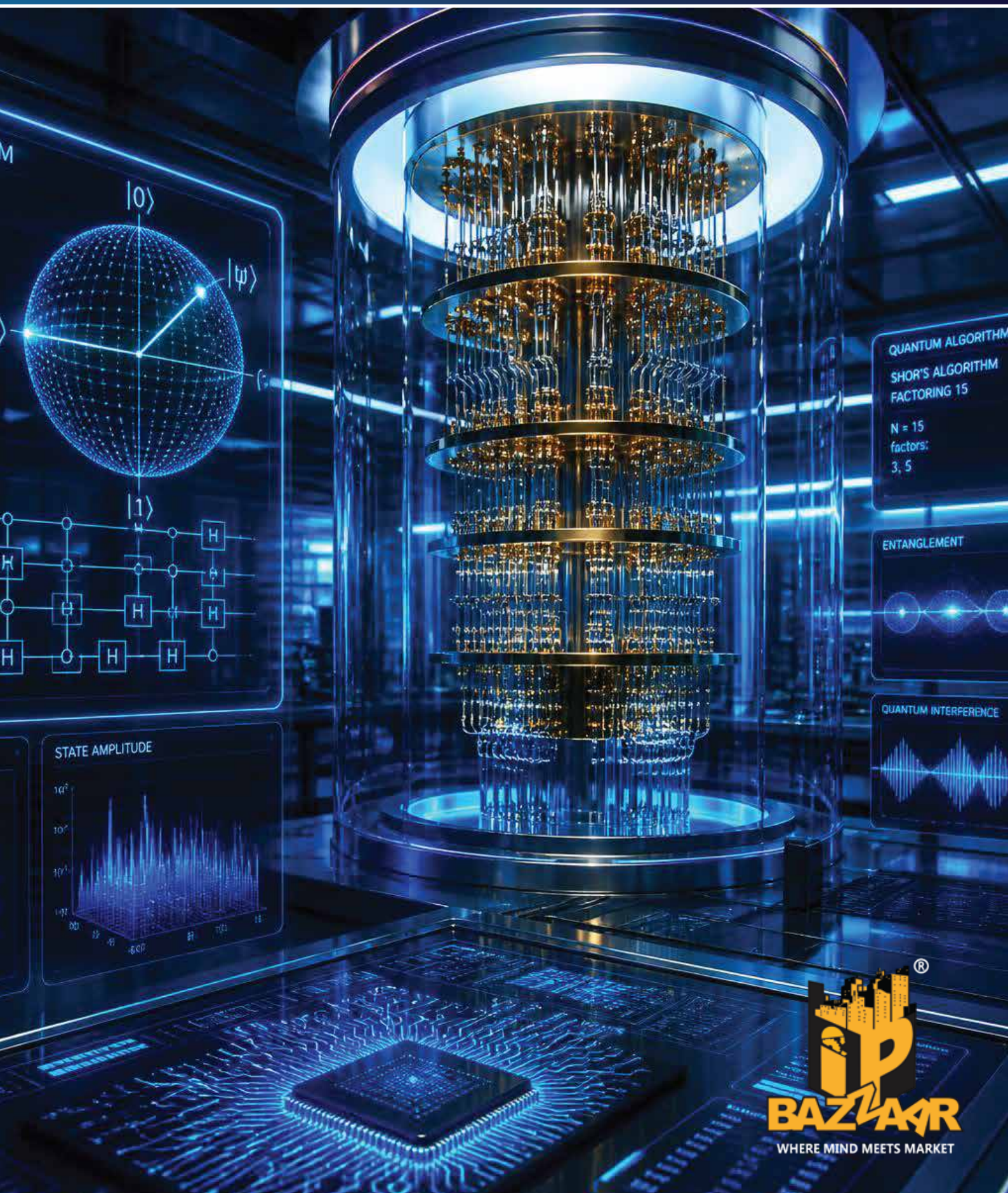


TECH SCAN

QUANTUM COMPUTERS



A quantum computer is an advanced computing system that uses the principles of quantum mechanics to process information. Unlike classical computers, which use bits represented as either 0 or 1, quantum computers use qubits that can exist in a superposition of 0 and 1. This allows quantum computers to solve certain complex problems more efficiently than classical computers.

