of quantum information were among the list of the 2023 Breakthrough Prize laureates, according to a statement from the Breakthrough Prize Foundation. David Deutsch, Peter Shor, Charles H. Bennett and Gilles Brassard were listed as this year's winner in the fundamental physics category. Each winner will receive about \$3 million.



## RESEARCH: IBM UNVEILS 400 QUBIT-PLUS QUANTUM PROCESSOR



IBM announced new advances in quantum hardware and software and outlining its pioneering vision for quantum-centric supercomputing. The annual IBM Quantum Summit showcases the company's broad quantum ecosystem of clients, partners and developers and their continued progress to bring useful quantum computing to the world.



## RESEARCH: QUANTINUUM STUDY SHOWS LOGICAL QUBITS CAN OUTPERFORM PHYSICAL QUBITS



**QUANTINUUM**

A team of Quantinuum scientists report that logical qubits can outperform physical qubits, a key step toward quantum computers that can be used to solve practical problems. It's also an achievement that only recently was thought to be years away. The demonstration offers a path toward scalability, qubit efficiency and less circuitry needed for fault-tolerance, the team added.



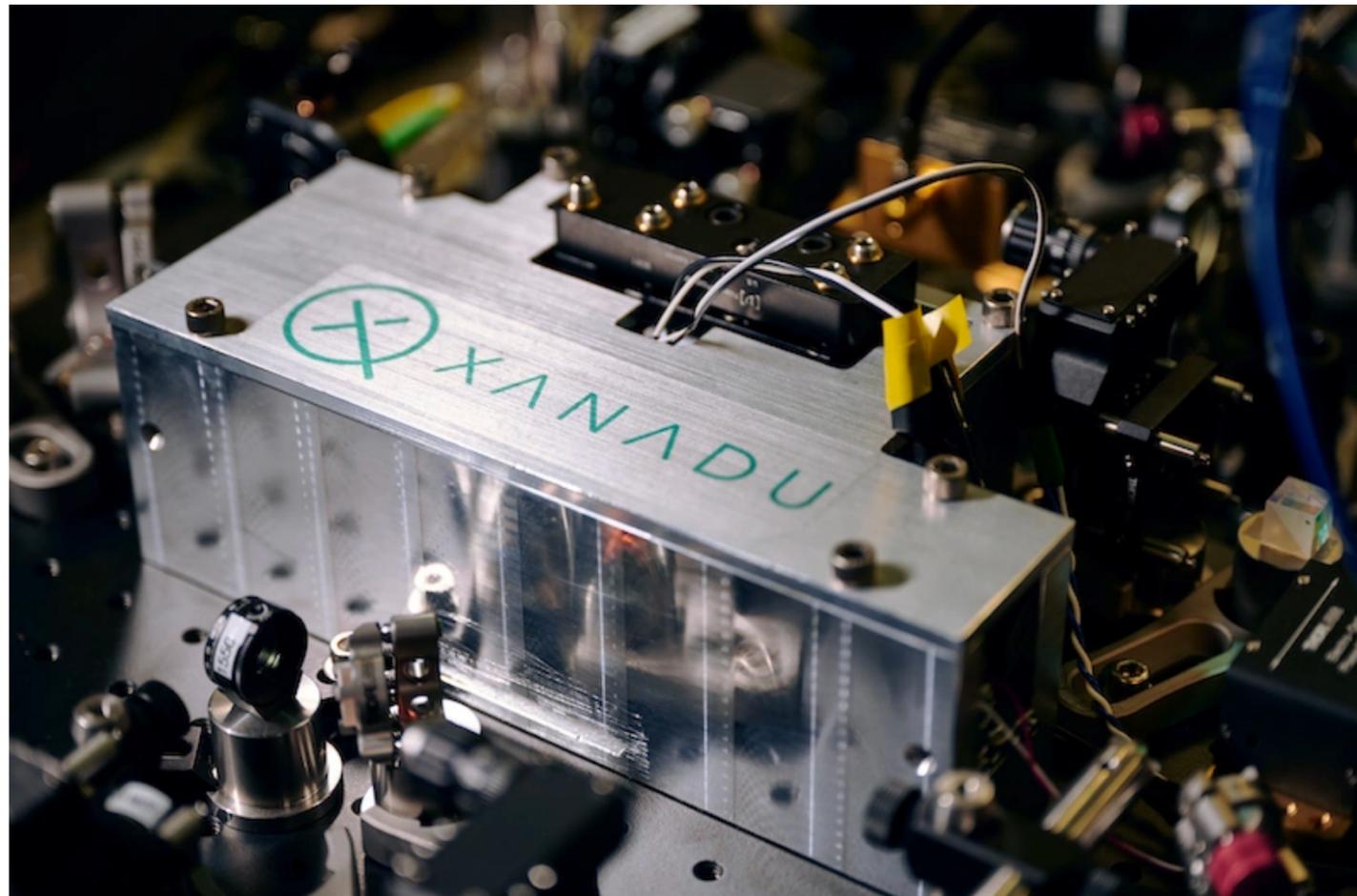
## RESEARCH: XANADU'S BOREALIS DEMONSTRATES QUANTUM ADVANTAGE



Xanadu demonstrated quantum computational advantage using Borealis, the company's newest photonic quantum computer. Borealis synthesizes a quantum state of 216 squeezed-state qubits, entangled in three dimensions according to the user's specified program. It then generates samples from this state at a rate exceeding the capabilities of any existing classical supercomputer. Using direct simulation, the fastest supercomputer in the world would take approximately 9,000 years to generate a single such sample, compared to 36 microseconds for Borealis.



