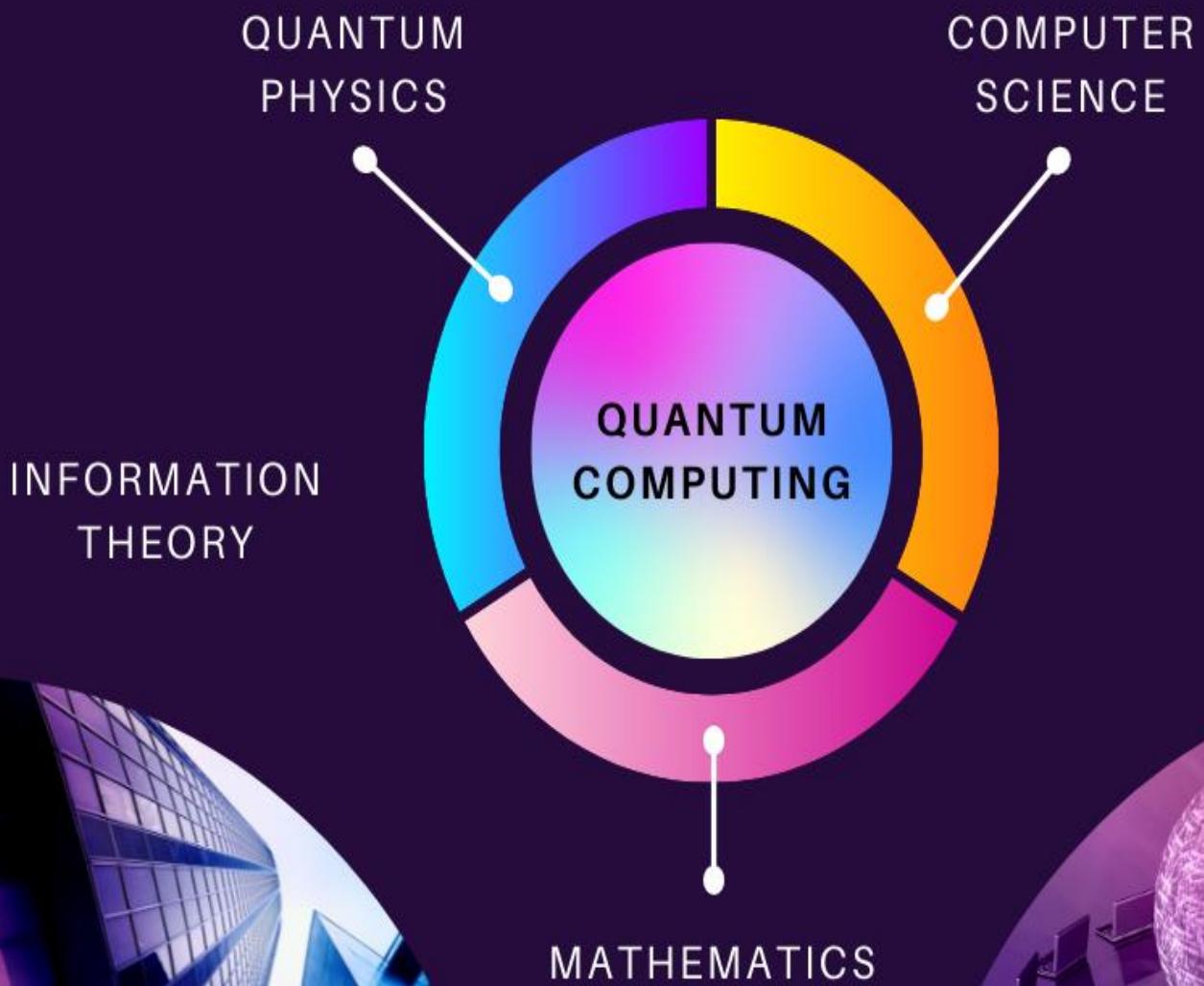


# Quantum Computing

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

## INDEX



Why Quantum Computing is future



Importance of Quantum Computing



Job prospects of Quantum Computing



Course Expenditure for learning



Initiative to make India Future-ready

LEVEL  
UP

# Quantum Computing

## Why Quantum Computing is Future

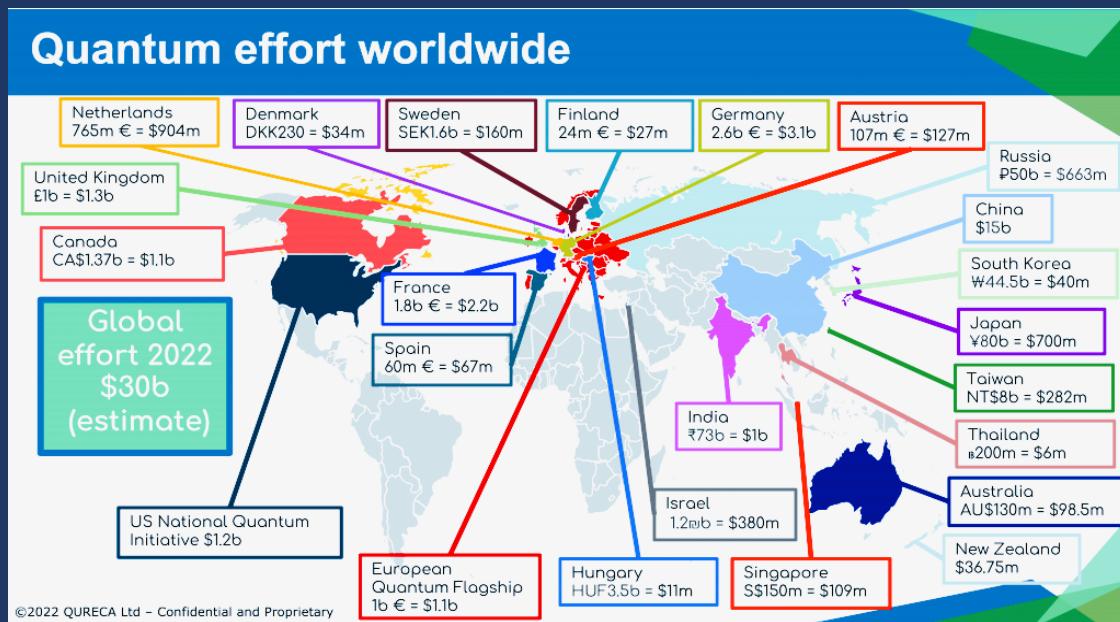
According to the Report titled “Quantum Technology Market by