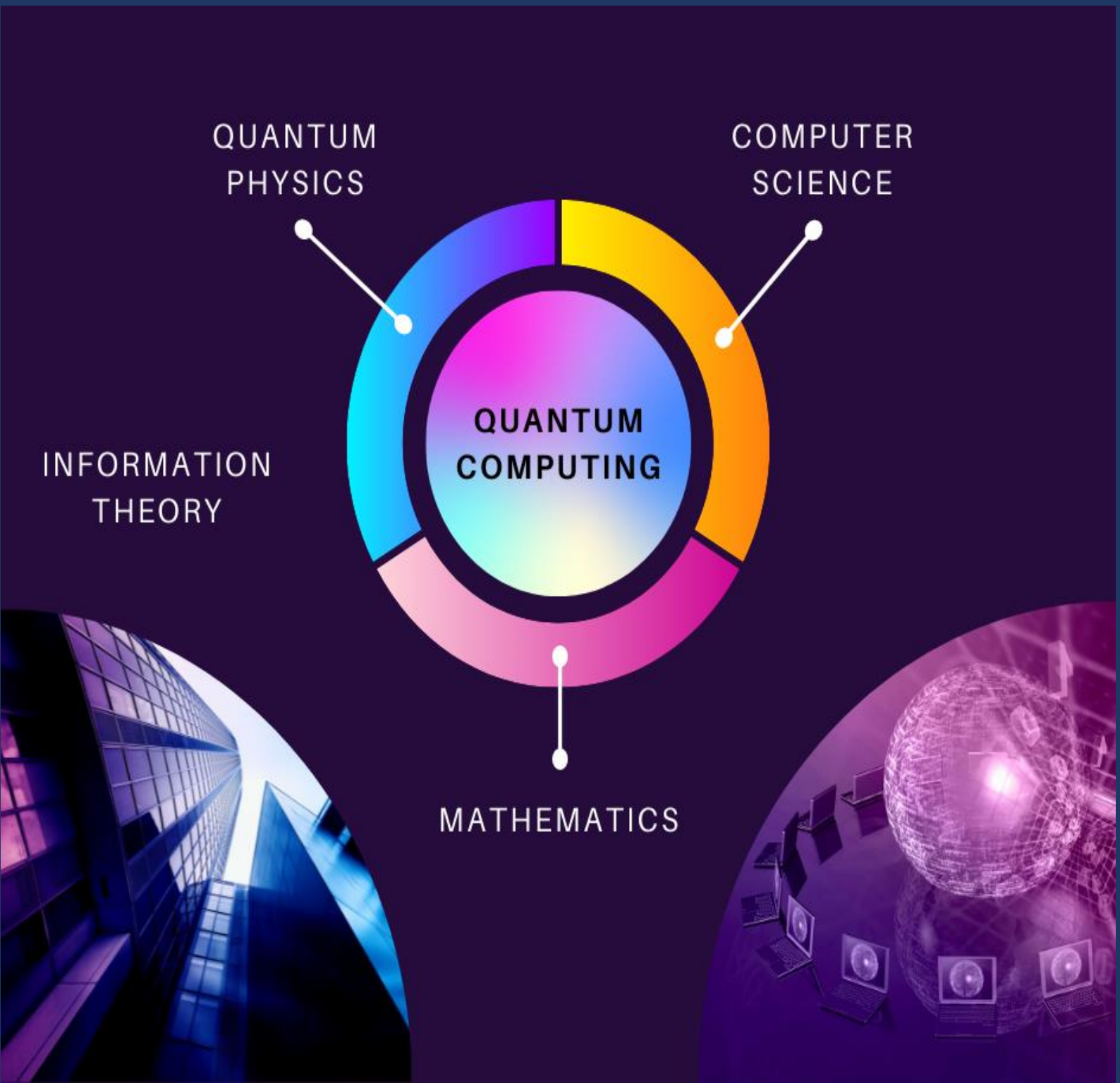
Quantum Computing

Quantum computing is a beautiful fusion of quantum physics and computer science, incorporating some of the most stunning ideas from twentieth-century physics into an entirely new way of thinking about computation.

Reference: Quantum Computing for Everyone

- Chris Bernhardt



Quantum Computing

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LEVEL UP

Quantum Computing

Why Quantum Computing is Future

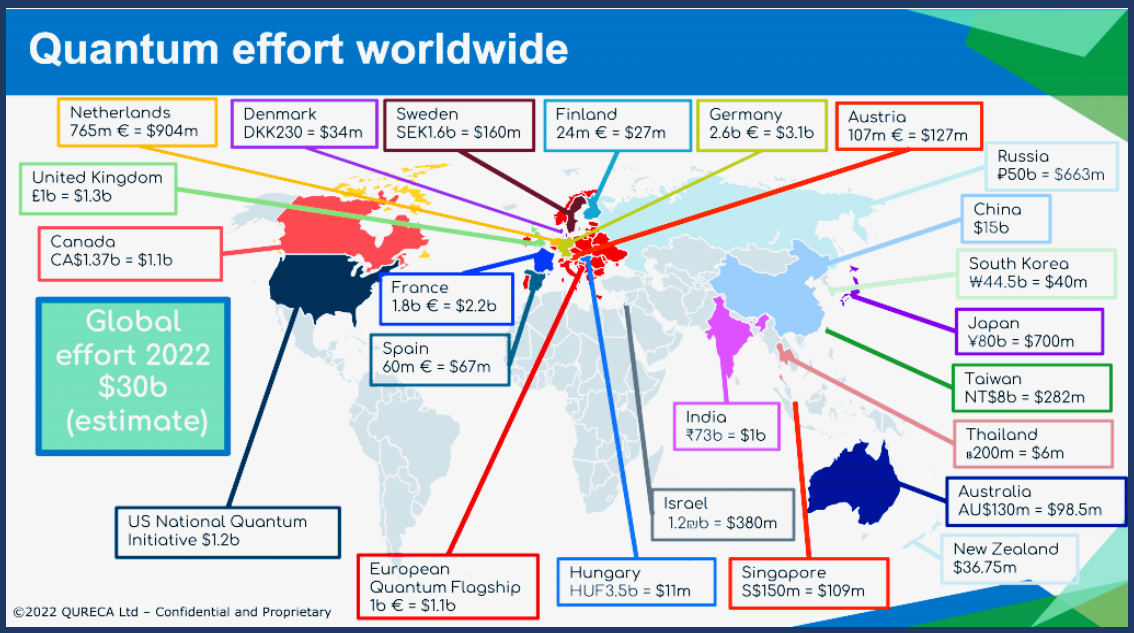
According to the Report titled “Quantum Technology Market by Computing, Communications, Imaging, Security, Sensing, Modeling and Simulation 2022 – 2027”, We can observe global and regional forecasts as well as the outlook for quantum technology's impact on embedded hardware, software, applications, and services from 2022 to 2027.

- Overall global quantum technology market will reach $42.4 billion by 2027
- Quantum computing will lead the market at $16.1 billion by 2027 and 39.4% CAGR
- North America will be the biggest regional market for quantum technologies overall
- China will lead the APAC quantum technology market at $5.41 billion by 2027 with a 38.5% CAGR
- Germany will lead the European quantum technology market at $3.6 billion by 2027 with a 33.1% CAGR
- The global quantum dots market will reach $13.25 billion by 2027, growing a 25.1% CAGR and led by displays
- The quantum sensing market will reach $989 million globally by 2027, nearly twice the size of the quantum imaging market
- The quantum magnetometer market will reach $925 million globally by 2027, led by superconducting quantum interference devices

Quantum Computing

Quantum Computing is a trending technology and has been widely adopted by various countries. The global quantum effort leading to research and innovation in quantum science and technology is continually rising with current worldwide investments reaching almost $30 billion.

Overview of public funding in quantum technologies



Insights of Country-wise Details

India:

- In 2020, The Indian government has introduced an NM-QTA (National Mission on Quantum Technologies and Applications) with a total budget of INR 8000 crores (approximately $1 billion) over five years.
- Finance Minister Nirmala Sitharaman stated that a lot of commercial applications are expected to emerge from theoretical constructs developing in quantum technology.
- Indian Institute of Science has a dedicated research area for quantum technology.
- The Initiative on Quantum Technology explores many areas such as superconducting qubit devices, single-photon sources and detectors for quantum communications, integrated photonic quantum networks, and quantum sensors.

Quantum Computing

China:

- China is believed to be one of the leading nations in quantum information science, as the country began investing in quantum research and development very early on, by the end of the 90s.
- Over the past two decades, quantum information science has received significant recognition in China, as the First Prize of National Natural Science of China in 2013 and 2015 has been awarded to this field.
- By 2030, the country aimed to expand its national quantum communications infrastructure, by developing a general quantum computer prototype and constructing a practical quantum simulator.

Canada:

- Canada is considered one of the world's leading nations in quantum research. It has invested more than $1 billion in quantum research over the past decade.
- It has a growing impact on the private sector, outstanding research expertise, and extensive government commitment to innovation.
- Canada is in a very strong position to drive quantum technology development.
- As of April 2021, the Canadian Government announced a further $360 million investment to launch a National Quantum Strategy.
- Quantum Algorithms Institute will receive $2.2 million from the Canadian Government to accelerate innovation and commercialization in quantum technologies.

Japan:

- Its total investment for quantum information science and technology is around ¥30 billion.
- The main funding agencies have been the Japan Science and Technology Agency, the National Institute of Information and Communications Technology, the Japan Society for the Promotion of Science, and the Cabinet Office of the Government of Japan.
- For example, the Japanese Government launched the Q-LEAP initiative in 2018 to invest in R&D projects in three fields of quantum technology:

1. Quantum simulation and computation,
2. Quantum sensing,
3. Ultrashort pulse lasers.

- New Japanese initiatives have recently been launched in 2018 to advance quantum information science and technology to the next phase.
- The Moonshot Project is expected to invest around ¥15-20 billion to create a fault-tolerant universal quantum computer by 2050.

Quantum Computing

France

- France has been investing 60 million € in quantum technologies every year.
- In 2020, plan they announced the strategic recommendations.

1. Deploy cutting-edge quantum computing infrastructure for research and industry.
2. Launch an ambitious technological development program.
3. Implement a program for supporting the development of applications.
4. Create an effective environment for innovation.
5. Deliver a tailored economic security strategy.
6. Establish effective governance.