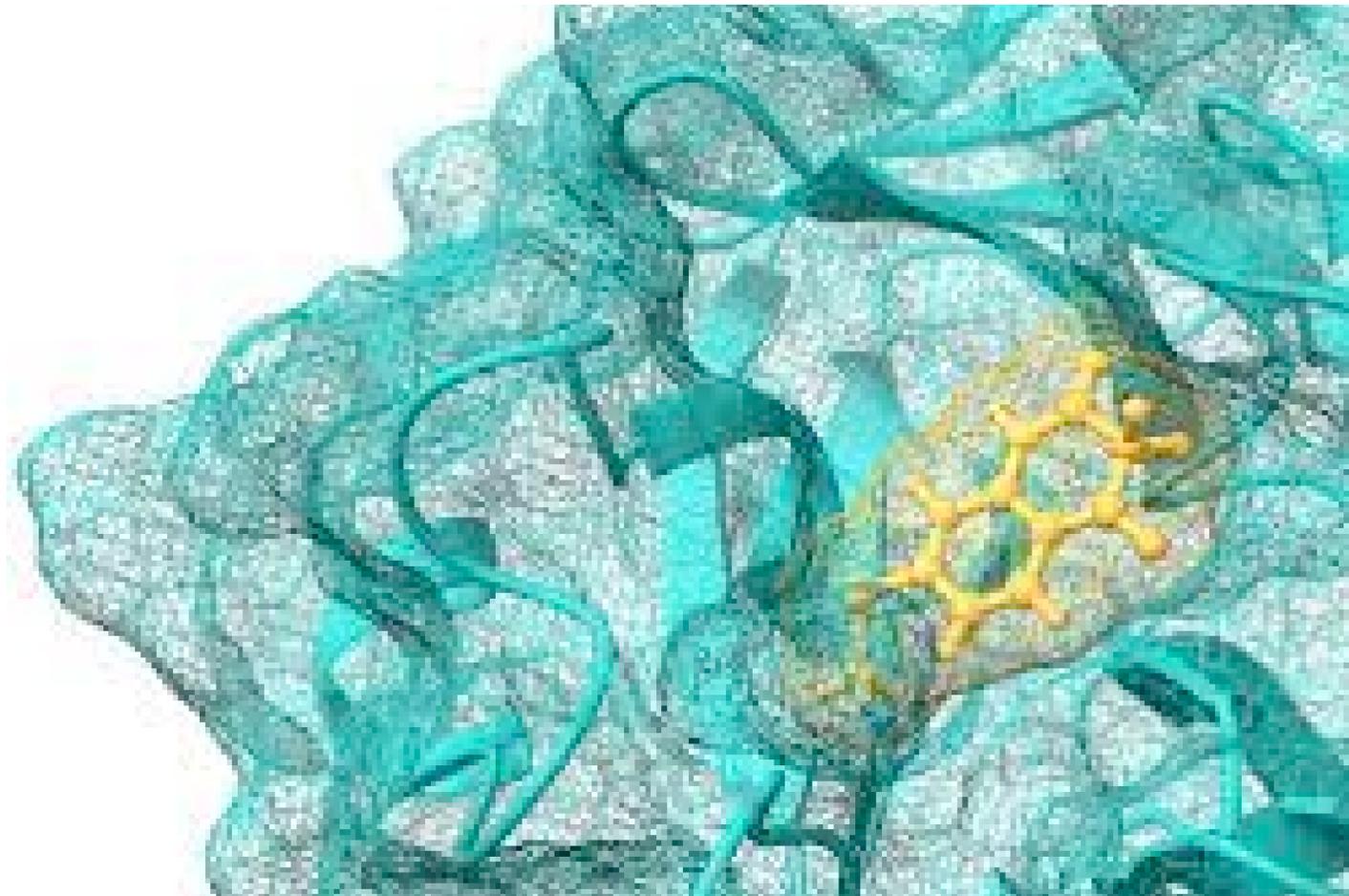
## SOURCES: XANADU CLOSES \$100 MILLION FUND RAISE, \$1 BILLION VALUATION



Xanadu announced it raised \$100 million USD in Series C financing. Georgian led the round with participation from Porsche Automobil Holding SE, Forward Ventures, Alumni Ventures, Pegasus Tech Ventures, Silicon Valley Bank, along with previous investors Bessemer Venture Partners, Capricorn, BDC Capital, and Tim Draper. To date, Xanadu has raised \$250M USD, bringing the company valuation to \$1 billion USD.



## COLD QUANTA -- NOW INFLEQTION -- RAISES \$110 MILLION SERIES B



ColdQuanta (Infleqtion) announced a \$110 million Series B round of funding to continue commercializing the company's product portfolio, including quantum computing, quantum algorithms and applications, atomic clocks, sensors, and components. Christopher Galvin, former Motorola chairman and CEO, joined the company's board of directors, and is also now an investor in ColdQuanta.



## CHINA'S ORIGIN QUANTUM SECURES \$148 MILLION SERIES B FUNDING ROUND



Origin Quantum, a quantum computing startup based in Hefei, China and founded in 2017 by Professor Guo Guoping and a team from the quantum information laboratory at the Chinese Academy of Sciences closed a \$148-million Series B (1 Billion Yuan) funding round.



## FINNISH STARTUP IQM RAISES €128 MILLION IN SERIES A2 FUNDING



IQM Quantum Computers (IQM), a Finland-based company that provides on-premises quantum computers for supercomputing data centres and research labs, announced it raised €128 million (\$128 million) in Series A2 funding led by World Fund to expand its international business and accelerate product development to tackle the world's most pressing problems, especially in the climate crisis.



## ATOM COMPUTING RAISES \$60 MILLION SERIES B TO BUILD SECOND-GENERATION QUANTUM COMPUTER



Atom Computing, the creators of the first quantum computer made of nuclear-spin qubits from optically-trapped neutral atoms, announced closure of a \$60M Series B round. Third Point Ventures led the round, followed by Primer Movers Lab and insiders including Innovation Endeavors, Venrock and Prelude Ventures. Following the completion of their first 100-qubit quantum computing system with world-record 40 second coherence times.



