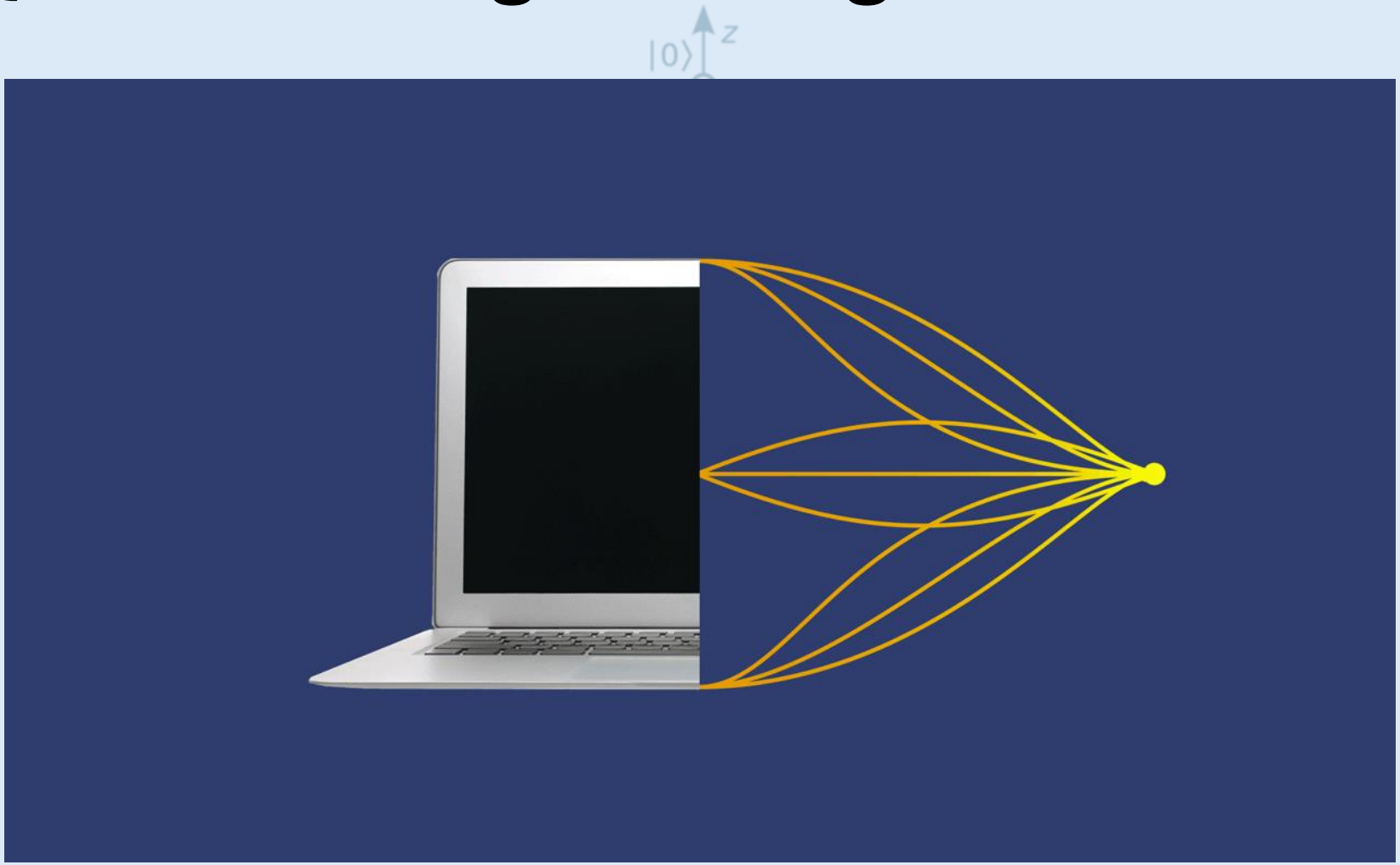
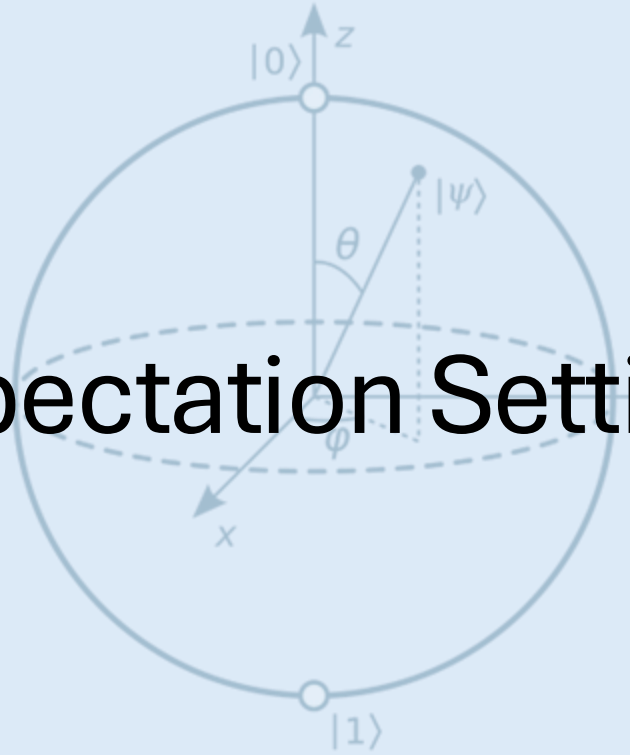
Quantum Programming and Simulation





Expectation Setting

Quantum Highlights

Google's 105-Qubit Willow Chip Achieves Major Quantum Milestones

Paul Smith-Goodson Contributor
Moor Insights and Strategy Contributor Group

Follow

0

Jan 28, 2025, 04:27pm EST

World's 1st hybrid quantum supercomputer goes online in Japan

News By Keumars Afifi-Sabet published February 11, 2025

Japan's Fugaku supercomputer has gained an edge following the installation of the Reimei quantum computer.