Many such initiatives can be seen in various fields and sectors throughout the world. Still, if anyone thinks Quantum is future technology, then they are wrong.

This year IBM plans to release a 433-qubit processor called Osprey. Osprey features a smaller chip that ensures more logical qubits that don't sacrifice performance.

In 2023, IBM plans to release a 1,121-qubit processor called Condor to succeed Osprey. By the time Condor is released, IBM believes they will be close to a "quantum advantage", the point at which quantum computers outperform classical computers.

Quantum Computing

Importance of Quantum Computing

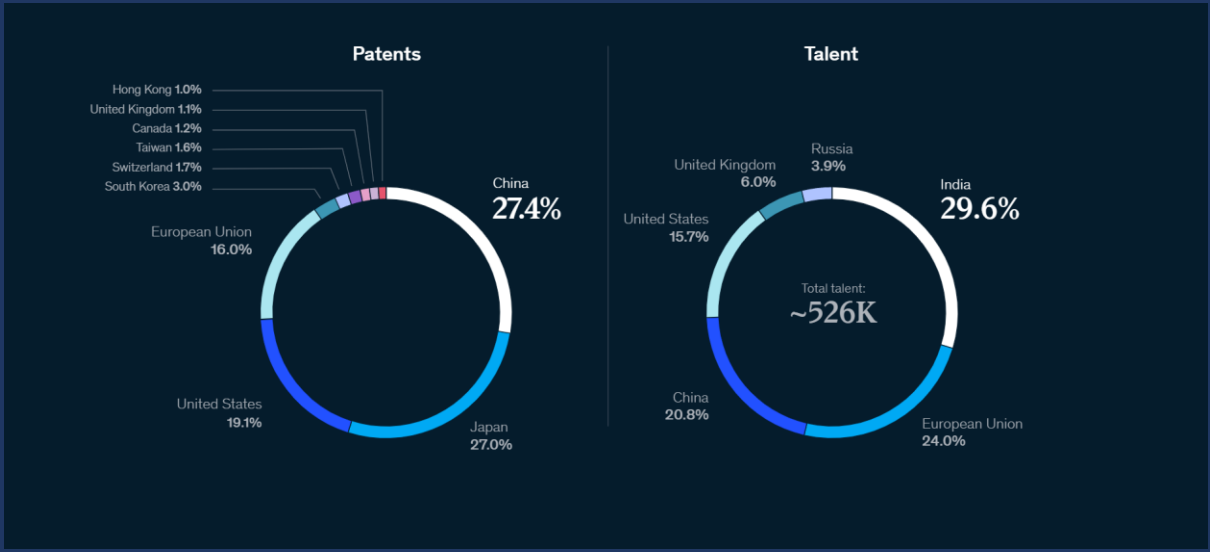
One classical machine learning approach optimized a portfolio in 33 hours; hybrid quantum annealing produced similar results in three minutes.

- **Konstantinos Karagiannis**

(Associate Director with Quantum Computing Services at Protiviti)

Quantum will soon reach a tipping point when quantum revolutionizes information security, fraud detection, logistics, and other optimization- and simulation-friendly activities.

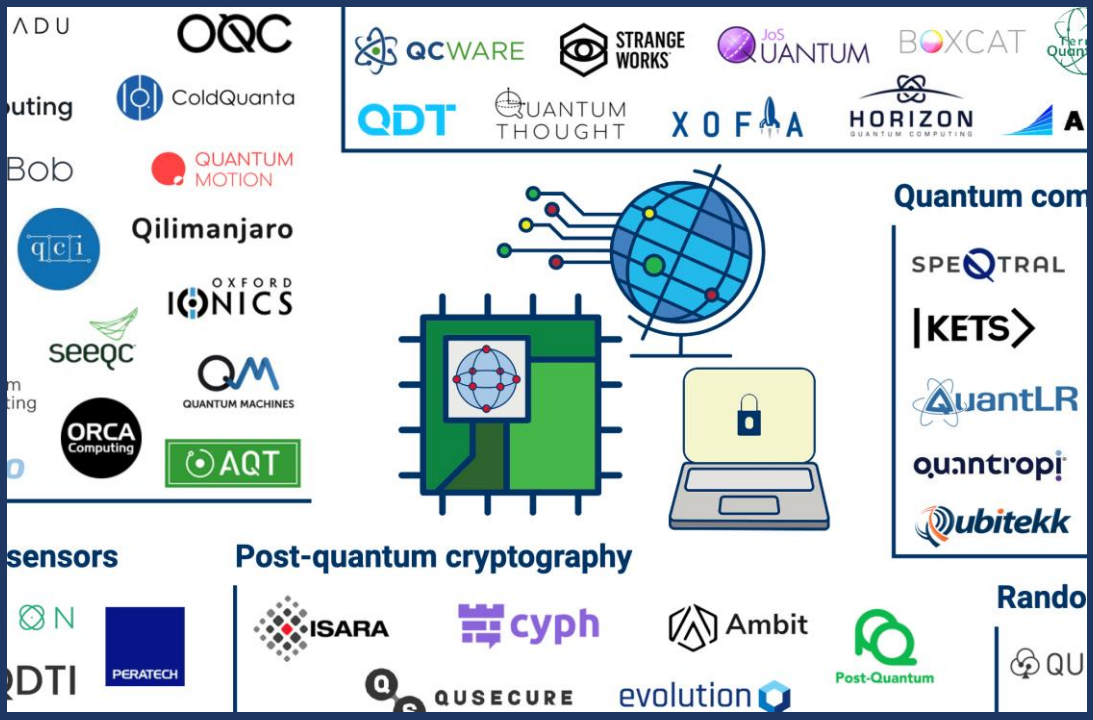
Sooner or later organizations will struggle to find and hire the quantum talent they need. The first wave is already underway, organizational leaders must understand what quantum computing is, which activities it is best suited for right now, and the challenges and enablers that must be addressed to facilitate its use and advancement in this area.



From McKinsey “China is leading in quantum technology patent activity, and India has the largest pool of relevant talent”.

Quantum Computing

Some List of Companies working on Quantum, including Start-up's



Use Cases of Quantum

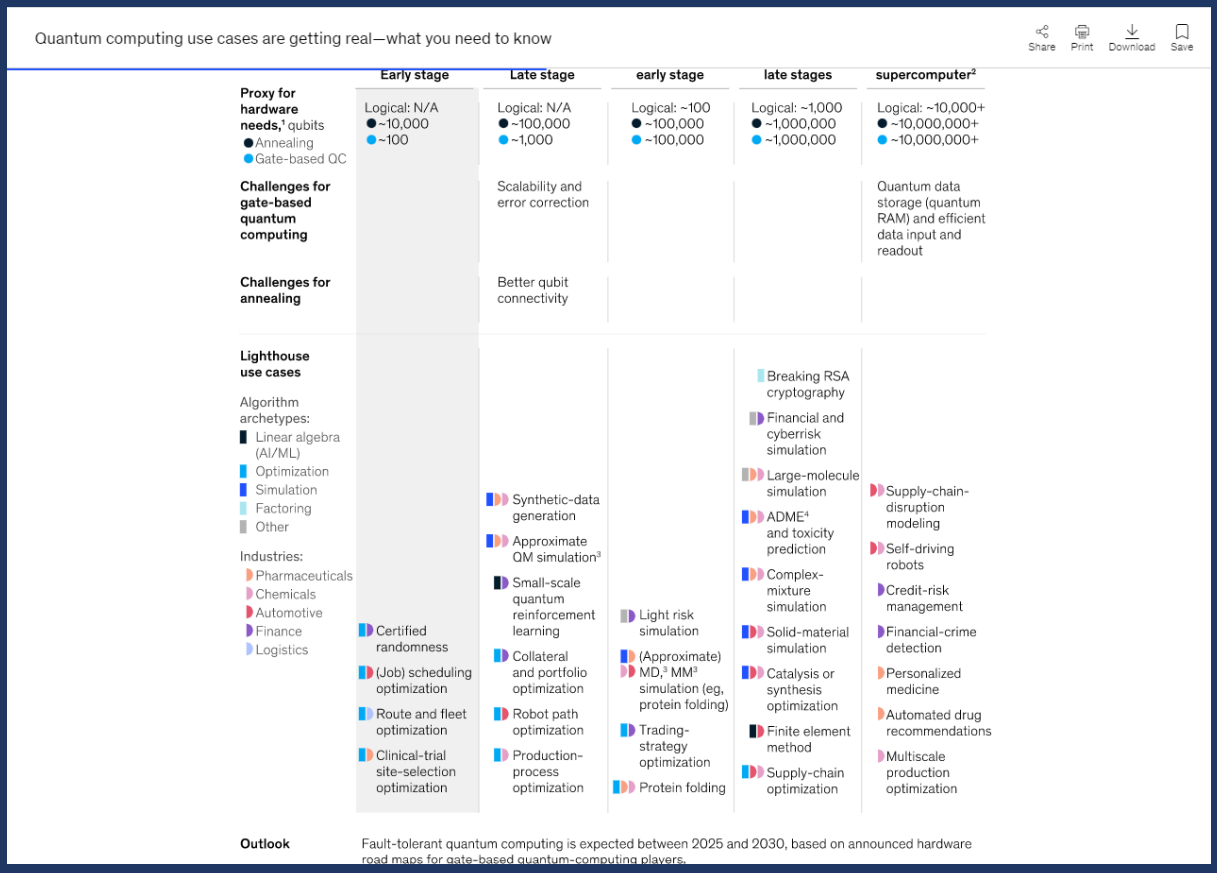
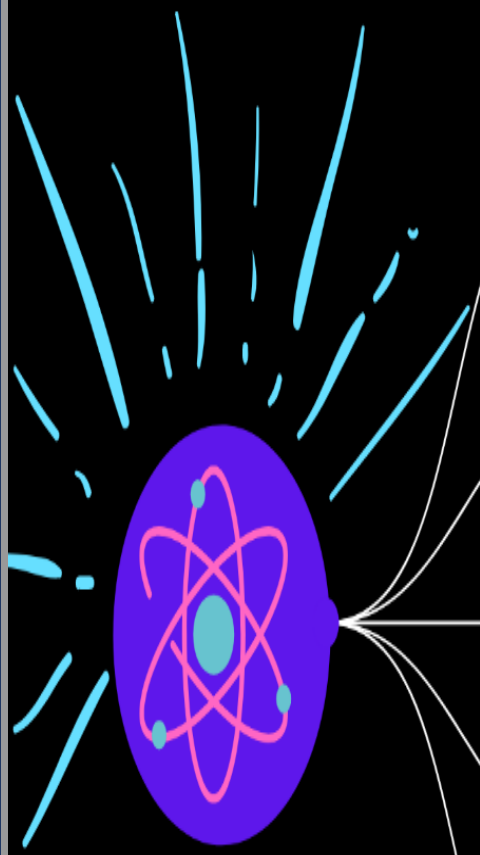
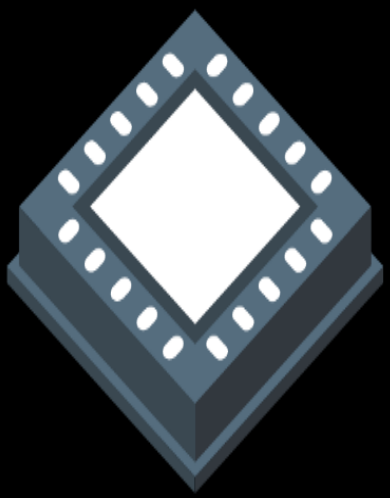