Computing, Communications, Imaging, Security, Sensing, Modeling and Simulation 2022 – 2027”, We can observe global and regional forecasts as well as the outlook for quantum technology's impact on embedded hardware, software, applications, and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

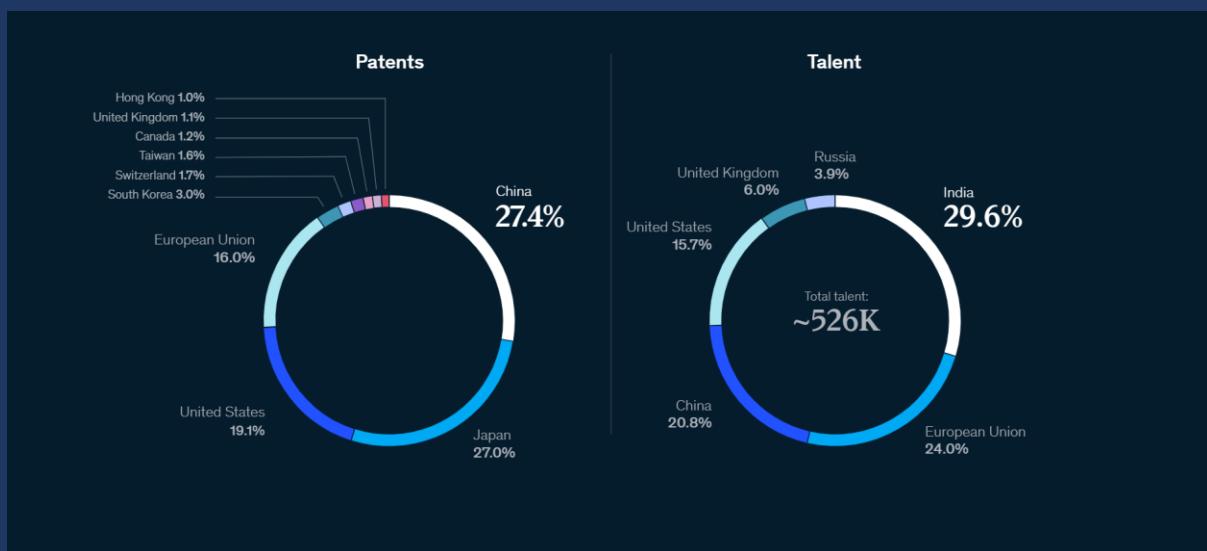
One classical machine learning approach optimized a portfolio in 33 hours; hybrid quantum annealing produced similar results in three minutes.

- 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.