Comments (0)

When you purchase through links on our site, we may earn an affiliate commission. Here's how it works.

TECHNOLOGY

Quantum Computers Just Got a Breakthrough Boost With Fiber-Optic Power

BY INSTITUTE OF SCIENCE AND TECHNOLOGY AUSTRIA – FEBRUARY 11, 2025

1 COMMENT 7 MINS READ

THE ECONOMIC TIMES | News

English Edition | Today's ePaper

My Watchlist Subscribe Sign In

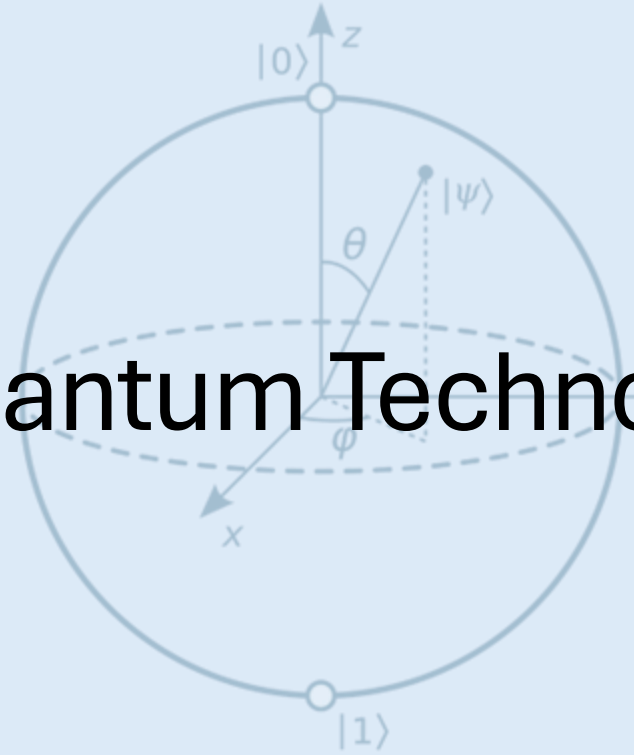
Special Offer: 35% Off

Home BUDGET'25 ETPrime Markets Market Data News Industry Rise Politics Wealth MF Tech Careers Opinion NRI Panache Videos

India Web Stories Economy Politics Newsblogs Elections Defence International More

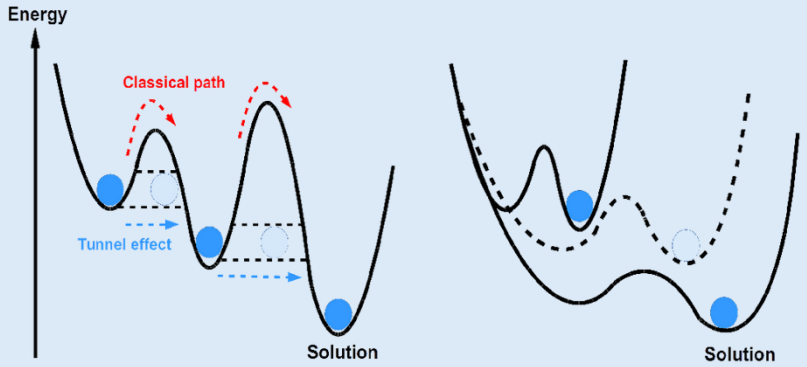
Business News › News › International › US News › Could Nvidia's reign end? Bill Gates says quantum computing is closer than you think

Could Nvidia's reign end? Bill Gates says quantum computing is closer than you think



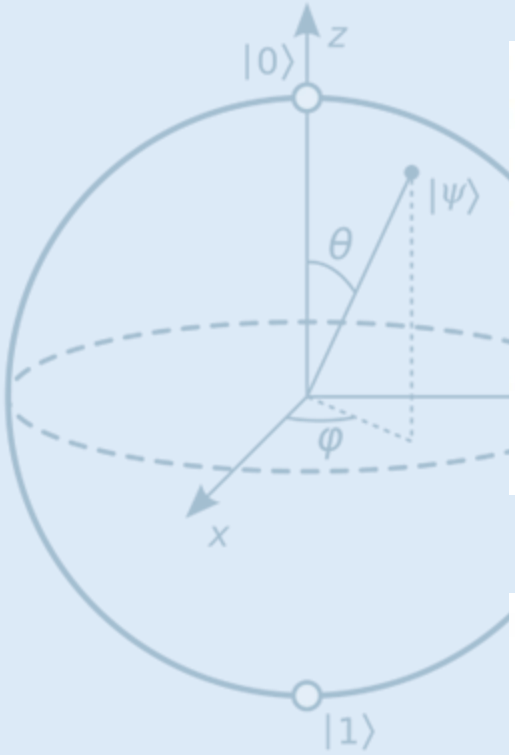
Why Quantum Technology?