## TERRA QUANTUM AG EXTENDS SERIES A FUNDING TO \$75 MILLION



Terra Quantum AG, a globally leading quantum technology company, announced today that it has extended its Series A funding round to \$75 million, as well as its research offering a ground-breaking solution to the longstanding challenge of efficient power devices for nanoelectronics. Terra Quantum is the first company to reveal the underlying mechanism of ferroelectric-based negative capacitance while also sharing methods for its practical realization.

THE QUANTUM ANNUAL



DATA

# \$2.1 BN

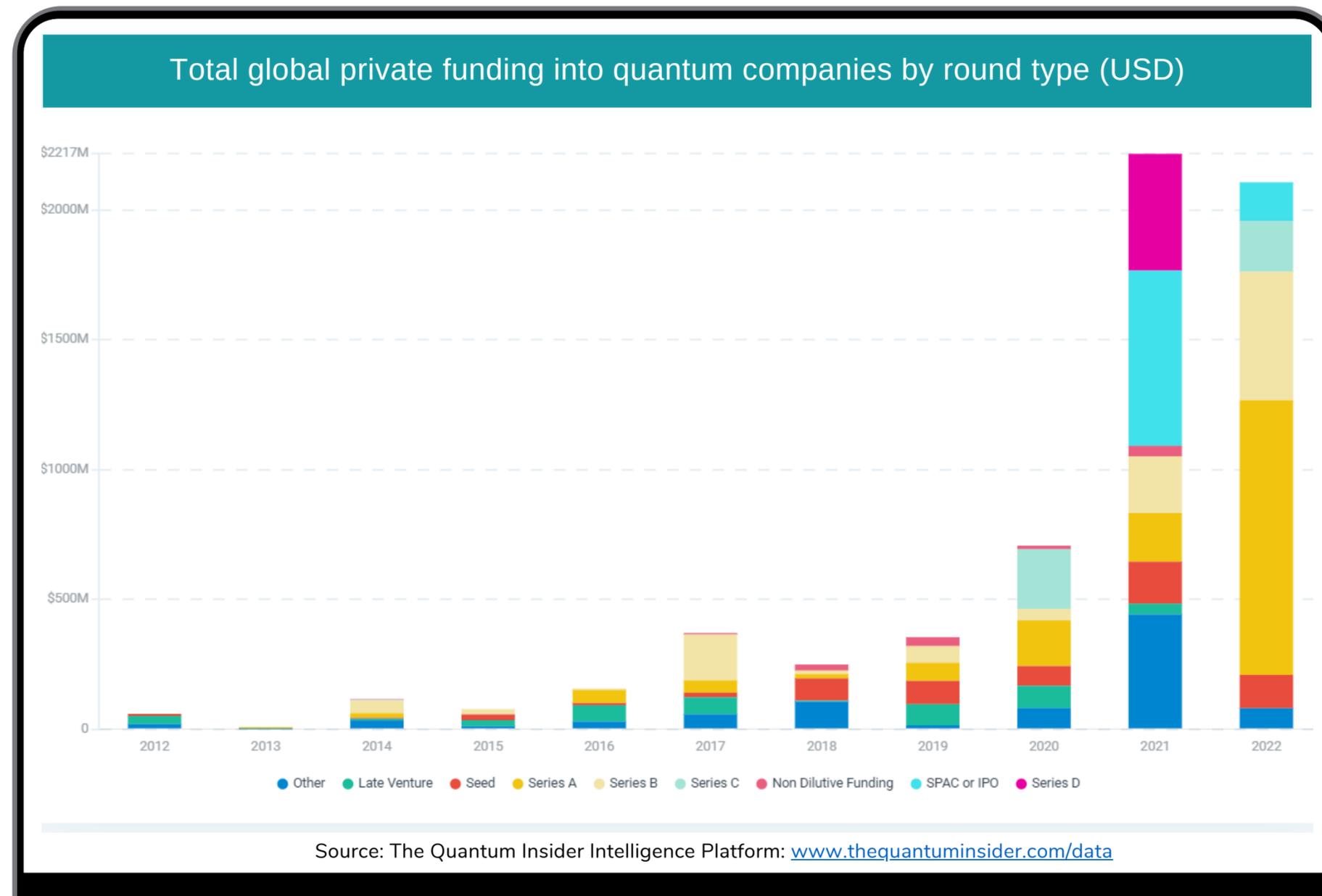
New private capital flowing into  
Quantum Technology companies in  
2022