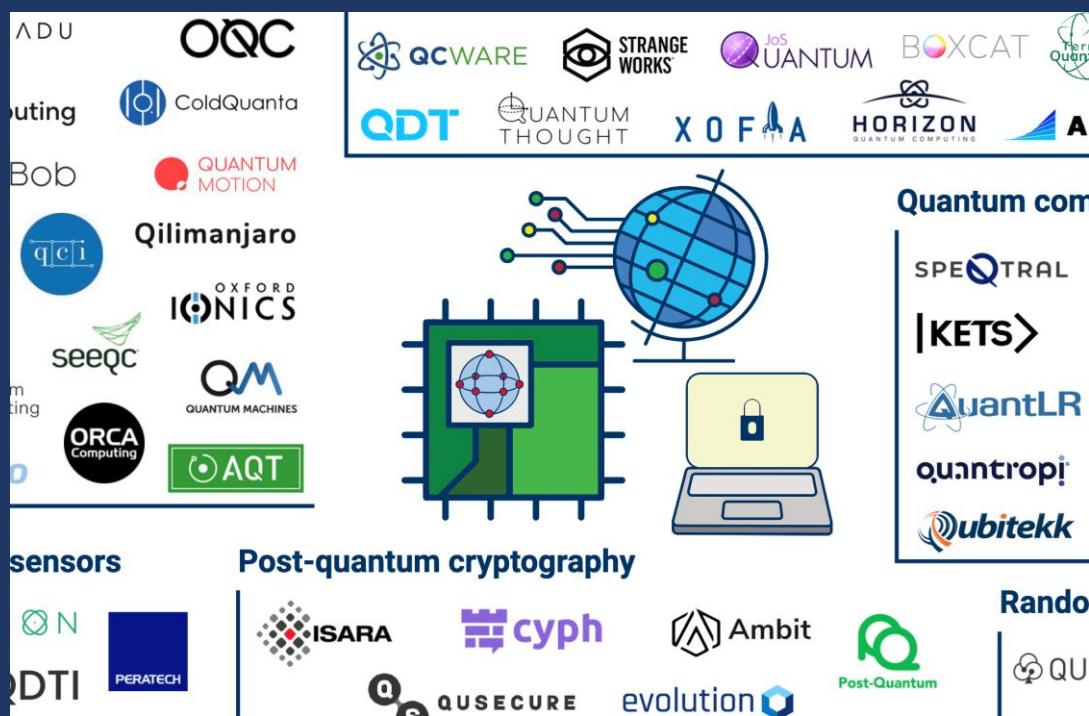
Sooner or later organizations will struggle to find and hire the quantum talent they need. The first wave is already underway, organizational leaders must understand what quantum computing is, which activities it is best suited for right now, and the challenges and enablers that must be addressed to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

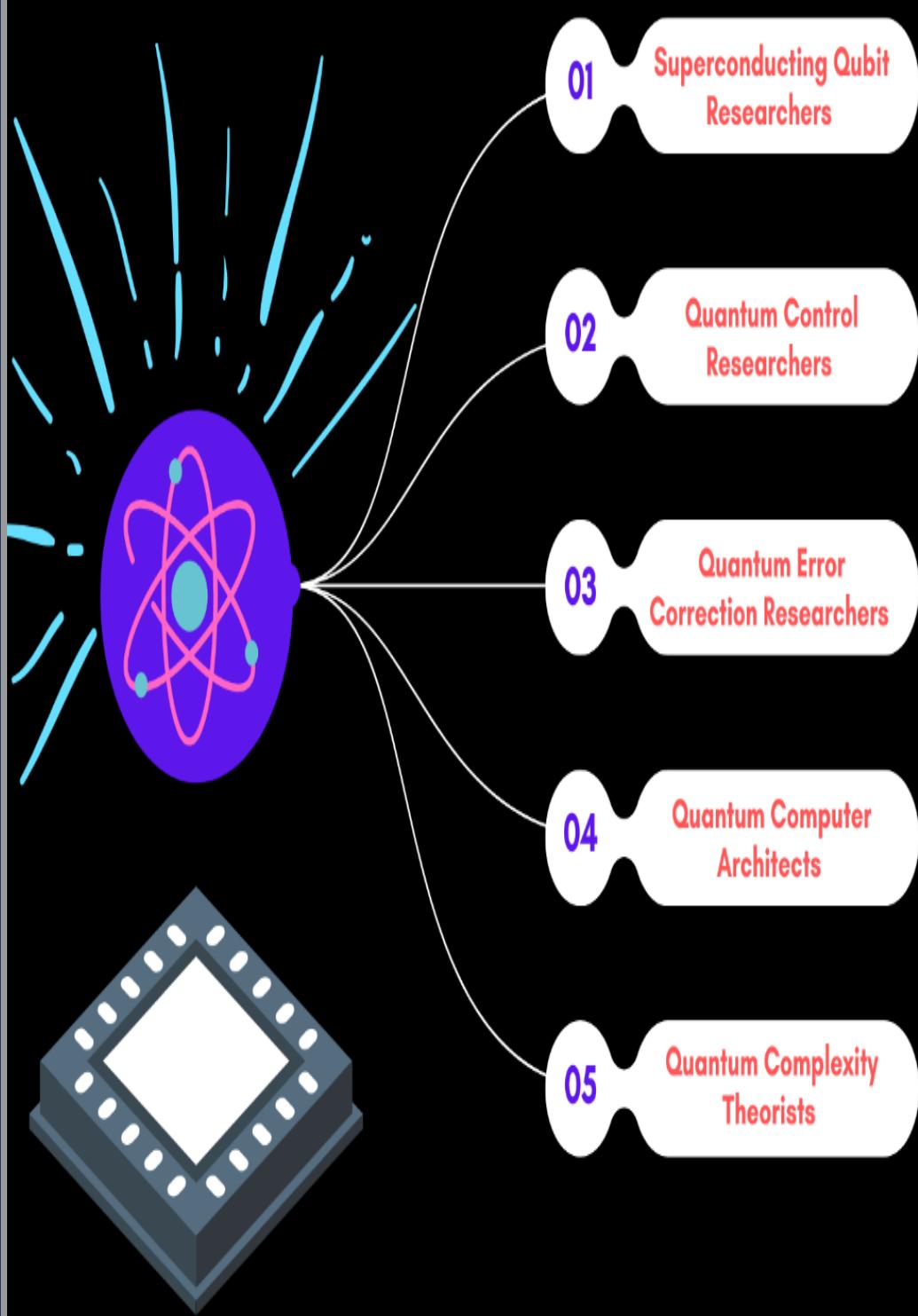
Quantum computing use cases are getting real—what you need to know