Image source and Credit: **McKinsey**

QUANTUM COMPUTING

Career Opportunities





01 Superconducting Qubit Researchers

02 Quantum Control Researchers

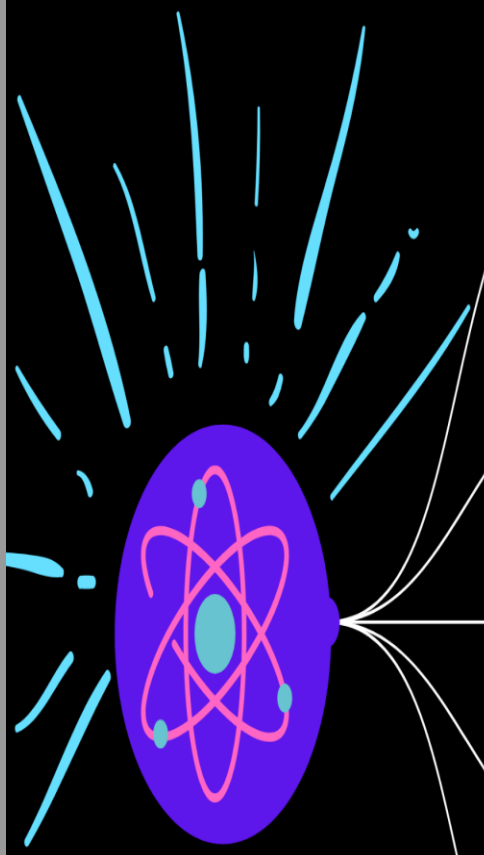
03 Quantum Error Correction Researchers

04 Quantum Computer Architects

05 Quantum Complexity Theorists

QUANTUM COMPUTING

Career Opportunities

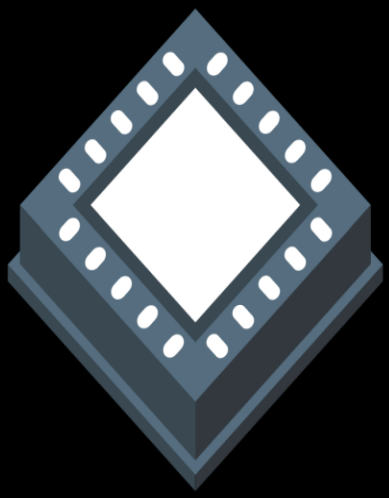


6 Quantum Algorithms Researchers

7 Quantum Cryogenic Engineers

8 Quantum Microwave Engineers

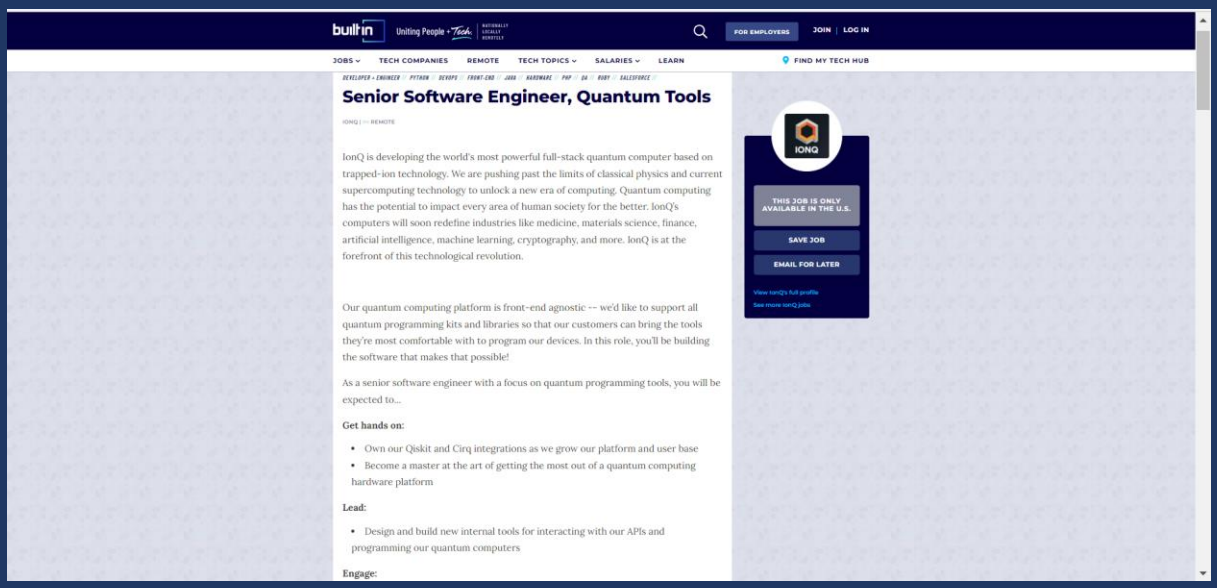
9 Quantum FPGA Engineers

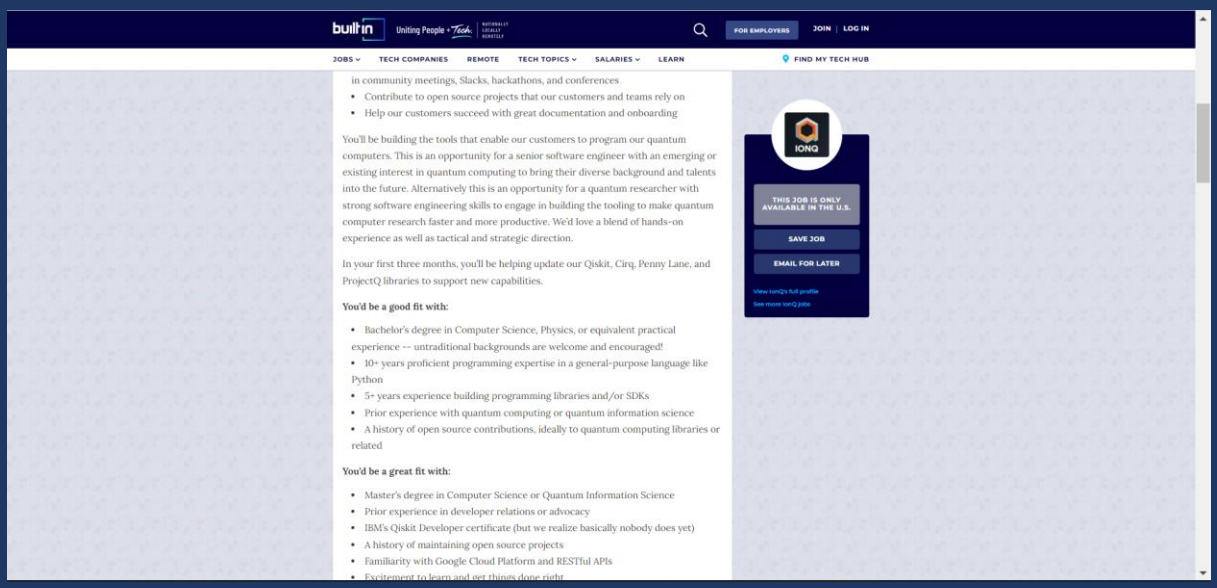


10 Quantum Software Developers

Quantum Computing

Small specimen of Job Roles





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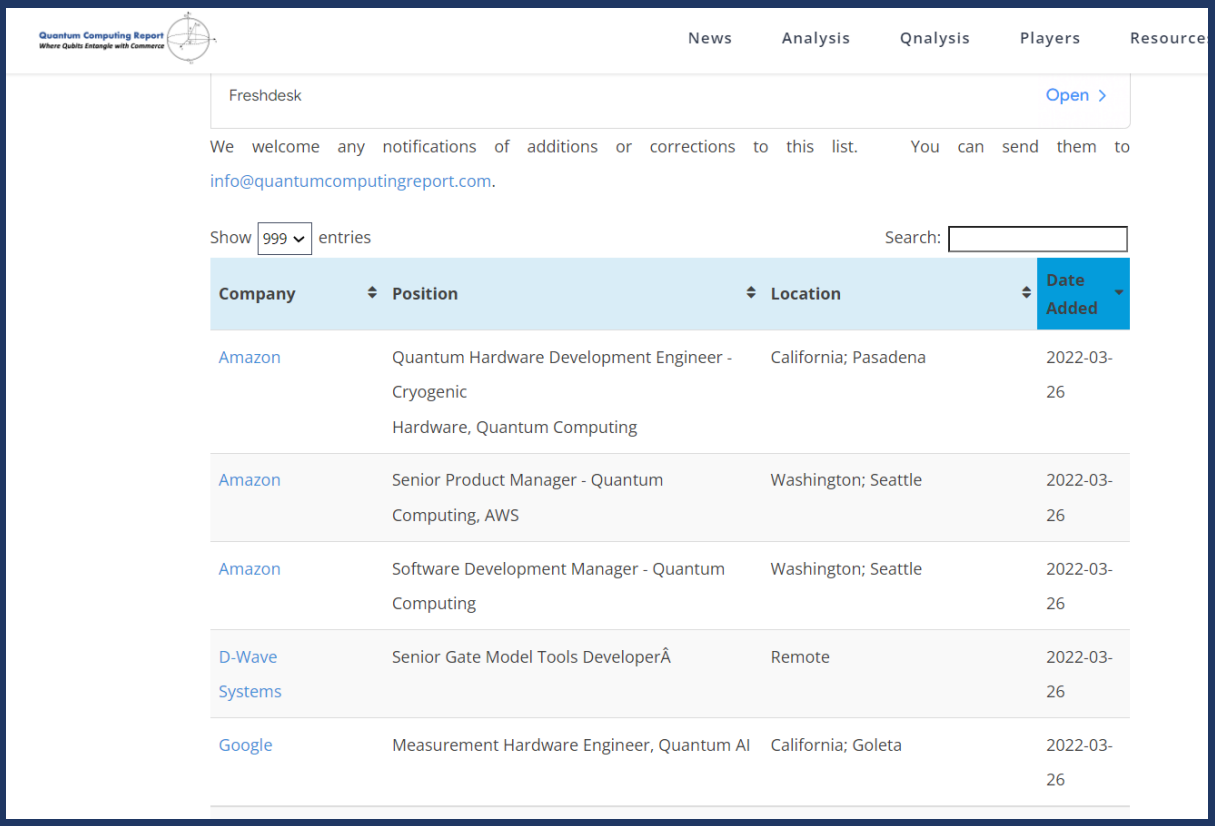