Excludes unknown raises and makes assumptions  
based on market rumours on Sandbox AQ raise

# 73

New disclosed private funding rounds  
in 2022

# 2022 private funding nearly matched 2021's SPAC-fueled fundraising environment...



...However new company formation appears to be slowing



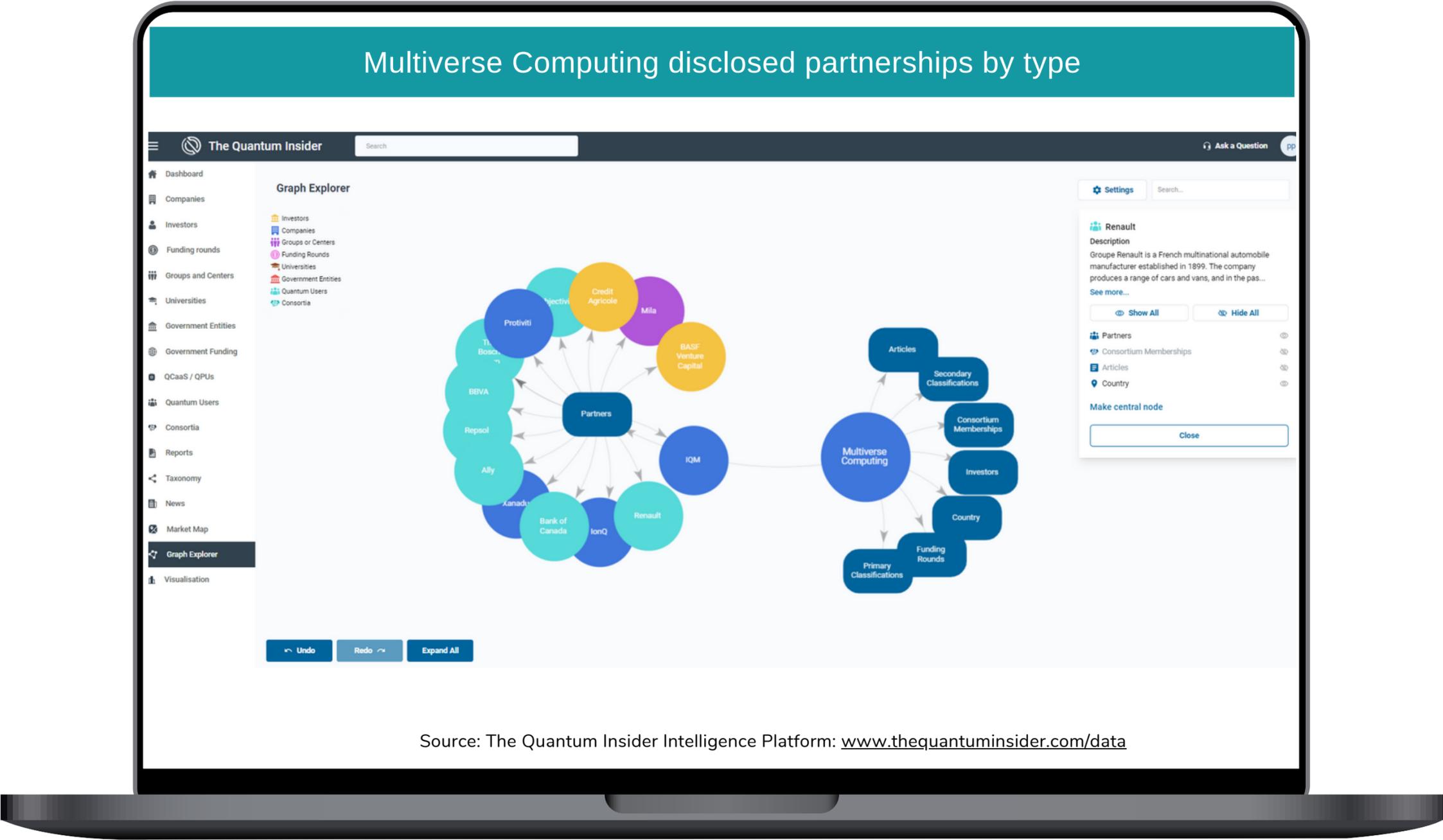
Nonetheless, impressive Series A and B funding rounds are starting to show the continued maturation of the industry