	Early stage	Late stage	early stage	late stages	supercomputer <sup>2</sup>
<b>Proxy for hardware needs,<sup>1</sup> qubits</b> ● Annealing ● Gate-based QC	Logical: N/A ● ~10,000 ● ~100	Logical: N/A ● ~100,000 ● ~1,000	Logical: ~100 ● ~100,000 ● ~100,000	Logical: ~1,000 ● ~1,000,000 ● ~1,000,000	Logical: ~10,000+ ● ~10,000,000+ ● ~10,000,000+
<b>Challenges for gate-based quantum computing</b>		Scalability and error correction			Quantum data storage (quantum RAM) and efficient data input and readout
<b>Challenges for annealing</b>		Better qubit connectivity			
<b>Lighthouse use cases</b>  Algorithm archetypes: ■ Linear algebra (AI/ML) ■ Optimization ■ Simulation ■ Factoring ■ Other  Industries: ■ Pharmaceuticals ■ Chemicals ■ Automotive ■ Finance ■ Logistics					<ul style="list-style-type: none"> <li>■ Breaking RSA cryptography</li> <li>■ Financial and cyberrisk simulation</li> <li>■ Large-molecule simulation</li> <li>■ ADMET<sup>4</sup> and toxicity prediction</li> <li>■ Complex-mixture simulation</li> <li>■ Solid-material simulation</li> <li>■ Catalysis or synthesis optimization</li> <li>■ Finite element method</li> <li>■ Supply-chain optimization</li> <li>■ Supply-chain disruption modeling</li> <li>■ Self-driving robots</li> <li>■ Credit-risk management</li> <li>■ Financial-crime detection</li> <li>■ Personalized medicine</li> <li>■ Automated drug recommendations</li> <li>■ Multiscale production optimization</li> </ul>
<b>Outlook</b>	Fault-tolerant quantum computing is expected between 2025 and 2030, based on announced hardware roadmaps for gate-based quantum-computing players.				