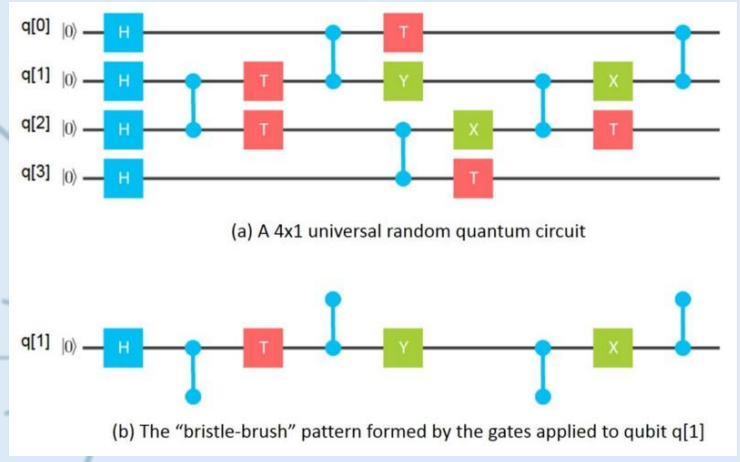
Types of Quantum Computing



Quantum Tunnelling

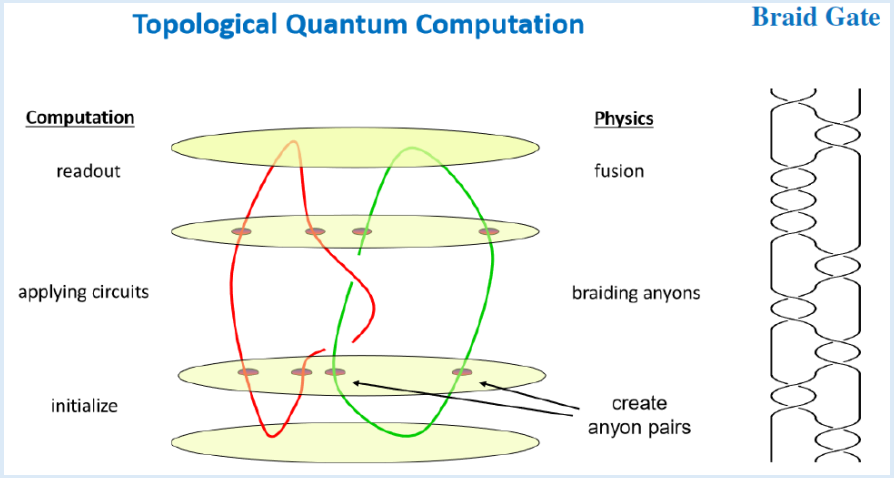
Adiabatic evolution

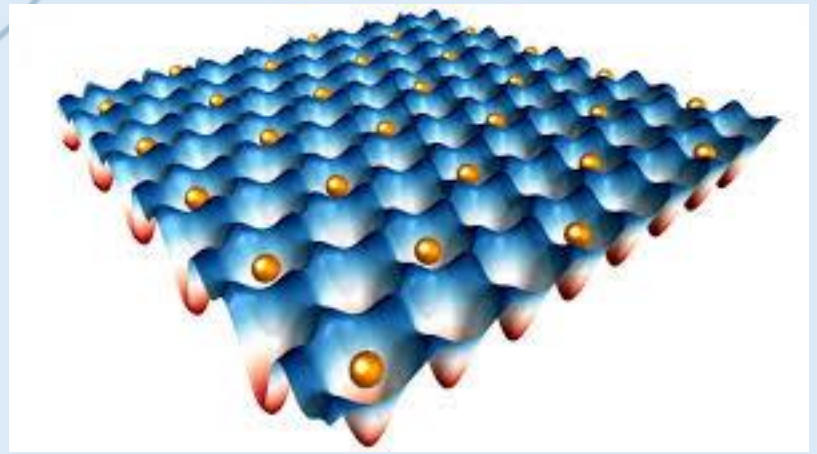




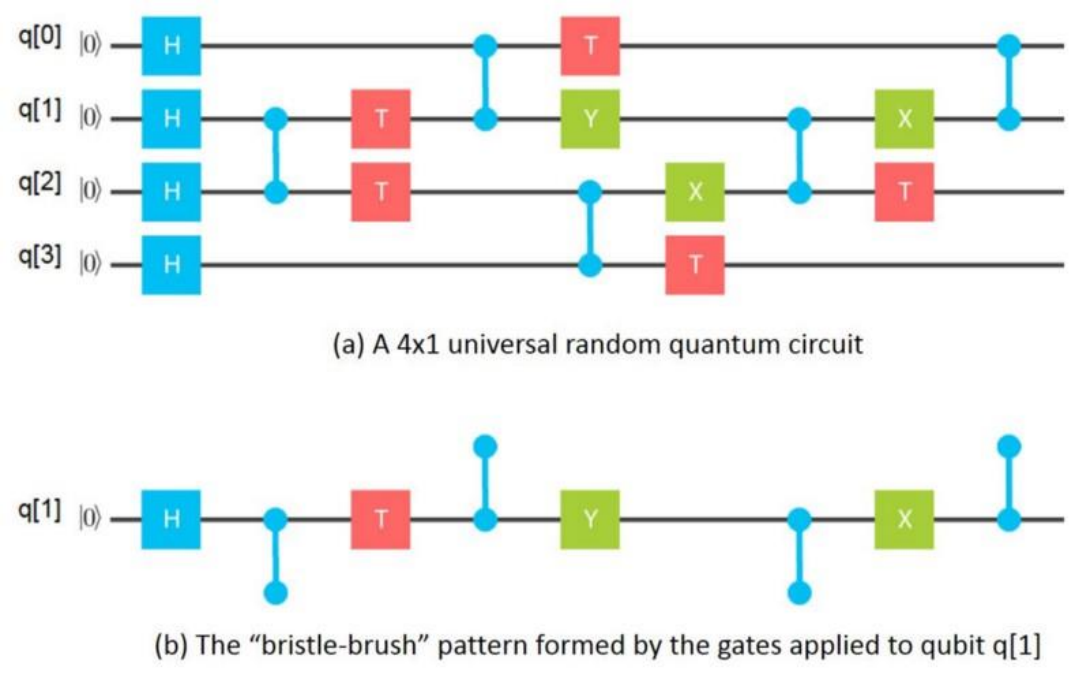
(a) A 4x1 universal random quantum circuit