Quantum Computing Report
Where Qubits Entangle with Commerce

News Analysis Qnalysis Players Resources

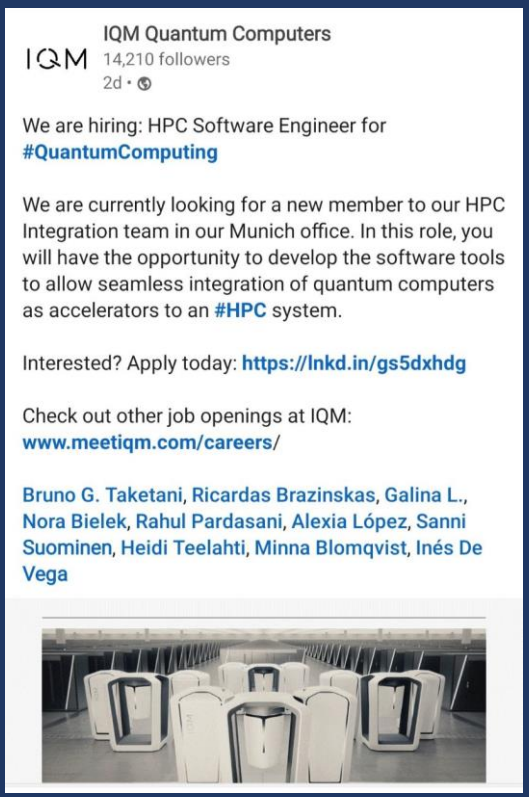
Freshdesk Open >

We welcome any notifications of additions or corrections to this list. You can send them to info@quantumcomputingreport.com.

Show 999 entries Search:

Company	Position	Location	Date Added
Amazon	Quantum Hardware Development Engineer - Cryogenic Hardware, Quantum Computing	California; Pasadena	2022-03-26
Amazon	Senior Product Manager - Quantum Computing, AWS	Washington; Seattle	2022-03-26
Amazon	Software Development Manager - Quantum Computing	Washington; Seattle	2022-03-26
D-Wave Systems	Senior Gate Model Tools DeveloperÂ	Remote	2022-03-26
Google	Measurement Hardware Engineer, Quantum AI	California; Goleta	2022-03-26

https://quantumcomputingreport.com/jobs/jobs-u-s-canada/



IQM Quantum Computers
14,210 followers
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We are hiring: HPC Software Engineer for #QuantumComputing

We are currently looking for a new member to our HPC Integration team in our Munich office. In this role, you will have the opportunity to develop the software tools to allow seamless integration of quantum computers as accelerators to an #HPC system.

Interested? Apply today: https://lnkd.in/gs5dxhdg

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Bruno G. Taketani, Ricardas Brazinskas, Galina L., Nora Bielek, Rahul Pardasani, Alexia López, Sanni Suominen, Heidi Teelahti, Minna Blomqvist, Inés De Vega

Quantum Computing

DEVELOPER + ENGINEER // HARDWARE // PYTHON // C++ // JAVA // LINUX //

Principal Engineer, Quantum Simulators

IONQ | REMOTE

IonQ is developing the world's most powerful full-stack quantum computer based on trapped-ion technology. We are pushing past the limits of classical physics and current supercomputing technology to unlock a new era of computing. Quantum computing has the potential to impact every area of human society for the better. IonQ's computers will soon redefine industries like medicine, materials science, finance, artificial intelligence, machine learning, cryptography, and more. IonQ is at the forefront of this technological revolution.

Simulating quantum computers helps us develop better algorithms and apply quantum-inspired algorithms to real-world problems before large-scale quantum computers are built! Simulators help us co-design our quantum hardware, software and applications to deliver maximum value for our customers. We're looking for a principal engineer to help build a collaborative team to architect and deliver the next-generation state-vector simulator of our universal, gate-based quantum computer.

Responsibilities:

- Design, develop, test, deploy, maintain and improve our quantum simulator
- Develop specialized simulators to model noise and error correcting codes
- Integrate simulators with other parts of the software stack such as compilers
- Develop simulators for our networked quantum computer architecture
- Ensure the quality of our simulator architecture and design
- Help hire the quantum simulation team
- Assist in the career development of others, providing mentorship on advanced

Quantum Computing

Quantum Physicist Internship

Chicago, United States / Guildford, England / remote Posted 6 days ago

Quantopticon Quantopticon Website

Quantopticon is a software start-up developing an automated platform for the design and optimisation of quantum photonic devices, such as qubits and single-photon sources: the constituent parts of photonic quantum computers and ultra-secure quantum communication channels. At Quantopticon we specialise in modelling quantum systems of the solid-state type, which are commonly embedded in optical cavity structures in order to control and enhance the quantum light emission from these devices.

For this position, we are seeking a physicist with experience and interest in quantum mechanics, quantum optics, electromagnetism and computational physics. You will perform a variety of highly innovative theoretical and computational physics tasks that will ensure successful product growth.

These tasks include:

- Assisting in developing a novel model of non-classical radiation;
- Further developing a Python script for interfacing different modules of our software suite, Quantillion;
- Developing a set of analytical tools for processing the calculated time dynamics;
- Assisting in developing and implementing into code a new model of single-photon generation through quantum-dot and optical cavity systems;
- Working closely with our experimental collaborators at the University of Oxford and the Technical University of Munich and utilising the experimental feedback to inform the model;
- Comparing the model predictions with the experimental data and refining the model to derive an optimised parameter set for the designed prototype.

Stipend: $1,200
Start date: 28 March 2022
End date: 3 June 2022 or earlier if working full-time
Working hours: full-time or part-time; full-time preferred
Time commitment: 150 hours

ZipRecruiter Suggested Jobs

Posted 07 March, 2022

Global Investment Research Division - Quantum & Verification - Analyst - Bangalore

Goldman Sachs

Bengaluru, KA, IND Full Time

About Goldman Sachs

At Goldman Sachs, we commit our people, capital and ideas to help our clients, shareholders and the communities we serve to grow. Founded in 1869, we are a leading global investment banking, securities and investment management firm. Headquartered in New York, we maintain offices around the world.

We believe who you are makes you better at what you do. We're committed to fostering and advancing diversity and inclusion in our own workplace and beyond by ensuring every individual within our firm has a number of opportunities to grow professionally and personally, from our training and development opportunities and firm wide networks to benefits, wellness and personal finance offerings and mindfulness programs. Learn more about our culture, benefits, and people at GS.com/careers

Quantum Computing

Quantum Software Developer Internship

Guildford, England / Chicago, United States / remote Posted 6 days ago

Quantopticon Quantopticon Website

Quantopticon is a software start-up developing an automated platform for the design and optimisation of quantum photonic devices, such as qubits and single-photon sources: the constituent parts of photonic quantum computers and ultra-secure quantum communication channels. At Quantopticon we specialise in modelling quantum systems of the solid-state type, which are commonly embedded in optical cavity structures in order to control and enhance the quantum light emission.

For this role, we are seeking a scientific programmer with experience in Intel Parallel Fortran, Python, and OpenMP. You will perform a variety of theoretical and computational physics tasks that will extend the capabilities of our flagship software suite, Quantillion.

These tasks include:

- Further developing Quantillion's 2D code to apply to 2D photonic structures;
- Extending Quantillion's quantum theoretical framework from 2D to 3D;
- Implementing 3D photonic structures into Quantillion's built-in library.

Knowledge of quantum mechanics, electromagnetics, quantum optics, and/or semiconductor physics is mandatory. Previous experience in computational physics, as well as MATLAB and other visualisation software for manipulating and displaying scientific data, is desirable.