Image source and Credit: McKinsey

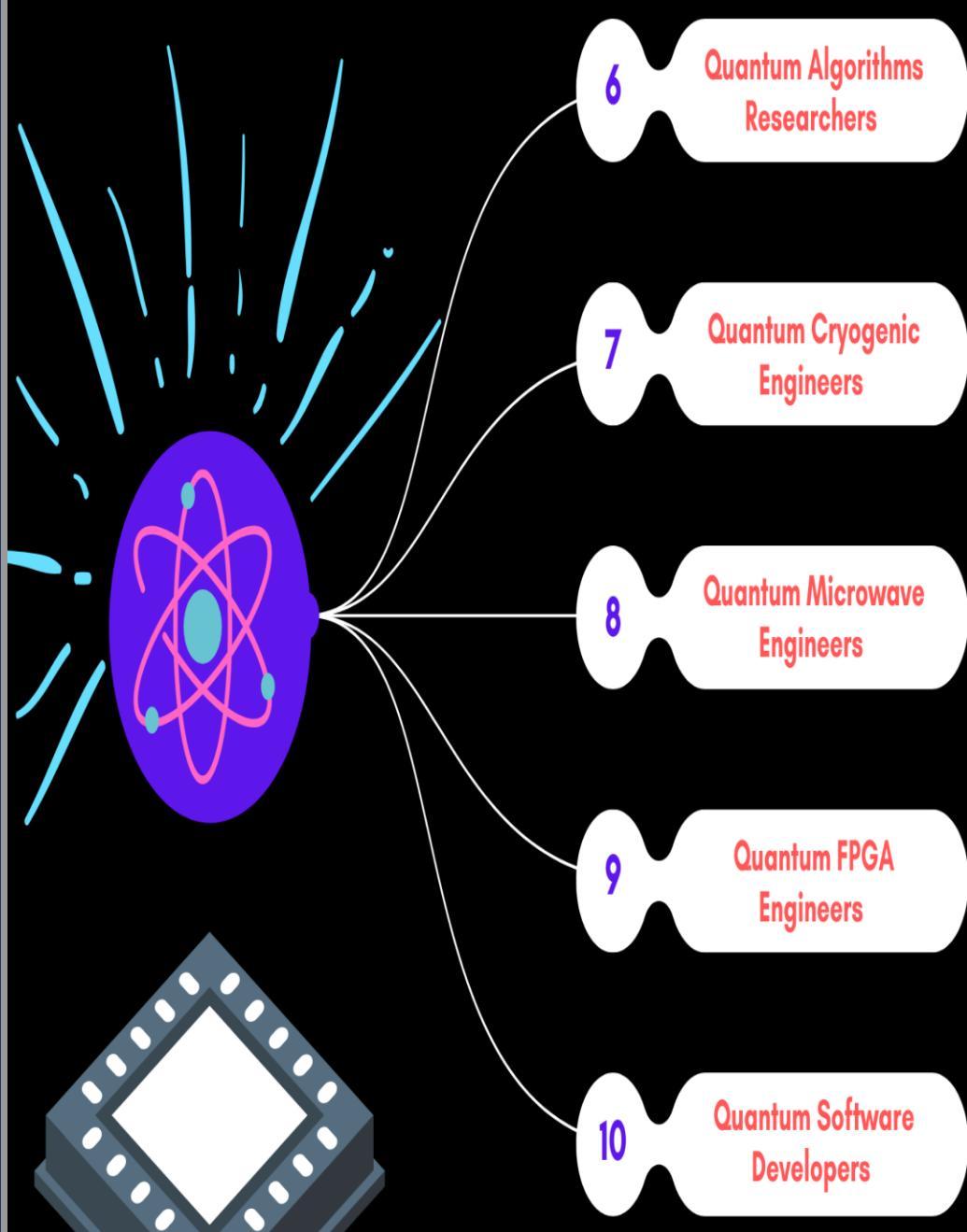
# QUANTUM COMPUTING

## Career Opportunities



# QUANTUM COMPUTING

## Career Opportunities



# Quantum Computing

## Small specimen of Job Roles

The image displays two side-by-side screenshots of the BuiltIn website, a platform for tech professionals. Both screenshots show a job listing for a "Senior Software Engineer, Quantum Tools" at IonQ.

**Screenshot 1 (Left):** This screenshot shows the initial details of the job posting. It includes a brief description of IonQ's mission to develop the world's most powerful full-stack quantum computer based on trapped-ion technology. It highlights the potential impact on various industries like medicine, materials science, finance, artificial intelligence, machine learning, cryptography, and more. The job requires a focus on quantum programming tools and front-end agnostic support. It also lists responsibilities for "Get hands on" and "Lead".

**Screenshot 2 (Right):** This screenshot shows the same job listing with a sidebar overlay. The sidebar features the IonQ logo and a message stating "THIS JOB IS ONLY AVAILABLE IN THE U.S.". It includes three buttons: "SAVE JOB", "EMAIL FOR LATER", and a link to "View IonQ's full profile". Below this, there are links to "See more ionQ jobs" and "See more IonQ profiles".

# Quantum Computing

Quantum Computing Report  
Where Qubits Entangle with Commerce

Freshdesk [Open >](#)

We welcome any notifications of additions or corrections to this list. You can send them to [info@quantumcomputingreport.com](mailto:info@quantumcomputingreport.com).