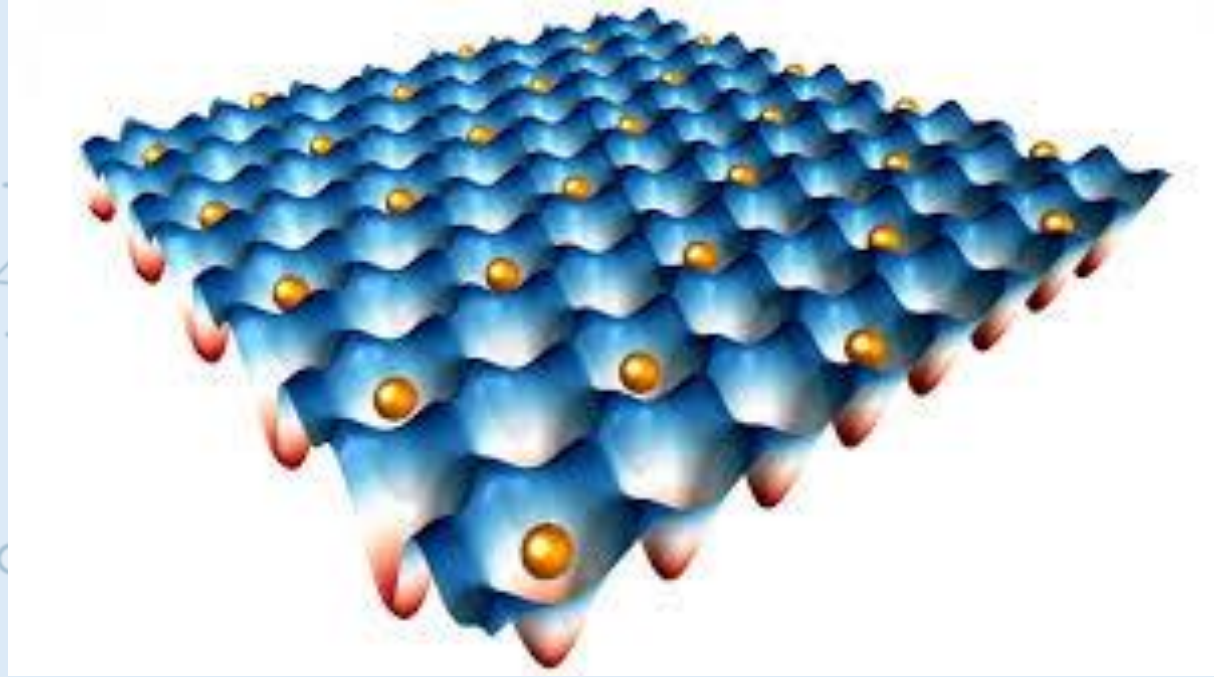
(b) The "bristle-brush" pattern formed by the gates applied to qubit q[1]



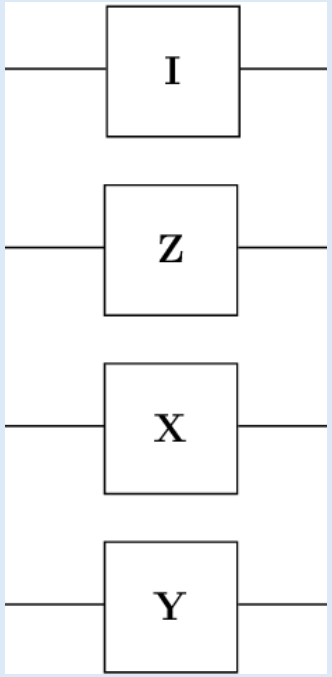


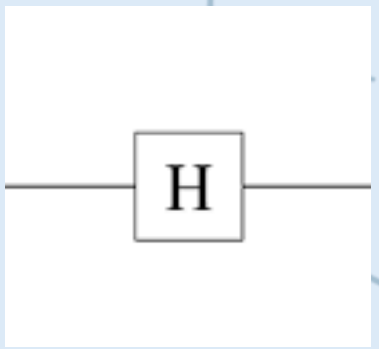
Types of Quantum Computing

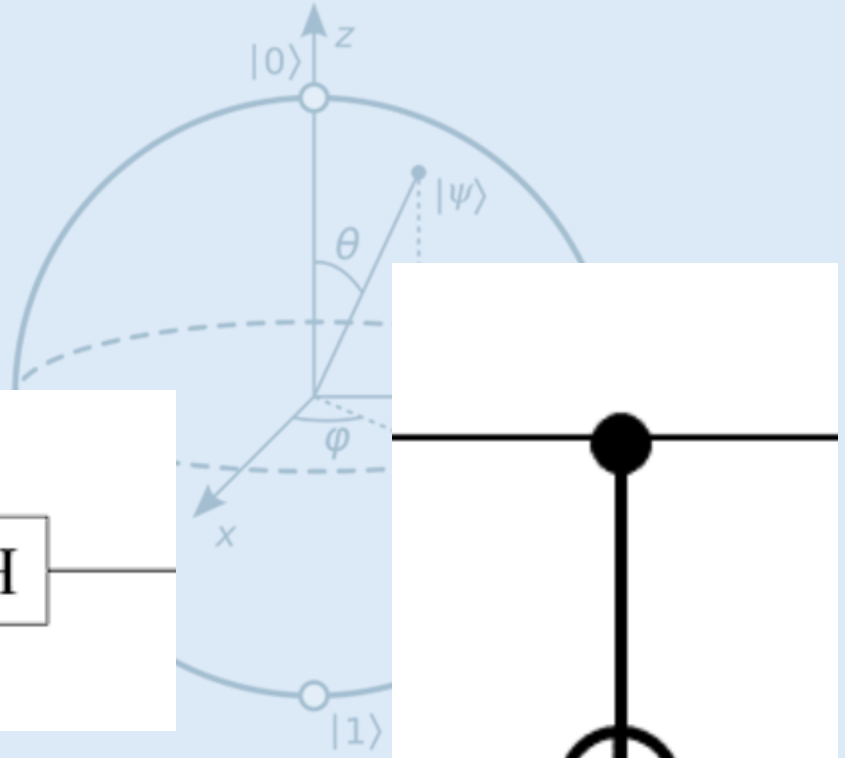


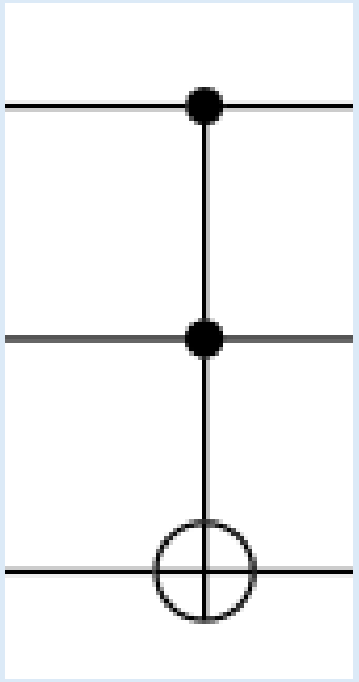


Quantum Gates(Recap)









Quantum Simulation

Quantum Simulation

The use of **quantum computers** to model complex systems that are **infeasible** or less practical for classical computers.