Stipend: $4,000
Start date: 6 June 2022
Internship time commitment: 400 hours
Working hours: full-time or part-time; full-time preferred

Apply for job

https://quantumzeitgeist.com/job/quantopticon-guildford-england-chicago-united-states-remote-quantum-software-developer-internship/

quantumcomputingreport.com/jobs-europe-asia-australia/

Show 999 entries Search: India

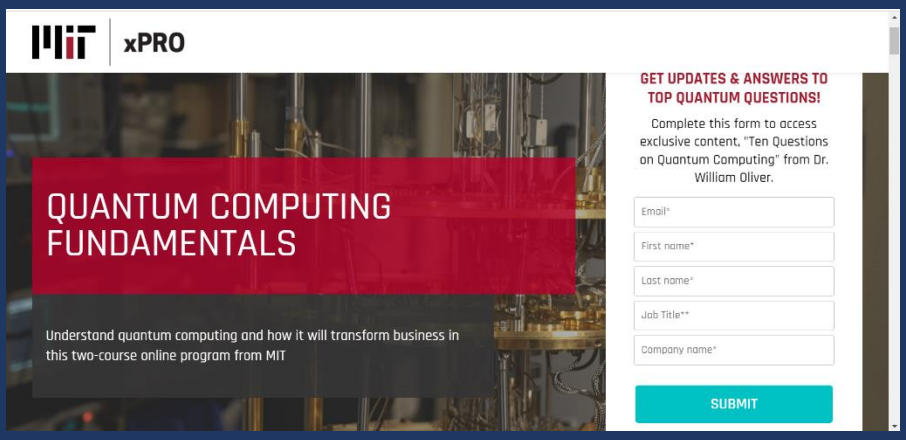
Company	Position	Location	Date Added
IBM	Hardware Developer	India; Bengaluru	2022-03-05
QpiAI	Quantum Research Scientist	India; Bangalore	2022-03-05
QpiAI	Quantum Software Engineer (Applications)	India; Bangalore	2022-03-05
QpiAI	HPC Developer	India; Bangalore	2022-02-26
ANI Calls India Private Limited	Quantum Computing, Investments	India; Mumbai	2020-12-19
ANI	Quantum Computing, SW	India; Chennai	2020-12-

https://quantumcomputingreport.com/jobs-europe-asia-australia/

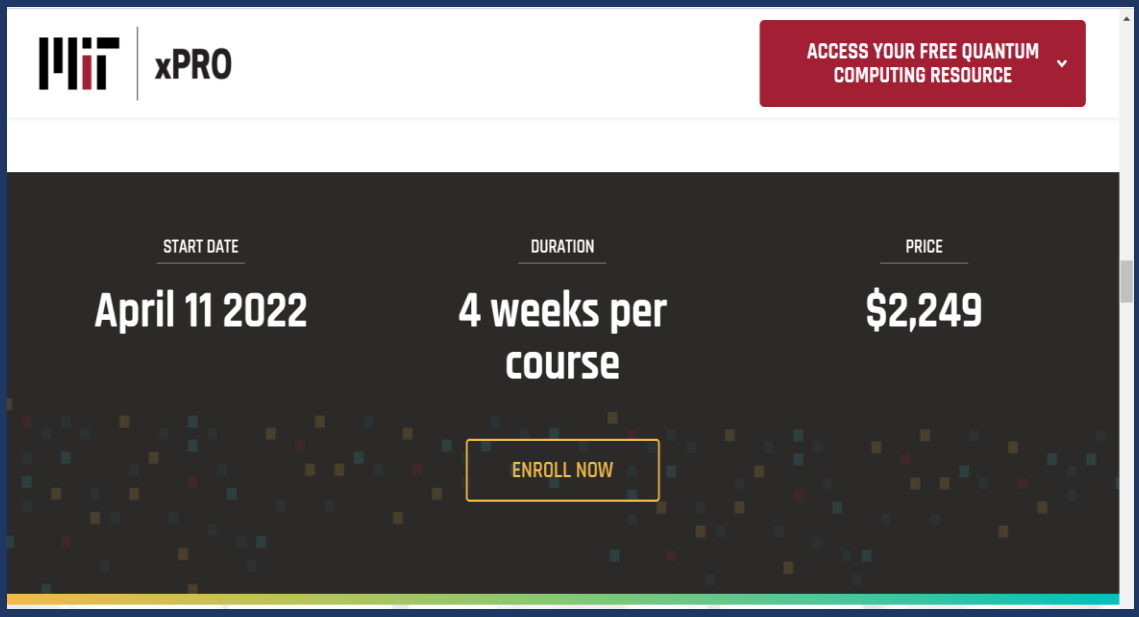
Quantum Computing

Course Expenditure

1. MIT xPro Quantum Computing Fundamentals



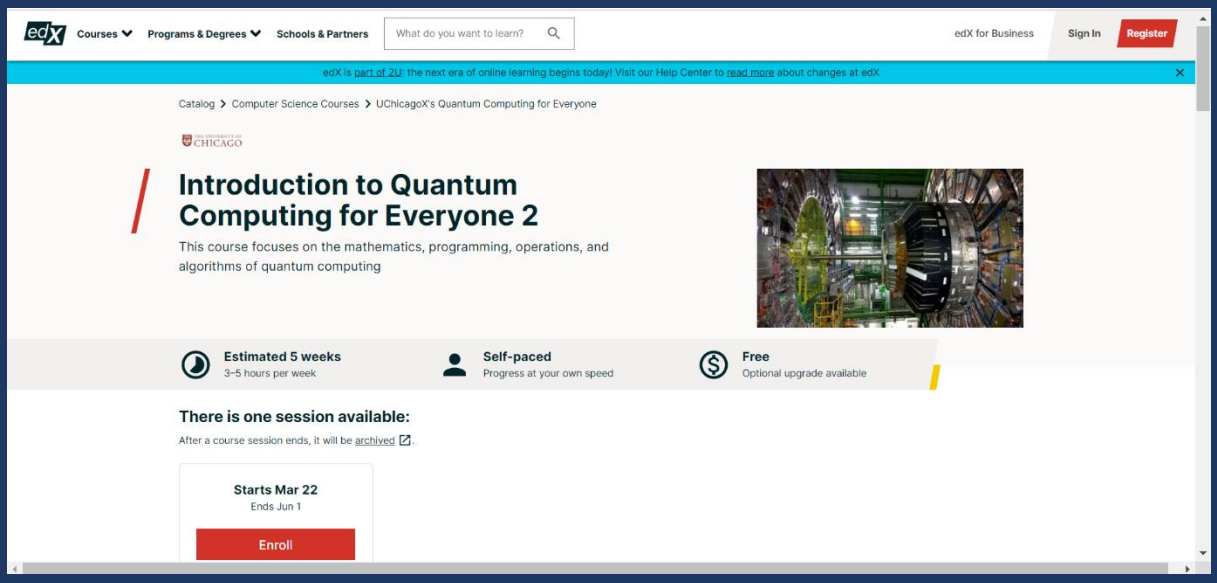
Cost Expenditure:



Quantum Computing

Course Syllabus / Outcome

2. UChicago - Introduction to Quantum Computing for Everyone 2



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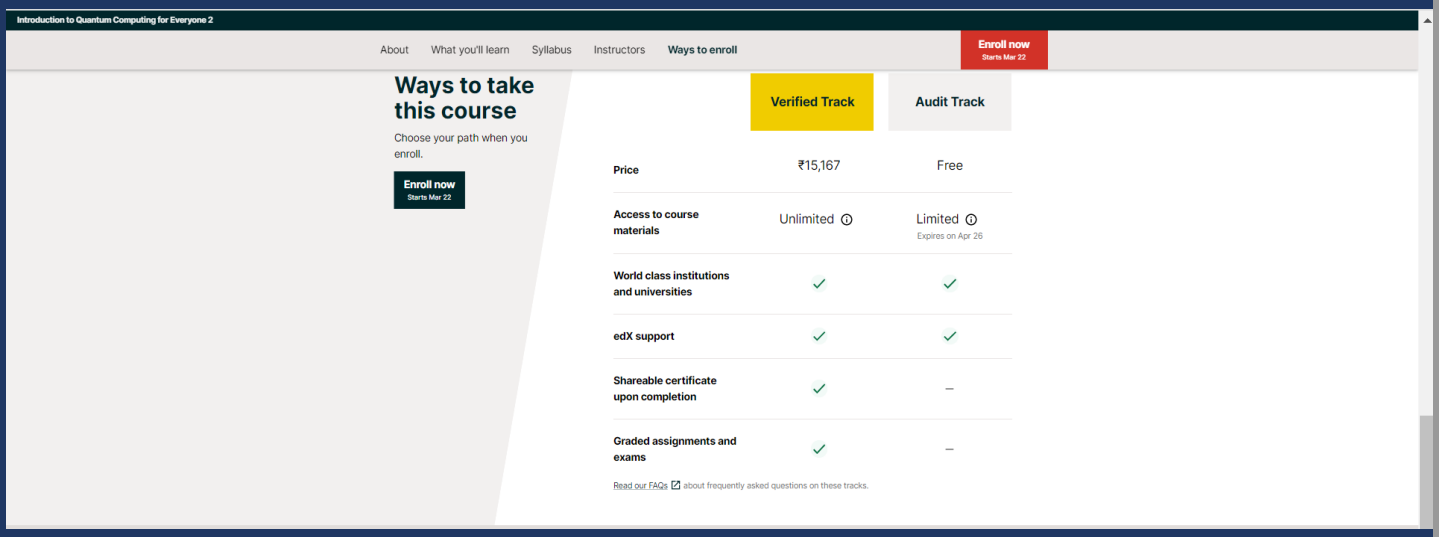
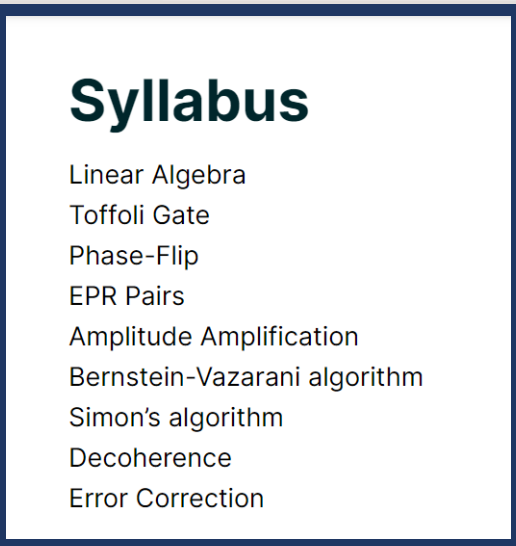
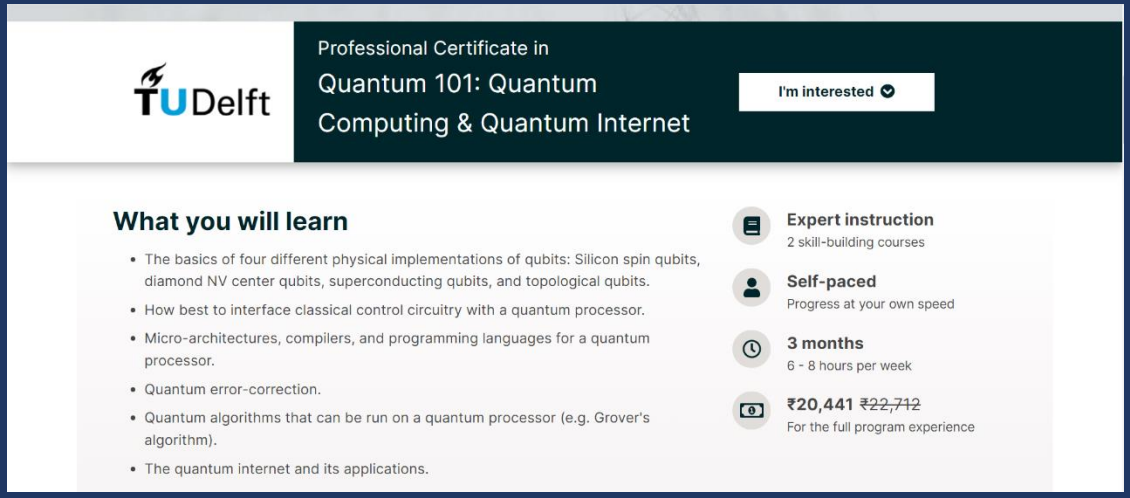
Expenditure:



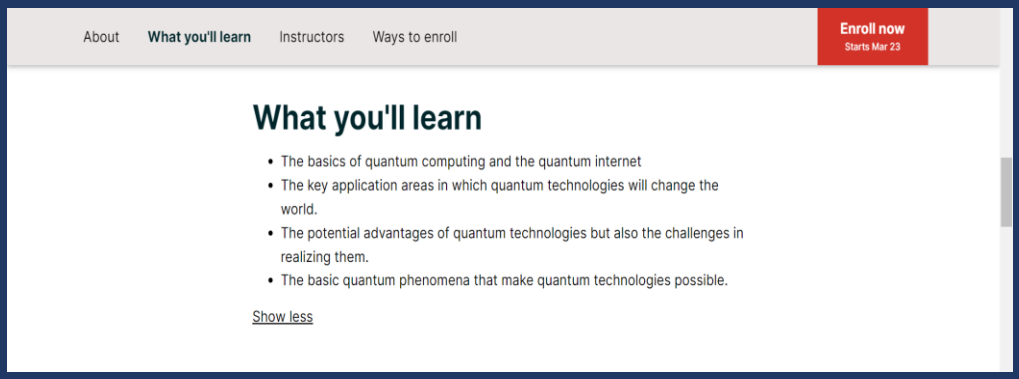


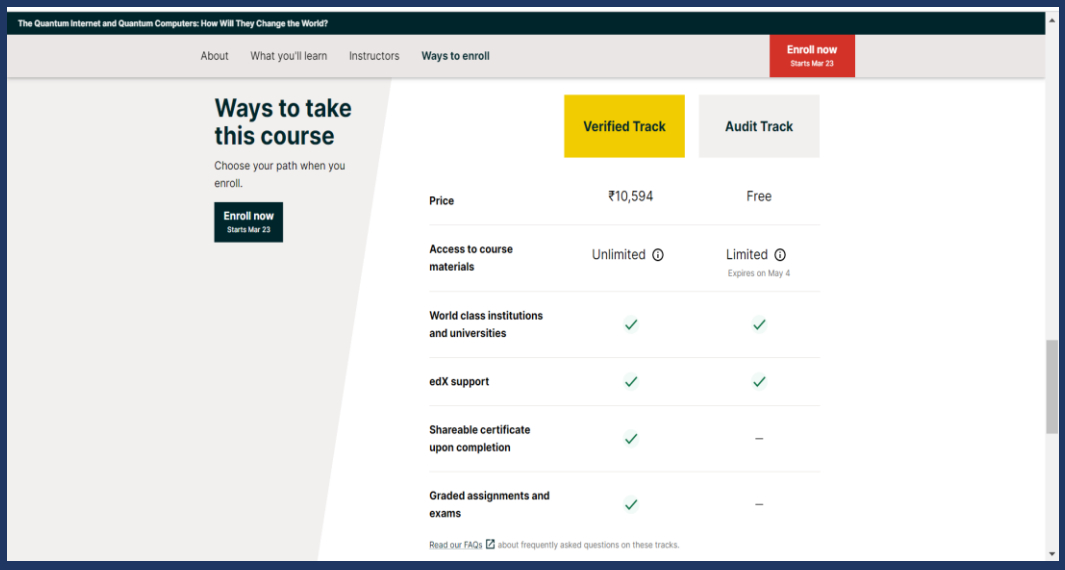
3. Delft: Quantum 101: Quantum Computing & Quantum Internet