Show 999 entries  [Search](#)

Company	Position	Location	Date Added
Amazon	Quantum Hardware Development Engineer - Cryogenic	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 Developer	Remote	2022-03-26
Google	Measurement Hardware Engineer, Quantum AI	California; Goleta	2022-03-26

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

**IQM** IQM Quantum Computers  
14,210 followers  
2d •

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>

Check out other job openings at IQM:  
[www.meetiqm.com/careers/](http://www.meetiqm.com/careers/)

**Bruno G. Tackett, 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

[Twitter 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/>

← → C  [quantumcomputingreport.com/jobs-europe-asia-australia/](#)

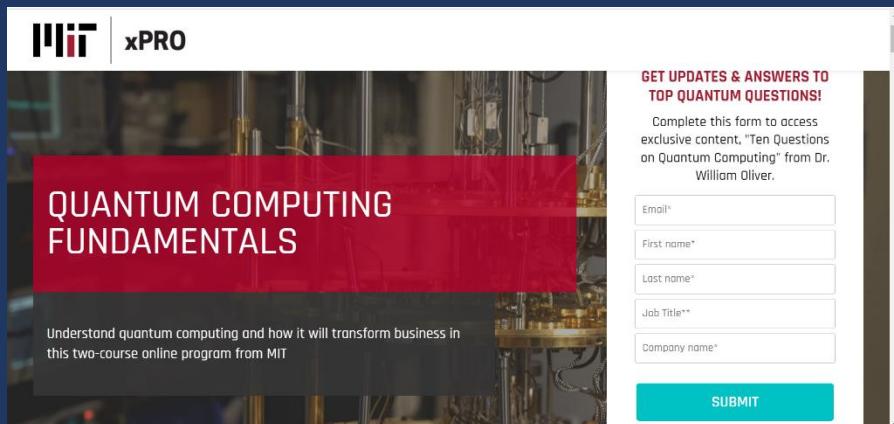
Jobs in Europe, Asia, Australia			
Company	Position	Location	Date Added
IBM	Hardware Developer	India; Bengaluru	2022-03-05
QpiAI	Quantum Research Scientist	India; Bangalore	2022-03-05
QpiAI	Quantum Software Engineer (Applications)	India; Bangalore	2022-03-05
QpiAI	HPC Developer	India; Bangalore	2022-02-26
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:

A screenshot of the MIT xPRO Quantum Computing Fundamentals course cost details page. It shows the start date as April 11 2022, duration as 4 weeks per course, and price as \$2,249. A red button labeled "ACCESS YOUR FREE QUANTUM COMPUTING RESOURCE" is visible. A yellow "ENROLL NOW" button is located at the bottom of the page.

# Quantum Computing

## Course Syllabus / Outcome

**MIT xPRO**

**ACCESS YOUR FREE QUANTUM COMPUTING RESOURCE**

**AFTER THIS PROGRAM, YOU WILL BE ABLE TO:**

- Describe the differences between quantum and classical computation.
- Assess the business applications of quantum computation.
- Become proficient with engineering requirements for quantum vs classical algorithm implementation.
- Determine technical requirements for quantum computers to run realistically large quantum algorithms.
- Understand the mathematical description of quantum states and basic quantum operations.
- Discern potential performance gains of quantum vs. classical algorithms.
- Understand engineering challenges currently faced by developers of quantum computers.
- Discern the scientific limits of quantum algorithms for chemistry and optimization.
- Evaluate key technology requirements for quantum computers to be able to function properly.



## 2. UChicago - Introduction to Quantum Computing for Everyone 2

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Catalog > Computer Science Courses > UChicagoX's Quantum Computing for Everyone

 **Introduction to Quantum Computing for Everyone 2**

This course focuses on the mathematics, programming, operations, and algorithms of quantum computing



**Estimated 5 weeks** 3–5 hours per week **Self-paced** Progress at your own speed **Free** Optional upgrade available

**There is one session available:**  
After a course session ends, it will be [archived](#).

**Starts Mar 22**  
Ends Jun 1

**Enroll**

# Quantum Computing

## Expenditure:

Introduction to Quantum Computing for Everyone 2

About What you'll learn Syllabus Instructors Ways to enroll Enroll now Starts Mar 22

### Ways to take this course

Choose your path when you enroll.

Enroll now Starts Mar 22

	Verified Track	Audit Track
Price	₹15,167	Free
Access to course materials	Unlimited ⓘ Expires on Apr 26	Limited ⓘ
World class institutions and universities	✓	✓
edX support	✓	✓
Shareable certificate upon completion	✓	—
Graded assignments and exams	✓	—

Read our FAQs ⓘ about frequently asked questions on these tracks.

## Syllabus

Linear Algebra  
Toffoli Gate  
Phase-Flip  
EPR Pairs  
Amplitude Amplification  
Bernstein-Vazirani algorithm  
Simon's algorithm  
Decoherence  
Error Correction

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

 Professional Certificate in  
Quantum 101: Quantum Computing & Quantum Internet I'm interested ⓘ

#### What you will learn

- The basics of four different physical implementations of qubits: Silicon spin qubits, diamond NV center qubits, superconducting qubits, and topological qubits.
- How best to interface classical control circuitry with a quantum processor.
- Micro-architectures, compilers, and programming languages for a quantum processor.
- Quantum error-correction.
- Quantum algorithms that can be run on a quantum processor (e.g. Grover's algorithm).
- The quantum internet and its applications.