🔹 Exploits **superposition and entanglement** to perform simulations exponentially faster.

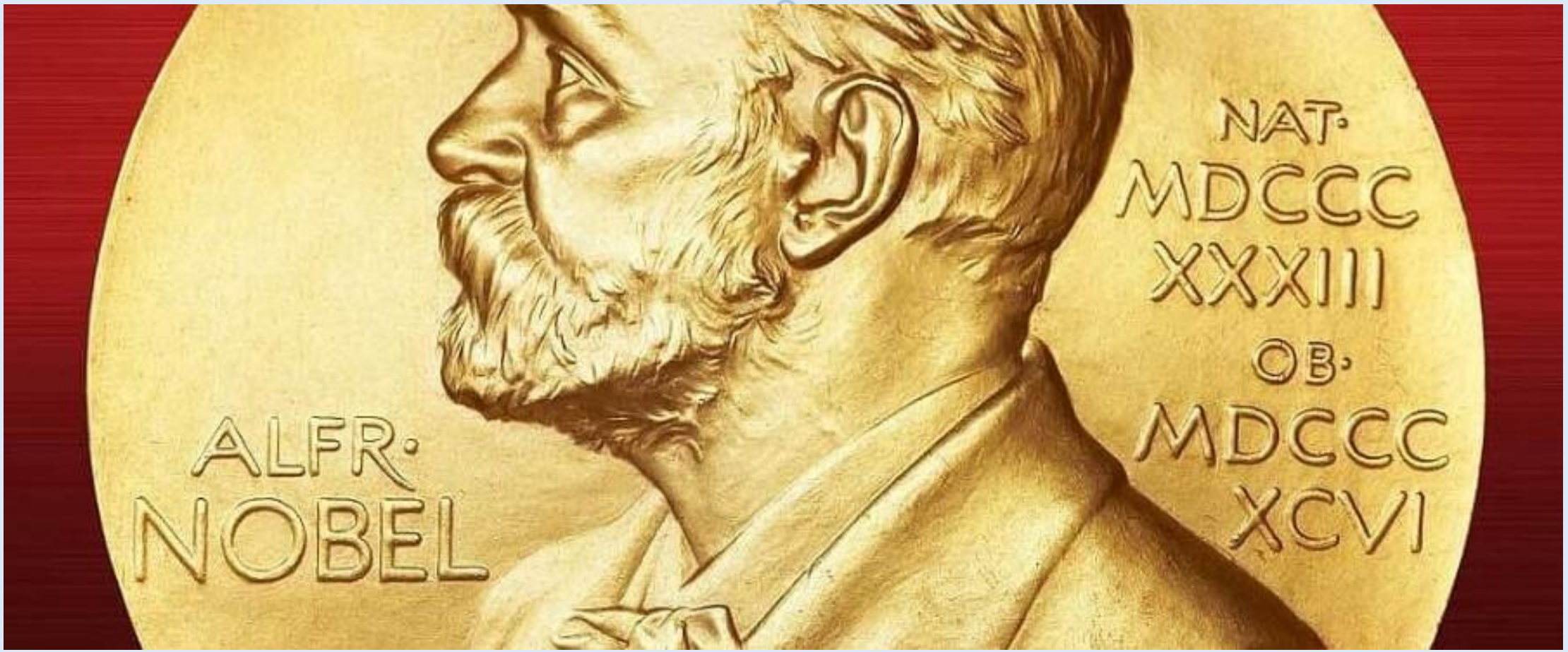
🔹 Particularly useful in **physics, chemistry, materials science, and drug discovery**.

Why Do We Need It?

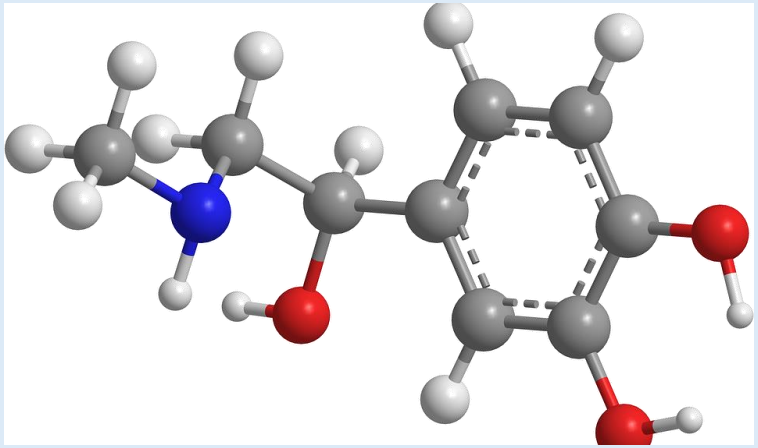
✅ Classical computers struggle with modeling **quantum mechanical systems** due to exponential complexity.

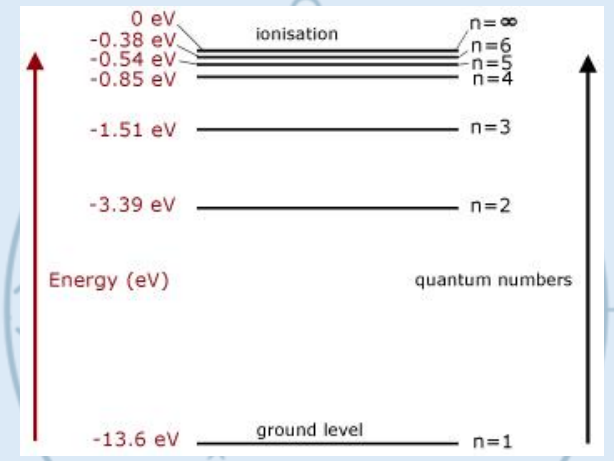
✅ Quantum simulation helps solve problems that are otherwise **intractable** for classical supercomputers.