Quantum computing combines quantum physics, computer science, mathematics, and engineering to develop new computing methods, algorithms, and hardware systems. The technology has strong potential in areas such as healthcare, financial modelling, material discovery, cybersecurity, optimization, and artificial intelligence.

India is also strengthening its position in this field through the National Quantum Mission, which focuses on developing quantum computing, quantum communication, quantum sensing, and quantum materials. The mission aims to support the development of intermediate-scale quantum processors and secure quantum communication networks.

From an industry and IP perspective, quantum computing is becoming a strategically important technology. Companies that begin testing quantum applications, building internal expertise, and developing quantum-ready solutions at an early stage may gain a competitive advantage. Patent protection will be important for safeguarding innovations in quantum hardware, qubit control, error correction, algorithms, software tools, and quantum-secure communication systems.



INNOVATION TIMELINE

Early theoretical foundations of quantum computing were developed by Yuri, Richard, and Paul Beniof

1980s

1985

David Deutsch introduced the concept of a universal quantum computer, establishing the theoretical basis for programmable quantum computation

Peter Shor published one of the first practical real world applications for a hypothetical quantum machine

1994

1996

Lov Grover designed Grover's algorithm, vastly accelerating data searches within unstructured, complex databases

Early experimental quantum computing was demonstrated using a 2-qubit algorithm on real nuclear magnetic resonance hardware.

1998

2001

Small-scale quantum processors were demonstrated, including NMR-based systems used to run simple quantum algorithms such as factoring 15.

D-Wave launched D-Wave One, recognized as the first commercially available quantum annealing system, although it was not a universal gate-based quantum computer.

2011

2016

IBM launched the IBM Quantum Experience, allowing global developers to access a 5-qubit machine via cloud platforms.

Google claimed "quantum supremacy" using its Sycamore processor to solve a hyper-specific problem in 200 seconds.

2019

2023

IBM debuted the Condor chip featuring 1,121 physical superconducting qubits to test hardware scalability limits.

Google announced the Willow quantum processor, focusing on improved error correction and higher-quality quantum computation.

2024

2026

Quantum computing is moving toward logical qubits, qLDPC-based memory modules, hybrid quantum-classical workflows, and early fault-tolerant architecture development.

PATENTABLE COMPONENTS

Quantum Processor Architectures:

- Quantum Processing Units (QPUs) with scalable qubit architectures
- Modular quantum processor designs

Qubit Technologies:

- Trapped-ion qubit systems
- Photonic qubit architectures
- Neutral-atom and spin-based qubit platforms

Quantum Control Systems:

- Microwave pulse generation and control systems
- RF and laser-based qubit manipulation technologies

Quantum Measurement & Readout Technologies:

- Quantum readout resonators
- Low-noise amplification architectures

Quantum Interconnects:

- Microwave quantum interconnects
- Photonic quantum communication channels
- Quantum bus architectures

Quantum Error Correction & Fault-Tolerance:

- Surface-code error-correction architectures
- qLDPC-based logical qubit systems

Quantum Memory Systems:

- Quantum state storage architectures
- Logical quantum memory modules

Cryogenic Infrastructure & Packaging:

- Dilution refrigerator systems
- Cryogenic packaging architectures
- Thermal isolation and shielding technologies
- Low-temperature wiring and integration platforms

Quantum Software & Runtime Platforms:

- Gate optimization and qubit mapping methods
- Quantum workload management systems

Processor Topology & Connectivity Designs:

- Qubit lattice architectures
- Connectivity optimization frameworks

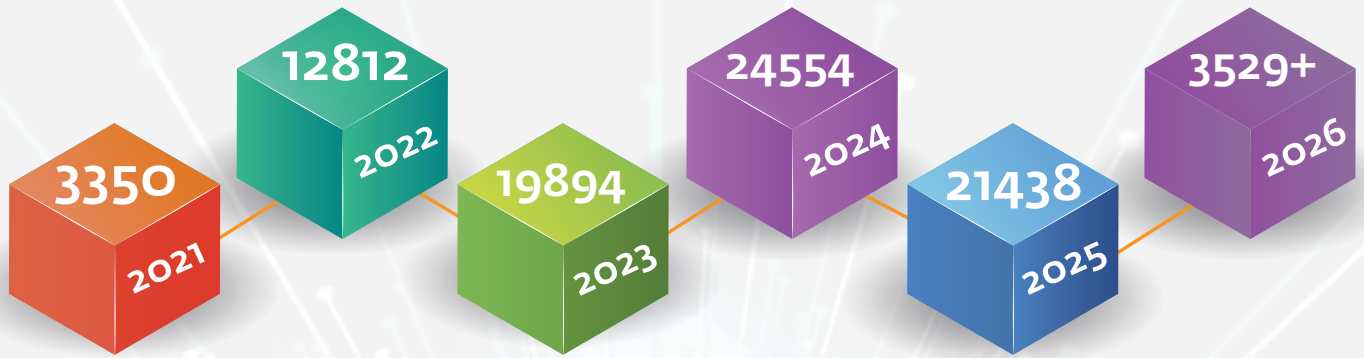
Methods of Production:

- Superconducting circuit manufacturing techniques
- Quantum chip packaging and assembly methods

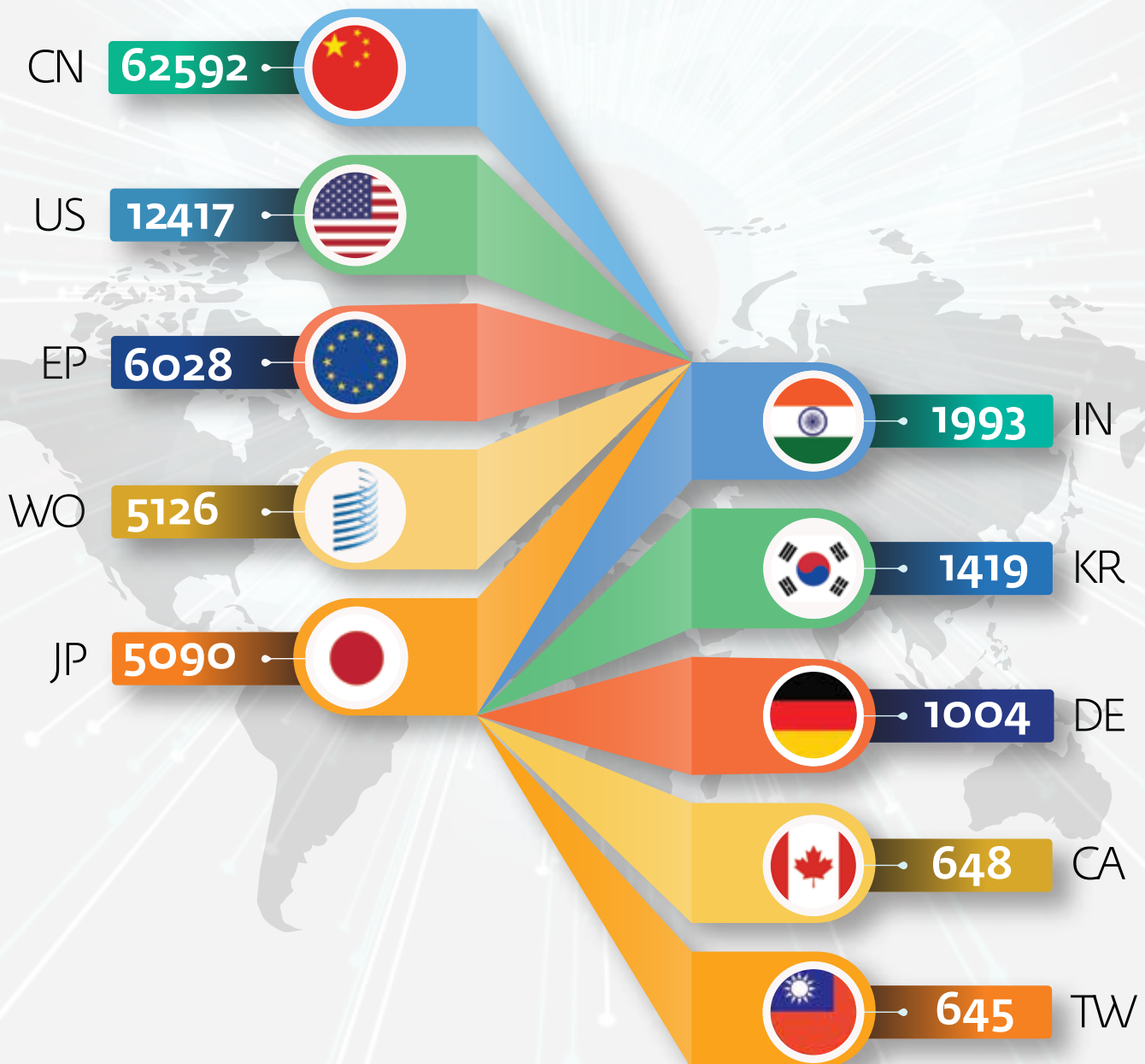
Novel Materials:

- Superconducting materials for quantum circuits
- Low-loss dielectric materials
- Coherence-enhancing material compositions

PATENT STATISTICS



PATENT LANDSCAPE



Database: Questel Orbit

Data Range: 01/01/2021 - 23/06/2026

TOP APPLICANTS

4694

IBM

2155

INDUSTRIAL & COMMERCIAL
BANK OF CHINA

1799

CHINA TELECOM

1648

TENCENT TECHNOLOGY SHENZHEN

1498

SHENZHEN POWER SUPPLY BUREAU

1431

ORIGIN QUANTUM COMPUTING
TECHNOLOGY HEFEI

1284

BANK OF CHINA

1272

TIANYI CLOUD TECHNOLOGY

1148

NEC

1027

CHINA CONSTRUCTION BANK

Database: Questel Orbit

Data Range: 01/01/2021 - 23/06/2026

NOTABLE INNOVATIONS

Patent Application	Priority date	Title	Assignee
DE4139286	29.11.1991	Quantum computer system for expert system - has hardware and software including linear and non-linear coding	WILLE ERNST GUENTER6520 WORMS
US5768297	26.10.1995	Method for reducing decoherence in quantum computer memory	AT&T
JP3297682	07.03.1997	Quantum computing device and quantum computer	AGENCY OF INDUSTRIAL SCIENCE & TECHNOLOGY
US6472681	17.09.1997	Quantum computer	NEWSOUTH INNOVATIONS; QUOCOR
JP5404801 B2	28.09.2009	Quantum computer and quantum memory	TOSHIBA
US20220261680	19.07.2019	Superconducting circuit and quantum computer	NEC
KR102778201 B1	11.11.2020	Superconducting qubit memory of quantum computer	SAMSUNG ELECTRONICS
US12387126	29.07.2020	Method for producing semiconductor apparatus for quantum computer	SHINETSU HANDOTAI
US12086690	28.05.2021	Quantum computer architecture system	ORIGIN QUANTUM COMPUTING TECHNOLOGY HEFEI
US20240193454	17.08.2021	Quantum computer system and method for operating quantum computer system	HITACHI

WHITESPACES

Cryogenic
Control
and Optical
Interconnects

Hybrid
AI-Quantum
Memory
Synthesizers

Quantum-
Inspired
Training
Simulators

Hardware
Scaling

Real-Time
Active Error
Decoders

Logical
Qubit
Layouts

Quantum
Verification
Chips

If you would like to learn more about any of these areas or have specific questions, we're here to provide further information and insights. Our team is dedicated to driving progress and staying at the forefront of quantum computers.

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