 **Expert instruction**  
2 skill-building courses

 **Self-paced**  
Progress at your own speed

 **3 months**  
6 - 8 hours per week

 **₹20,441 ₹22,712**  
For the full program experience

# Quantum Computing

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

About    **What you'll learn**    Instructors    Ways to enroll

**Enroll now**  
Starts Mar 23

### What you'll learn

- The basics of quantum computing and the quantum internet
- The key application areas in which quantum technologies will change the world.
- The potential advantages of quantum technologies but also the challenges in realizing them.
- The basic quantum phenomena that make quantum technologies possible.

[Show less](#)

The Quantum Internet and Quantum Computers: How Will They Change the World?

About    What you'll learn    Instructors    **Ways to enroll**

**Enroll now**  
Starts Mar 23

### Ways to take this course

Choose your path when you enroll.

**Enroll now**  
Starts Mar 23

	Verified Track	Audit Track
Price	₹10,594	Free
Access to course materials	Unlimited ⓘ Expires on May 4	Limited ⓘ
World class institutions and universities	✓	✓
edX support	✓	✓
Shareable certificate upon completion	✓	—
Graded assignments and exams	✓	—

Read our FAQs ⓘ about frequently asked questions on these tracks.

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edX is part of 2U: the next era of online learning begins today! Visit our Help Center to [read more](#) about changes at edX

Catalog > Science Courses

TU Delft

## The Quantum Internet and Quantum Computers: How Will They Change the World?

Discover quantum computers and the quantum internet. Learn the principles and promises behind these developments and how they will impact our future.



**Estimated 6 weeks**  
2–3 hours per week

**Self-paced**  
Progress at your own speed

**Free**  
Optional upgrade available

**There is one session available:**

18,012 already enrolled! After a course session ends, it will be archived ⓘ.

# Quantum Computing

## 5. Future Learn: Understanding Quantum Computing

The screenshot shows the Future Learn platform. At the top, there's a navigation bar with the Future Learn logo, a search icon, and links for 'Sign in' and 'Register'. Below the navigation, a breadcrumb trail reads 'Online Courses / IT & Computer Science'. A small Keio University logo is present. The main title 'Understanding Quantum Computers' is displayed in large, bold, dark text. Below it, a yellow star rating indicates '4.7 (55 reviews)'. A brief course description follows: 'Explore the key concepts of quantum computing and find out how it's changing computer science with this introductory course.' A prominent blue button labeled 'Join course' is at the bottom left. To the right, a large, stylized graphic features the words 'UNDERSTANDING QUANTUM COMPUTER' and 'Interference' in a futuristic, glowing font against a dark background with abstract light patterns.

This is a detailed view of the course page. The title 'Understanding Quantum Computers' is again at the top, along with its 4.7 rating. The course description is identical to the previous screenshot. Below the description, another 'Join course' button is visible. To the right, the same 'Interference' graphic is shown. At the bottom of the page, several course details are listed: 'Duration 4 weeks', 'Weekly study 5 hours', '100% online How it works', and 'Unlimited \$29.99 \$15.83/month Learn more'.

This screenshot shows the 'Overview' tab of the course page. It includes a 'Start dates' section with a blue underline, 'Requirements', 'Educators', 'Learner reviews', and 'More courses' links. Below this, a section titled 'What topics will you cover?' lists a variety of quantum computing topics:

- Waves and interference
- Quantum superposition and entanglement
- Computational complexity
- The quantum Fourier transform
- Shor's algorithm for factoring large numbers
- Grover's algorithm
- Quantum chemistry and machine learning
- Physical phenomena as quantum bits (qubits)
- Quantum computing hardware and architecture
- Quantum error correction
- The quantum information technology industry

# Quantum Computing

## 6 . Perdue: Quantum Technology: Computing Micromasters

The screenshot shows the landing page for the MicroMasters Program in Quantum Technology: Computing. The main title is "Learn the fundamentals of quantum science". Below it, the Purdue University logo is displayed. The program is described as a MicroMasters® Program in Quantum Technology: Computing. A "I'm interested" button is visible. The "What you will learn" section lists several topics including basic quantum phenomena, engineering challenges, quantum algorithms, communication, and sensing technologies. To the right, there are icons and details for "Expert instruction" (5 graduate-level courses), "Instructor-led" (assignments and exams have specific due dates), "10 months" (7 - 9 hours per week), "7 Academic Credits" (Build your skills and your transcript), and the cost "₹360,121 ₹400,135" (For the full program experience). A "Play Video" button and a "Program Overview" dropdown menu are also present.

