INDIA'S FIRST QUANTUM : SCIENCE & TECHNOLOGY

NEWS : India's first quantum computer set for launch under National Quantum Mission

WHAT'S IN THE NEWS?

National quantum computing mission

QUANTUM COMPUTING

Definition: Quantum computing utilizes the principles of quantum mechanics to process information.

Information Storage:

- **Classical Computing:** Information is stored as bits, represented by 0 or 1.
- **Quantum Computing:** Information is stored in quantum bits (qubits), which can be 0, 1, or a superposition of both states.

Quantum Parallelism:

- Quantum computers can perform multiple calculations simultaneously due to the unique behavior of quantum particles.
- This capability allows quantum computers to solve certain types of problems much faster than classical computers.
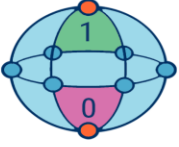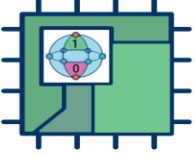
Potential Impact: Quantum computing has the potential to revolutionize various fields, including cryptography, drug discovery, and materials science.

Current Stage:

- Quantum computing is still in its early stages of development.
- Numerous researchers and companies are actively working on building practical quantum computers.

Future Possibilities: The potential breakthroughs that quantum computing could unlock have generated significant excitement in the scientific community and industry.

Quantum Computing   Vs.   Classical Computing

Quantum Computing	Classical Computing
Calculates with qubits, which can represent 0 and 1 at the same time	Calculates with transistors, which can represent either 0 or 1
Power increases exponentially in proportion to the number of qubits	Power increases in a 1:1 relationship with the number of transistors
Quantum computers have high error rates and need to be kept ultracold	Classical computers have low error rates and can operate at room temp
Well suited for tasks like optimization problems, data analysis, and simulations	Most everyday processing is best handled by classical computers

India's First Quantum Computer & National Quantum Mission

Mission Overview:

- **Goal:** Establish a quantum computer with:
  - 20-50 qubits in the next 3 years
  - 50-100 qubits in the next 5 years
  - 50-1000 qubits in the next 10 years
- **Importance:**
  - Strengthen India's digital infrastructure against cyber threats.
  - Compete with global leaders like China and the US in quantum computing.
  - Impact multiple sectors: computing, communication, cryptography, sensing, healthcare, finance, defense.

National Quantum Mission (NQM):

- **Approval Date:** 19th April 2023 by the Union Cabinet.

- **Total Cost:** ₹6003.65 crore (2023-24 to 2030-31).
- **Implementation Strategy:**
  - Establish 4 Thematic Hubs (T-Hubs) in top academic and National R&D institutes focusing on:
    1. Quantum Computing
    2. Quantum Communication
    3. Quantum Sensing & Metrology
    4. Quantum Materials & Devices
  - Promote R&D in both basic and applied research in these areas.

Mission Objectives:
- Develop intermediate-scale quantum computers using platforms like superconducting and photonic technology.
- Establish satellite-based secure quantum communications between ground stations over 2000 km within India.
- Enable long-distance secure quantum communications with other countries.

Quantum Computing Goals:
- **Short-term:** Achieve 20-50 qubits in 3 years.
- **Medium-term:** Achieve 50-100 qubits in 5 years.
- **Long-term:** Achieve 50-1000 qubits in 10 years.

Impact:
- Elevate India's technology ecosystem to global standards.
- Benefit various sectors, including communication, health, financial, and energy.
- Applications in drug design, space exploration, banking, and security.
- Support national initiatives like Digital India, Make in India, Skill India, Stand-up India, Start-up India, Self-reliant India, and Sustainable Development Goals (SDG).

Source : https://www.thehindubusinessline.com/info-tech/indias-first-quantum-computer-set-for-launch-under-national-quantum-mission/article68566042.ece