Funding rounds classified as Series B (USD) – excludes material Series A rounds from e.g., IQM

Companies	Primary Classification	Secondary Classification	Date	Country	City	Transaction Type	Region	Total \$
 <b>Infleqtion</b>	Quantum Computers	Neutral Atoms	2022-11-01	United States	Boulder	Series B	Americas	110,000,000
 <b>OTI Lumionics</b>	Software	Quantum Computing Applications	2022-10-26	Canada	Toronto	Series B	Americas	55,000,000
 <b>SpinQ</b>	Quantum Computers	Superconducting	2022-09-21	China	Shenzhen	Series B	APAC	13,300,000
 <b>Classiq</b>	Software	Development Toolkits	2022-09-20	Israel	Tel Aviv-Yafo	Series B	EMEA	48,500,000
 <b>Origin Quantum</b>	Quantum Computers	Superconducting	2022-07-26	China	Hefei	Series B	APAC	148,200,000
 <b>Nanosys</b>	Quantum Sensing & Imaging	Quantum Dots	2022-07-26	United States	Milpitas	Series B	Americas	50,000,000
 <b>QunaSys</b>	Software	Multiple Software Offerings	2022-03-27	Japan	Tokyo	Series B	APAC	10,000,000
 <b>Atom Computing</b>	Quantum Computers	Neutral Atoms	2022-01-20	United States	Berkeley	Series B	Americas	60,000,000

Source: The Quantum Insider Intelligence Platform: [www.thequantuminsider.com/data](http://www.thequantuminsider.com/data)

# Quantum companies are building strong partnerships with enterprises



# Rich quantum ecosystem building globally

## QED-C membership base extract from TQI platform

**The Quantum Insider** Search

Dashboard  
Companies  
Investors  
Funding rounds  
Groups and Centers  
Universities  
Government Entities  
Government Funding  
QCaaS / QPUs  
Quantum Users  
Consortia  
Reports  
Taxonomy  
News

**QED-C Consortium**

Profile **Members** Articles Graph Explorer

Quantum companies	Investors	End Users
Cosmic Microwave Technology, Inc.	Quantum 1 Investments	PayPal Holdings
Thor Labs	Scout Ventures	General Dynamics Miss Systems
Zapata Computing	Terranet Ventures	Northrop Grumman
SHI Cryogenics	In-Q-Tel	BAE Systems
Aliro Quantum		Azimuth Corporation
Cryomech		L3Harris
Sharpe Engineering		SPIE
OEwaves Inc.		Corning
DaiQuantum		Booz Allen Hamilton

## Launch of UKQuantum

**Executive summary**

- UKQuantum was launched on the 10th November during the week of the National Quantum Technologies Showcase.
- UKQuantum is a consortium of members from the UK working in quantum technologies, who have a common goal to grow the UK quantum industry.
- Our mission is to unite the UK quantum industry with one voice, to champion within government and internationally, advising on interventions and policies that will advance the UK quantum industry, and to promote the adoption and benefits of quantum technologies across the UK economy.
- Our members benefit in a variety of ways, from being a part of the community connecting directly with other members, to being informed on UK opportunities and participating in work to define key domestic policies and priorities.