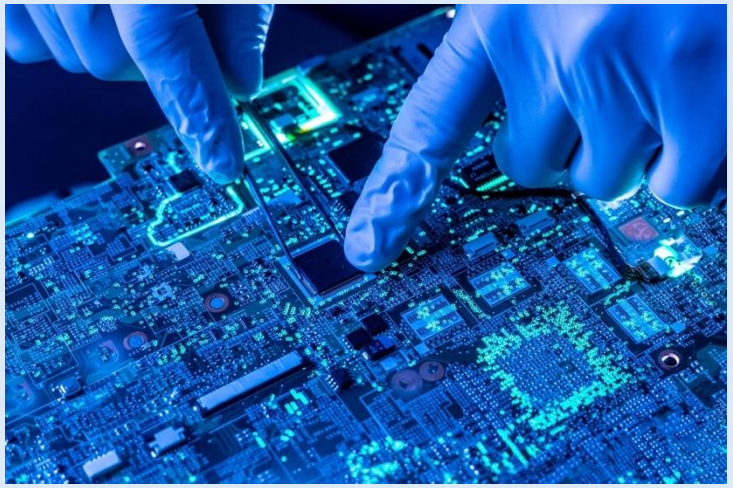
Applications of Quantum Simulation

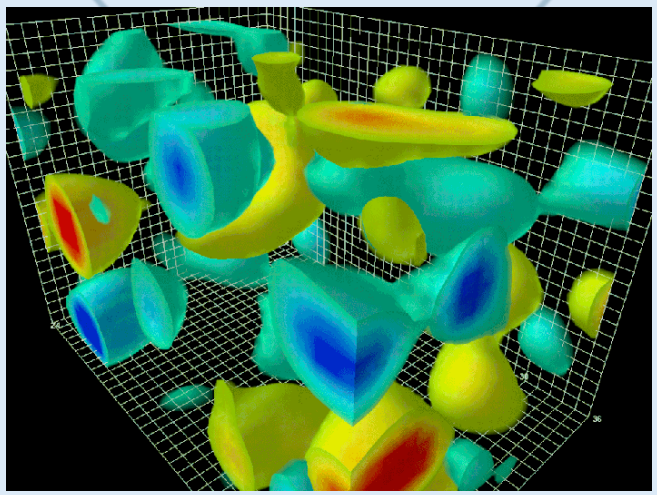


Applications of Quantum Simulation



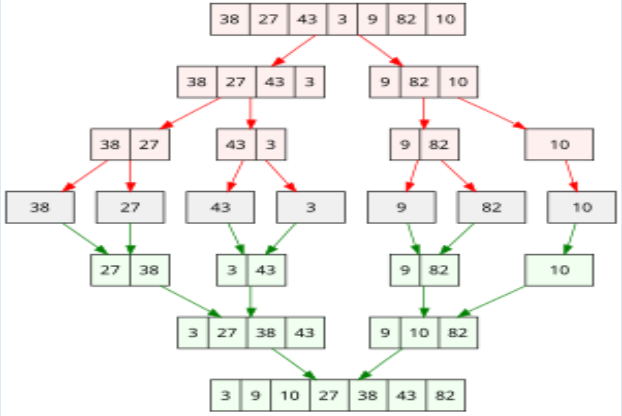


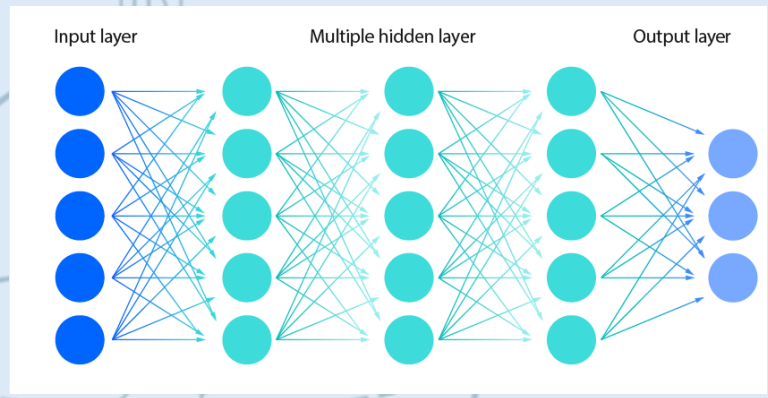


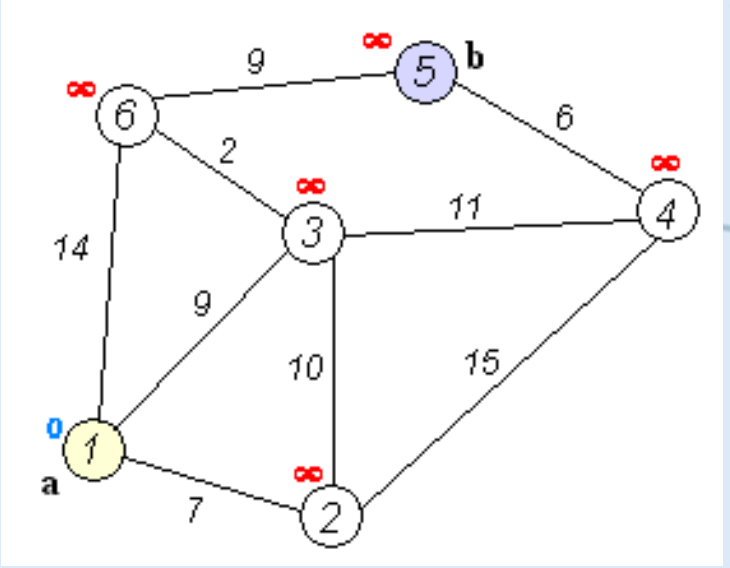


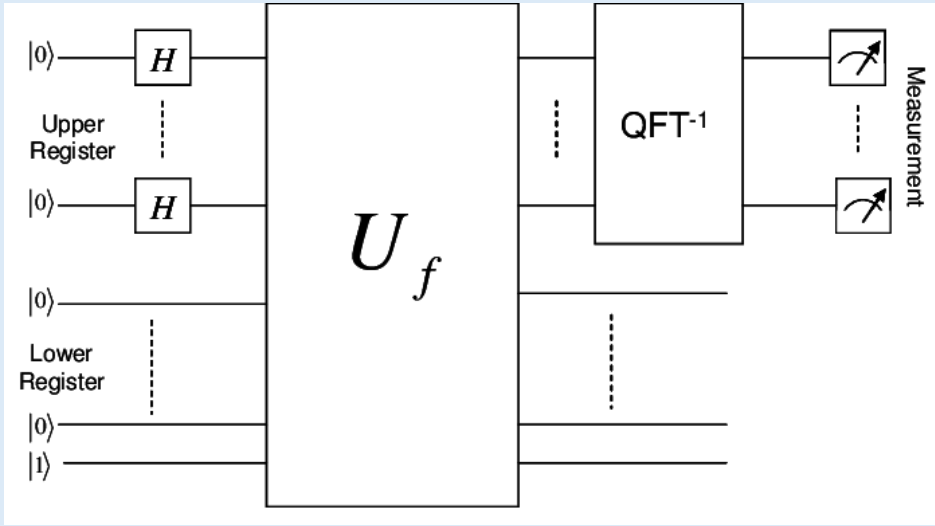
SHEROY COOPER

Algorithms History



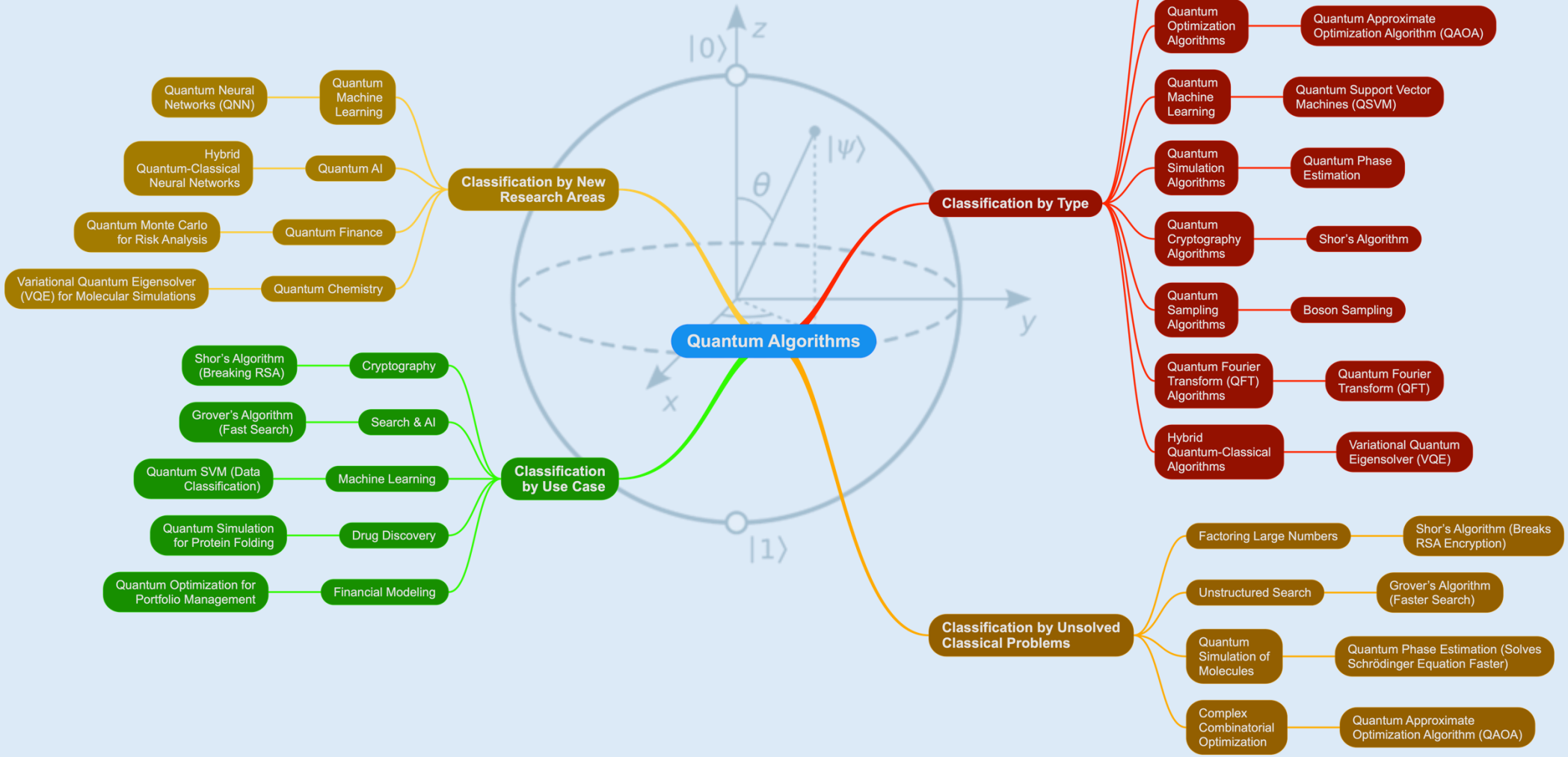






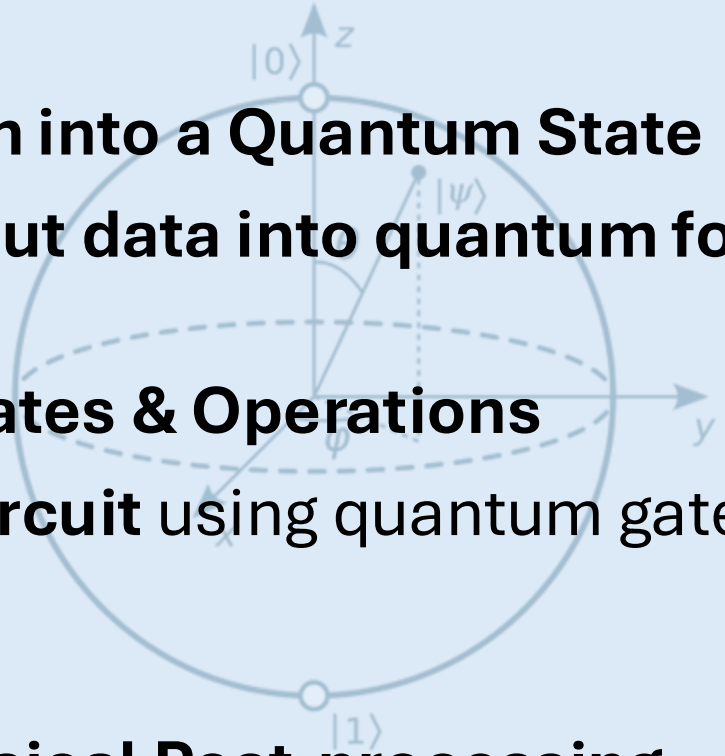
Q→NU

Quantum Algorithms



SHEROY COOPER

Steps for executing Quantum Algorithms