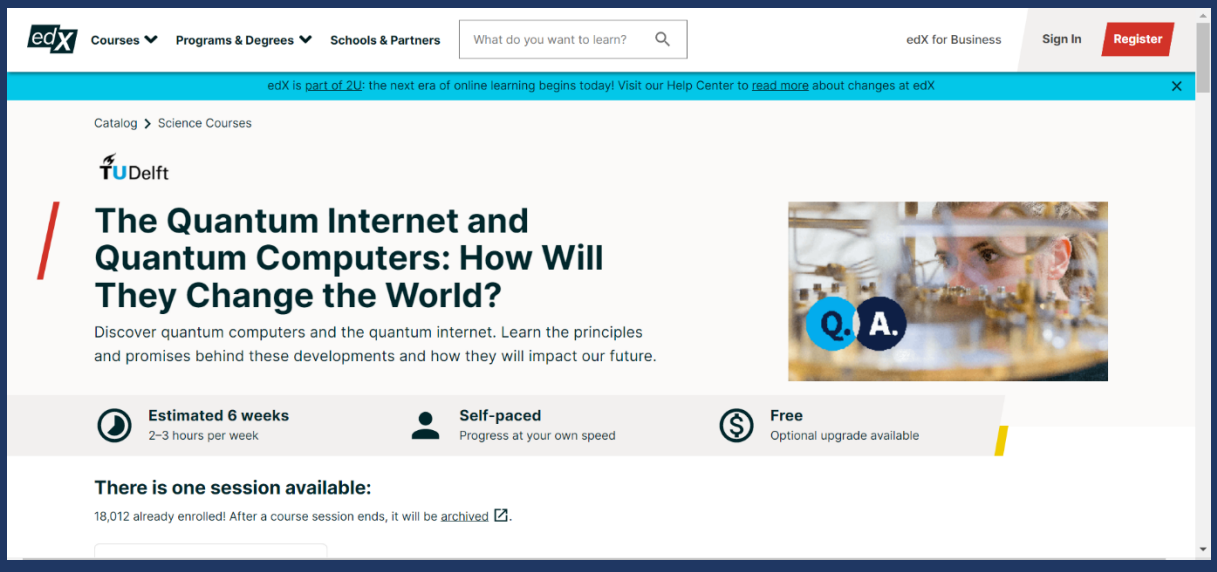


Quantum Computing

4. Delft: [The Quantum Internet and Quantum Computers: How Will They Change the World?]

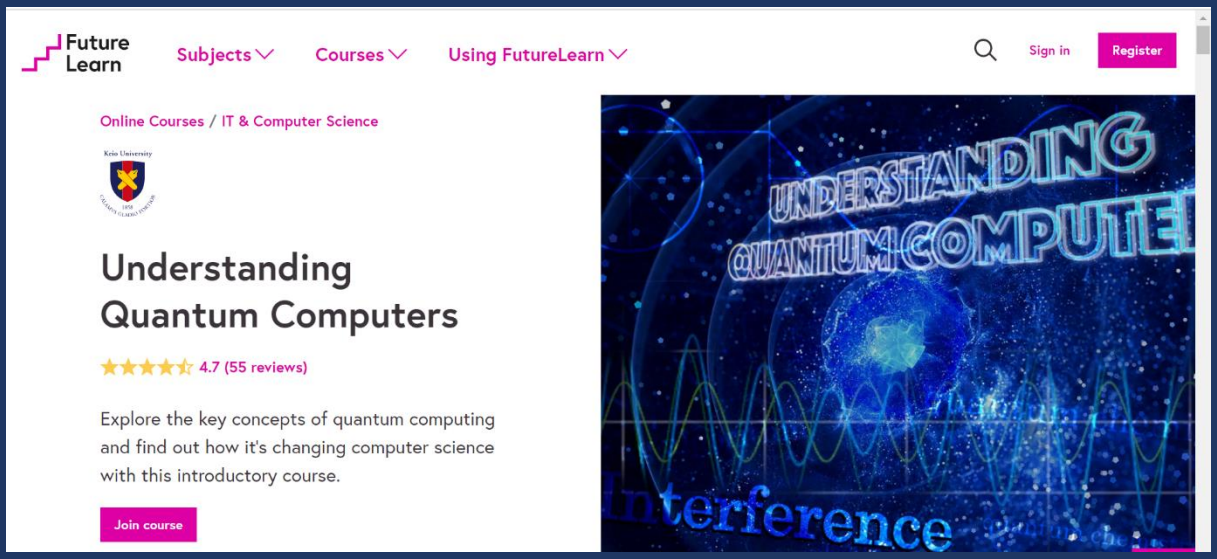


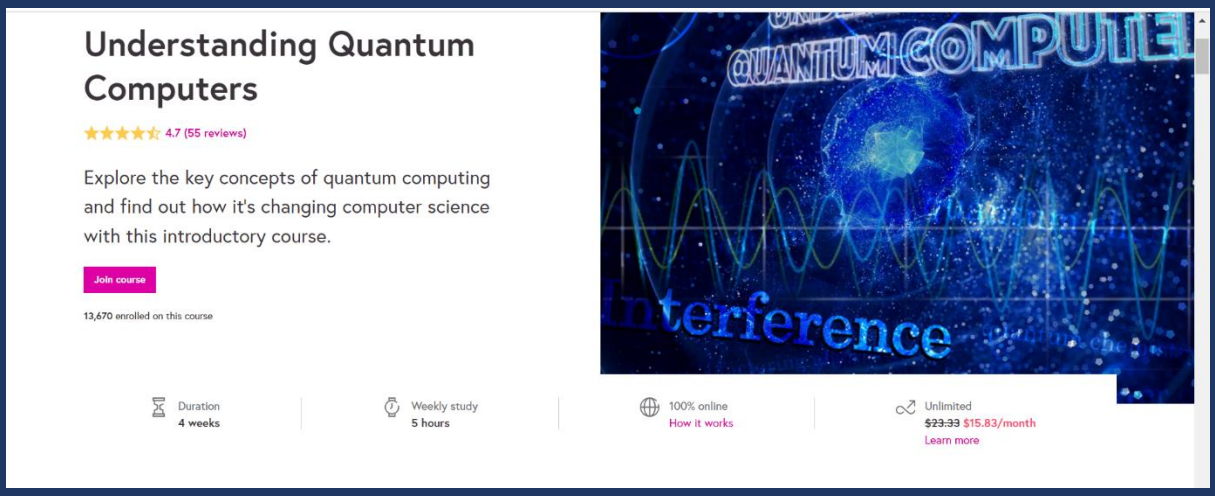


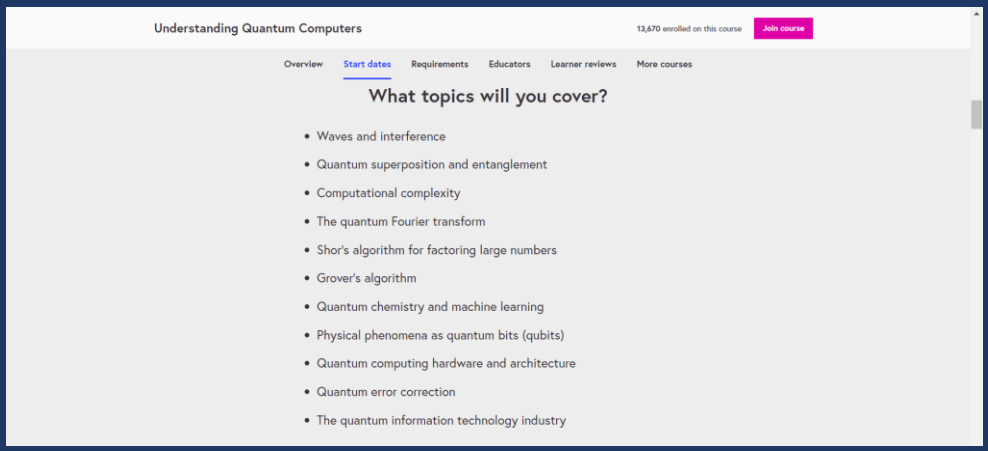


Quantum Computing

5. Future Learn: Understanding Quantum Computing

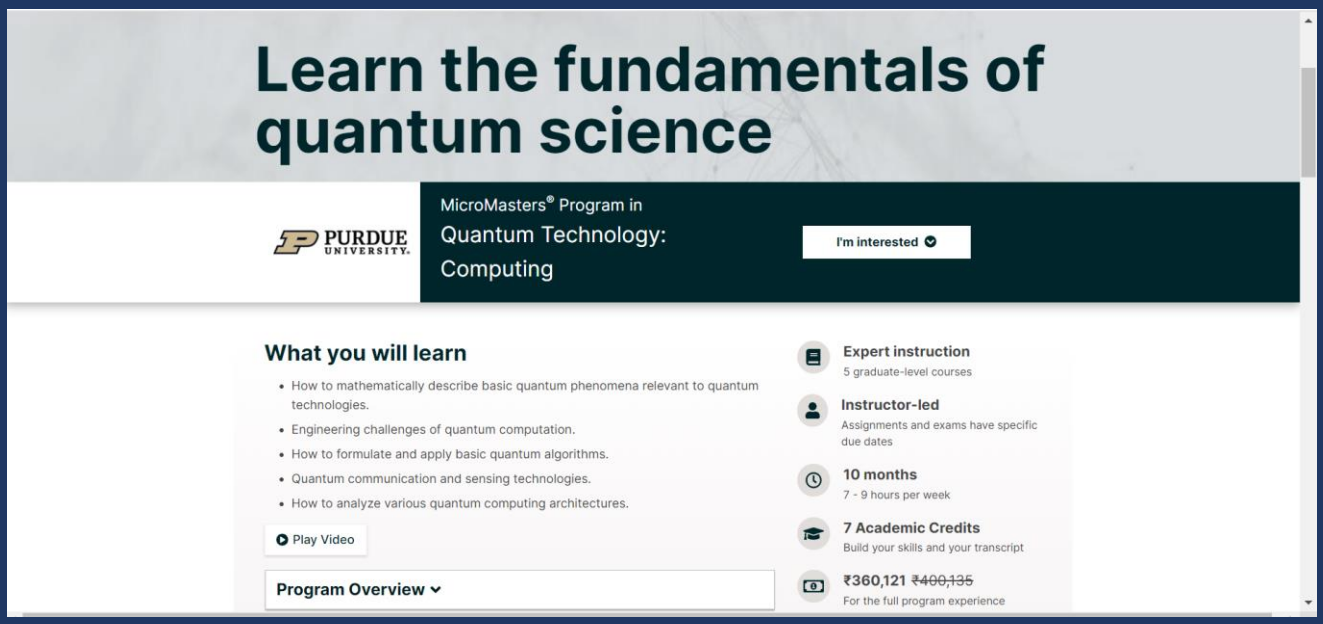




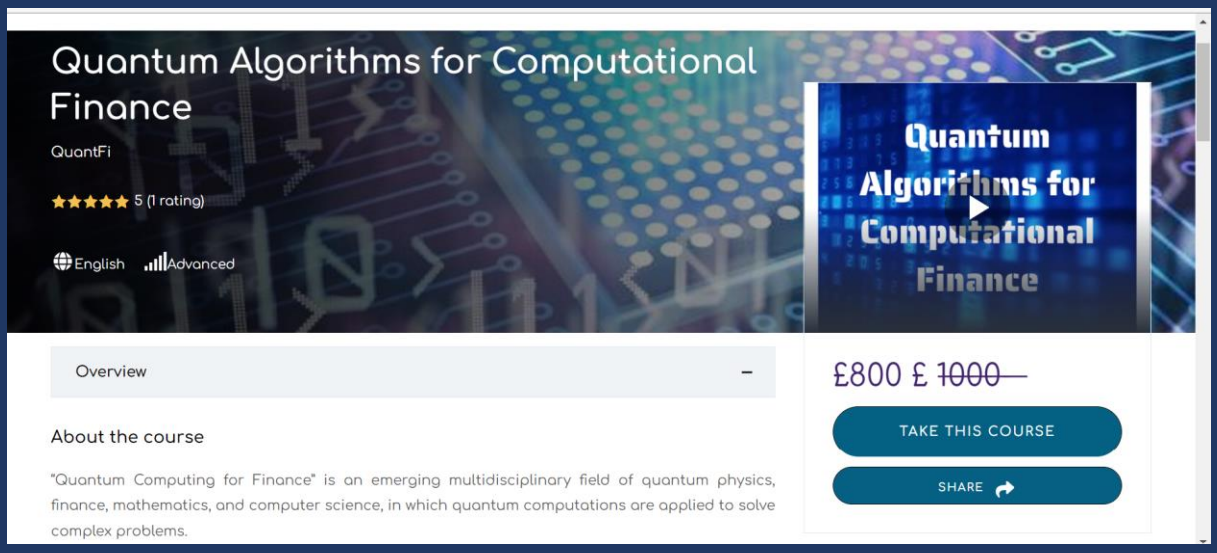


Quantum Computing

6 . Perdue: [Quantum Technology: Computing Micromasters]



7. Qureca: [Quantum Algorithms for Computational Finance]



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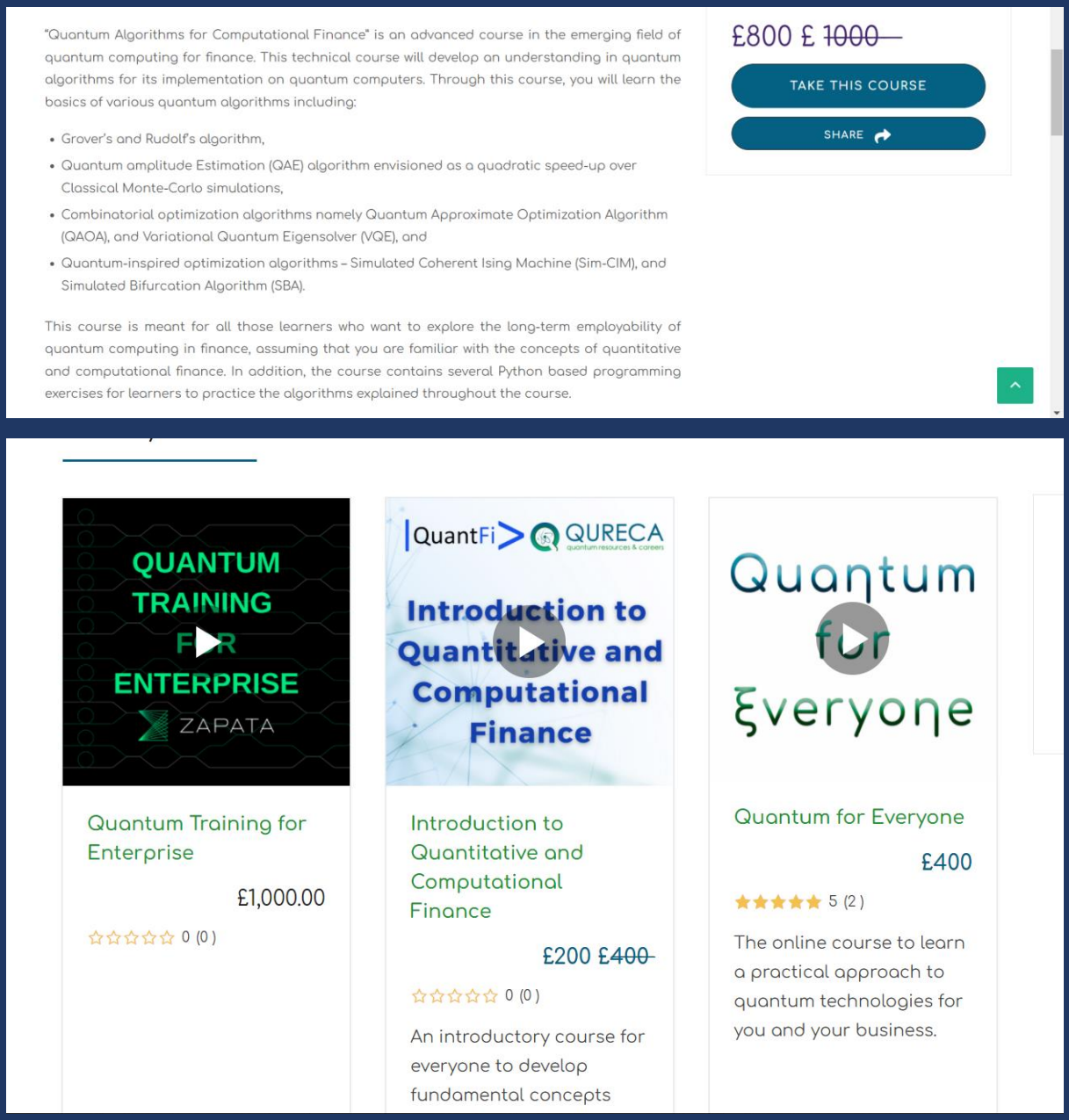


From the above details, you can observe the Cost estimation to learn Quantum Computing offered by various institutes and online platforms.