**What is UKQuantum?**

**Our vision**

- Our vision is for the UK to lead the world in the development and exploitation of quantum technologies.
- By 2030 UK quantum companies will have a commanding presence in the international market and UK businesses will have clear and robust plans for adopting quantum technologies.

**Our mission**

- Unite the UK quantum industry with one voice.
- Champion within Government and internationally, advising on interventions and policies that will advance the UK quantum industry.
- Promote the adoption and benefits of quantum technologies across the UK economy.

**Background to UKQuantum's formation**

- In Spring 2020, BEIS requested a coordinated group to advise government strategy, and the founding members of UKQuantum came together.
- We have since been working for over a year and already been advising Government on the new quantum strategy.
- The UK has always been a pioneer of quantum science in our academic institutions.
- The UK was also one of the leading countries in supporting the growth of the UK industry - 8 years ago, the UK Government launched the National Quantum Technologies programme, which has since been replicated in many countries across the world.
- The programme was incredibly successful - today, we UK's quantum industry is thriving: In the UK there are 42 quantum start-ups with over 700 employees.

**How are we doing?**

Launched 10 November    Founding members    Members already in application process

35

Quantum forms a vital part of the Government's vision for the UK to become a global science and technology superpower, and these exciting new technologies have the potential to transform our society and economy, from advancing drug discovery to helping to reduce gas emissions. So, I am extremely pleased that UKQuantum is now open to membership applications, uniting the industry while working closely with Government to help to shape the future of quantum technology in the UK.

Department for Business, Energy & Industrial Strategy

Founding members: |KETS>, CASAPULT, river lane, QUANTUM, BT, BAE SYSTEMS, QUANTUM, QUANTUM, ORCA Computing, NU, Q

# PQC top of many people's minds

## President Biden Signs Quantum Computing Cybersecurity Preparedness Act

BY MATT SWAYNE • DECEMBER 22, 2022 • NATIONAL

## NIST Announces First Four Quantum-Resistant Cryptographic Algorithms

BY MATT SWAYNE • JULY 5, 2022 • RESEARCH

### PQC companies extract from TQI platform

	<b>QuSecure</b>	QuSecure provide quantum security applications for enterprises.	Quantum Communications & Security	Post Quantum Encryption	15,200,000	Americas
	<b>Post-Quantum</b>	Post Quantum develops quantum encryption propositions.	Quantum Communications & Security	Post Quantum Encryption	11,439,000	EMEA
	<b>Quantropi</b>	Quantropi has developed a set of post quantum communication solutions which include asymmetric encryption, symmetric encryption and strong random numbers.	Quantum Communications & Security	Post Quantum Encryption	5,000,000	Americas
	<b>QRL</b>	Blockchain that is a future-proof post quantum value store.	Quantum Communications & Security	Post Quantum Encryption	2,000,000	EMEA
	<b>Cyph</b>	Quantum resistant communications.	Quantum Communications & Security	Post Quantum Encryption	1,020,000	Americas
	<b>Abelian</b>	Abelian is a quantum-resistant blockchain infrastructure which enables digital gold 2.0 and empowers the post-quantum crypto ecosystem. Abelian is open source, and community driven.	Quantum Communications & Security	Post Quantum Encryption	Unknown	Americas
	<b>Stealthy Bamboo</b>	Founded by Avishai Ziv, Stealthy Bamboo works on computer and network security.	Quantum Communications & Security	Post Quantum Encryption	Unknown	Americas
	<b>HaQien</b>	HaQien specializes in securing data against cyberattacks by implementing post quantum cryptography.	Quantum Communications & Security	Post Quantum Encryption	Unknown	APAC

Source: The Quantum Insider Intelligence Platform: [www.thequantuminsider.com/data](http://www.thequantuminsider.com/data)