1 Encoding the Problem into a Quantum State

- **Transform classical input data into quantum form (qubits).**

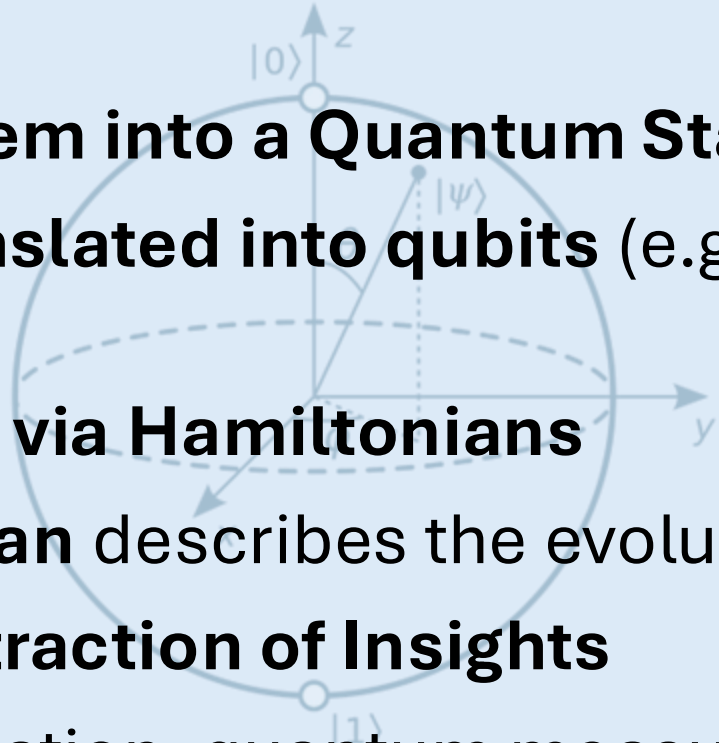
2 Applying Quantum Gates & Operations

- Construct a **quantum circuit** using quantum gates (Hadamard, CNOT, Phase gates, etc.).

3 Measurement & Classical Post-processing

- Once the computation is complete, **qubits collapse** to classical bits.

Steps for executing Quantum Simulation



1 Encoding the Problem into a Quantum State

- Physical system is **translated into qubits** (e.g., molecules, particles).