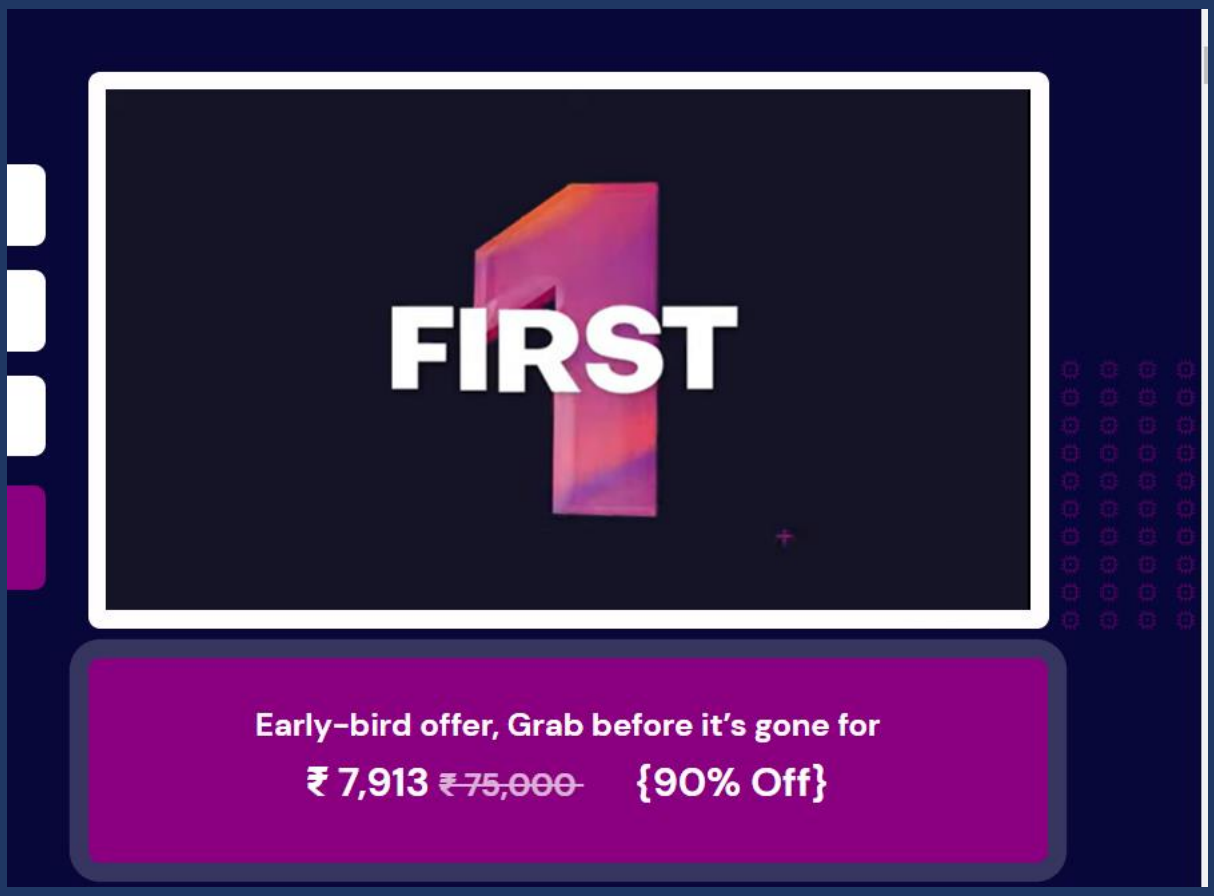
Sooner or later, every industry will start moving towards Quantum Computing, by seeing this **Mr. Vimal Daga** sir started a mission to make India's future-ready in "Quantum Computing" along with the #13 community.

Quantum Computing

Initiative to Make India Future Ready

Mr. Vimal Daga – 2x World Record holder and my mentor, is on a mission to make Indian students future-ready on various tools and technology.

Recently I can across one of his initiative “Quantum Computing” which is going to happen soon, a Full hands-on practical session. Have a look at the course contents and do register.



Quantum Computing

No-prerequisite knowledge Needed

Master Quantum computing from scratch: As we're starting from basics, anyone can join.

The only way to be Future-proof

All you know already will become irrelevant if Quantum Computing isn't a part of your technology stack.

At a price like never before!

The same course is offered in top institutes like Harvard, MIT but this training is tailored to be accessible for everyone.

Real-time Experience

Learn to write your own codes, create the circuits and execute on real quantum computers, all enabled by our virtual lab.

One-time Opportunity

Just like our other training, the quantum computing training is happening only once; there is no next time.

What will you learn?

Day 1

Day 2

Day 3

Day 4

- **Introduction**
  - Are Quantum Computers Real?
  - Intro Quantum Mechanics
  - Quantum Computer: Fiction or Fact
- **Mathematical for Quantum Computing –**
  - Trigonometry, Complex Numbers, Linear Algebra and Probability
  - Building Blocks of Quantum Computer and Classical Computer principals
  - Probability, Statistics, Matrices
- **The Quantum Computations Model and its Supremacy**
  - Superposition – Probabilistic Nature
  - Quantum Entanglement
  - Quantum Tunneling
  - Interference
- **Qubit- Introduction**
  - Creating, Retaining and Reading out Qubits
  - Vector and Matrix Quantum States
  - Popular Quantum Frameworks
  - Multi Qubit states introduction

Quantum Computing

What will you learn?

- Day 1
- **Day 2**
- Day 3
- Day 4

- **Multi Qubit Quantum Gates**
  - Quantum CX/CNOT Gate
  - Quantum CZ or CPHASE Gate
  - Quantum SWAP Gate
  - The Bell States
  - Quantum CCNOT/CCX/Toffoli Gate
  - Quantum CSWAP/Fredkin Gate
  - Hadamard Gate Applied to n Qubits
- **Representing Multi Qubit States**
  - Physical implementations of quantum computers
  - Bloch sphere: 3D representation of a qubit state
- **Quantum Programming**
  - Defining Quantum Circuits
  - Solving Graph Problem on Quantum Processing Unit
  - Quantum Annealer to solve a Graph-Optimization problem
- **Superdense Coding**
- **Quantum Teleportation: how is this even possible ?**
- **Bernstein Vazirani Algorithm**
  - Bernstein Vazirani Algorithm I – The Problem
  - Bernstein Vazirani Algorithm II – Circuit Analysis

What will you learn?

- Day 1
- Day 2
- **Day 3**
- Day 4

- **Deutsch Algorithm**
  - Intro
  - Problem
  - Oracles
  - Algo Steps
  - Circuit Analysis
- **Shor Algorithm**
- **Deutsch Jozsa Algorithm**
  - Intro
  - Deutsch Jozsa Algorithm II – Problem and Classical Case
  - Deutsch Jozsa Algorithm III – Features of DJ Algorithm
  - Deutsch Jozsa Algorithm IV – Constant vs Balanced Oracles
  - Deutsch Jozsa Algorithm V – Circuit Analysis Step
- **Grover Algorithm**
  - Grover's Algorithm I – Intro
  - Grover's Algorithm II – The Algorithm
  - Grover's Algorithm III – Geometric Interpretation

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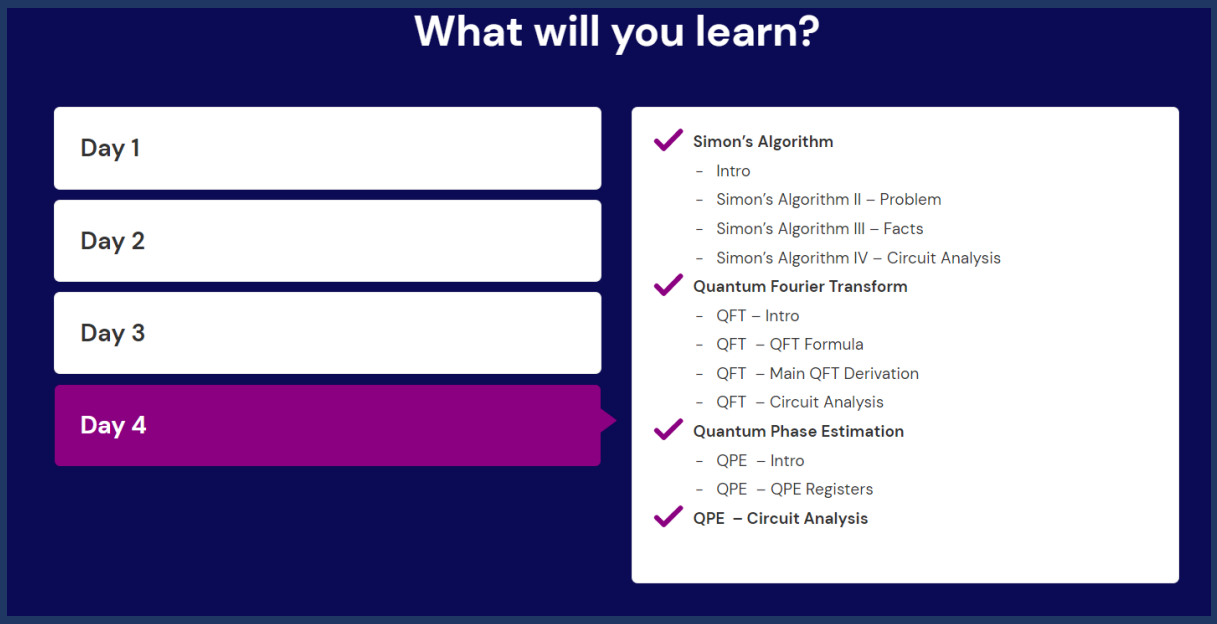

"Sometimes the smallest step in the right direction ends up being the biggest step of your life"

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