# QCaaS a strong theme, but many looking at deep integration with HPC providers

## Q-Exa Collaborative: IQM Quantum Computer Will Be First Quantum System to be Integrated Into a HPC Supercomputer

BY MATT SWAYNE • NOVEMBER 17, 2021 • RESEARCH



## Dell Technologies Advances High Performance Computing With Hybrid Quantum-Classical System

BY MATT SWAYNE • NOVEMBER 15, 2022 • QUANTUM COMPUTING BUSINESS, SLIDER



## QCaaS companies extract from TQI platform

Company	Facilitates access to	Cloud offering	Simulator offering	Consulting offering?
 Amazon Braket	IonQ, Oxford Quantum Circuits, D-Wave Systems, QuEra, Rigetti Computing	Amazon launched its Braket quantum computing service in Aug-20. Using Jupyter notebooks and existing AWS services, Braket users can assess present and forthcoming capabilities, including quantum annealing, ion trap devices, and superconducting chips. Offers quantum processing and simulators	The local simulator in the Amazon Braket SDK is free and is suitable for running small simulations (up to 25 qubits). The SV1 simulator is a fully managed state vector simulator for quantum circuits. A state vector simulator takes the full wave function of the quantum state and applies the operations of the circuit to calculate the result. SV1 automatically scales AWS computing resources to deliver high performance for testing and execution of your quantum algorithms. It supports simulations up to 34 qubits in size. The Amazon Braket TN1 simulator is a managed, high-performance tensor network simulator that is used for	Yes, Amazon Quantum Solutions Lab
 Google Quantum AI lab	IonQ, Google Quantum AI lab	Google's Quantum Computing Service gives customers access to Google's quantum computing hardware. Programs that are written in Cirq, an	Google offers access to its simulator in the same interface as its access to quantum computer offering. It also offers TensorFlow Quantum to	Unknown



Atom is an example of company actively developing gen2 systems for QCaaS

Source: The Quantum Insider Intelligence Platform: [www.thequantuminsider.com/data](http://www.thequantuminsider.com/data)

# THE QUANTUM INSIDER (TQI) IS THE LEADING PROVIDER OF NEWS AND MARKET INTELLIGENCE IN THE QUANTUM TECHNOLOGY SECTOR



TQI has 3 mutually synergistic offerings

## WHAT WE HAVE

## WHAT WE OFFER



### NEWS

Incisive and regular news on the quantum technology market - keeping people informed, up-to-date and connected

Multi-channel digital marketing campaigns designed to support your product, service or call to action



### INTELLIGENCE

Robust market intelligence on the quantum technology industry - providing stakeholders with rich commercial data and insights

Free community access to our basic data; paid subscription access to online intelligence platform

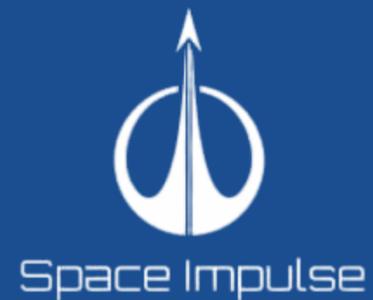


### CONSULTING

Advisory and strategy consulting in the quantum technology market - supporting client's business growth through quantum tech

Bespoke advisory and consulting projects to answer specific questions for our clients

# TQI IS THE LEADING PLATFORM OWNED AND OPERATED BY RESONANCE



[Platforms](#) [Solutions](#) [Contact Us](#)

The tech  
intelligence  
engine of the  
future.





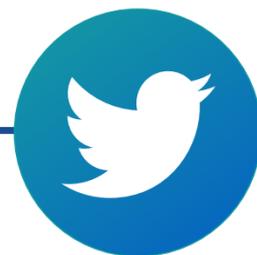
[/thequantumdaily](#)



[@thequantuminsider](#)



[/thequantuminsider](#)



[thequantuminsider](#)



[/TheQuantumInsider](#)



[@Thequantuminsider](#)





## GET IN TOUCH

We would love to hear your feedback on our work.

Please don't hesitate to contact us.

[hello@thequantuminsider.com](mailto:hello@thequantuminsider.com)