2 Quantum Evolution via Hamiltonians

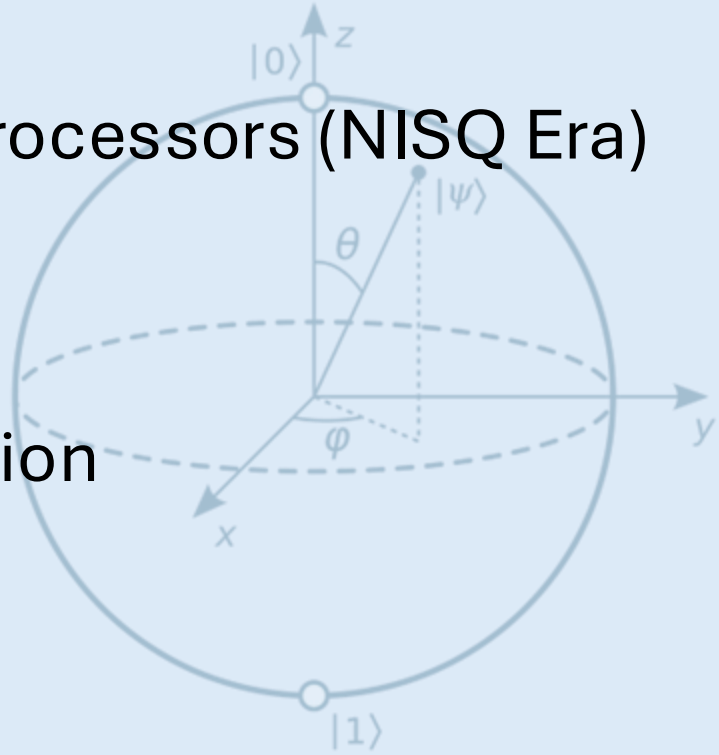
- A **quantum Hamiltonian** describes the evolution of the system.

3 Measurement & Extraction of Insights

- After running the simulation, quantum measurements provide insights (e.g., molecular energy states, material properties).

Future scope for Quantum Programming

- Near-term Quantum Processors (NISQ Era)
- Complexity reduction
- QuantumAI, QML
- Quantum Cloud Adoption



THANK YOU

“When you change the way you look at things, the things you look at change.”