## 7. Qureca: Quantum Algorithms for Computational Finance

The screenshot shows the course page for "Quantum Algorithms for Computational Finance" on Qureca. The course title is prominently displayed at the top. Below it, the provider is listed as QuantFi. The course has a rating of 5 stars (1 rating). It is offered in English and is labeled as Advanced. The price range is £800 - £1000. A large "TAKE THIS COURSE" button is visible. The course description states: "'Quantum Computing for Finance' is an emerging multidisciplinary field of quantum physics, finance, mathematics, and computer science, in which quantum computations are applied to solve complex problems." There is also a "SHARE" button with a social media icon.

# Quantum Computing

"Quantum Algorithms for Computational Finance" is an advanced course in the emerging field of quantum computing for finance. This technical course will develop an understanding in quantum algorithms for its implementation on quantum computers. Through this course, you will learn the basics of various quantum algorithms including:

- Grover's and Rudolf's algorithm,
- Quantum amplitude Estimation (QAE) algorithm envisioned as a quadratic speed-up over Classical Monte-Carlo simulations,
- Combinatorial optimization algorithms namely Quantum Approximate Optimization Algorithm (QAOA), and Variational Quantum Eigensolver (VQE), and
- Quantum-inspired optimization algorithms – Simulated Coherent Ising Machine (Sim-CIM), and Simulated Bifurcation Algorithm (SBA).

£800 £ 1000

TAKE THIS COURSE

SHARE 

This course is meant for all those learners who want to explore the long-term employability of quantum computing in finance, assuming that you are familiar with the concepts of quantitative and computational finance. In addition, the course contains several Python based programming exercises for learners to practice the algorithms explained throughout the course.



Quantum Training for Enterprise

£1,000.00

 0 (0)



Introduction to Quantitative and Computational Finance

£200 £400

 0 (0)

An introductory course for everyone to develop fundamental concepts



Quantum for Everyone

£400

 5 (2)

The online course to learn a practical approach to quantum technologies for you and your business.

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.

Early-bird offer, Grab before it's gone for  
₹ 7,913 ₹75,000 {90% Off}

# 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.

### 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

# Quantum Computing

## What will you learn?

Day 1

Day 2

Day 3

Day 4

- ✓ Simon's Algorithm
  - Intro
  - Simon's Algorithm II – Problem
  - Simon's Algorithm III – Facts
  - Simon's Algorithm IV – Circuit Analysis

### ✓ Quantum Fourier Transform

- QFT – Intro
- QFT – QFT Formula
- QFT – Main QFT Derivation
- QFT – Circuit Analysis

### ✓ Quantum Phase Estimation

- QPE – Intro
- QPE – QPE Registers

### ✓ QPE – Circuit Analysis

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

Join Quantum revolution from **#hash13** Community

Become India's first-ever Quantum Computing Experts

- **Qubits squad**

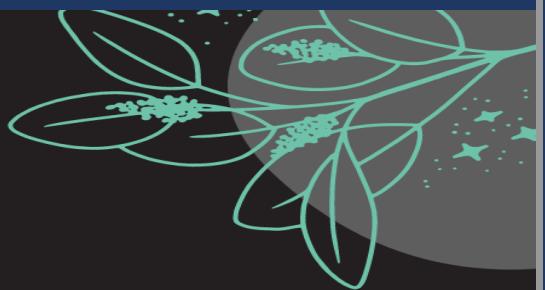
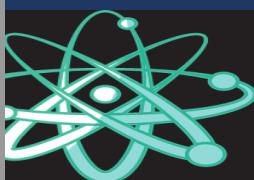
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**#13**

# Quantum Computing

Quantum Computing is a rapidly growing field that promises to revolutionize computing.

It is based on the principles of quantum mechanics, which describe the behavior of matter and energy at the smallest scales.

Quantum computers use quantum bits, or qubits, which can exist in multiple states simultaneously.

This allows them to perform many calculations at once, making them potentially much faster than classical computers.

Quantum computing has the potential to solve problems that are currently unsolvable by classical computers.

It is also being used to develop new materials and to simulate complex systems.

Quantum computing is still in its early stages, but it has already shown great promise and is likely to continue to grow and develop in the future.

If you are interested in learning more about quantum computing, there are many resources available online and in books.

Some good starting points include the following:

[Quantum Computing for Everyone](#) by Sundar Ramamurti and Brian Lanyon

[Quantum Computing Since Democritus](#) by Scott Aaronson

[Quantum Computation and Quantum Information](#) by Michael A. Nielsen and Isaac L. Chuang

[Quantum Computing: A Gentle Introduction](#) by Eleanor Rieffel and Wolfgang Hjörvarsson

[Quantum Computing: Theory and Experiment](#) by Marko Stojanovic

[Quantum Computing: A Practical Introduction](#) by John Preskill

[Quantum Computing: A Gentle Introduction](#) by Eleanor Rieffel and Wolfgang Hjörvarsson

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