Quantum Computing Technologies: References, Institutes & Glossary

Industry 4.0 Market Research

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1	California Institute of Technology – Institute for Quantum Information and Matter (IQIM)
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4	Centre for Quantum Technologies (CQT) – National University of Singapore
5	Chapman University – Institute for Quantum Studies
6	Delft University of Technology and TNO – QuTech
7	ETH Zurich – Computational Physics Group
8	Georgia Tech Research Institute – Quantum Systems Group
9	Keio University – Advancing Quantum Architecture (Aqua) Group
10	Massachusetts Institute of Technology
11	MIT Lincoln Laboratory – Quantum Information and Integrated Nanosystems
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18	University of Calfornia Berkeley – Berkeley Quantum Information & Computation Center
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20	University of Malta – Quantum Complexity Science Initiative
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23	University of New Mexico – Center for Quantum Information and Control (CQuIC)
24	University of Southern California – Center for Spintronics and Quantum Computation

25	University of Sussex – Ion Quantum Technology Group
26	University of Technology Sydney – Centre for Quantum Computation & Intelligent Systems (QCIS)
27	University of Toronto – Centre for Quantum Information and Quantum Control
28	University of Washington – Trapped Ion Quantum Computing Group
29	University of Wisconsin at Madison – Wisconsin Institute for Quantum Information
30	University of Waterloo – Institute for Quantum Computing
31	Yale Quantum Institute

2 Glossary

Source: NQIT

Diamond color centers:
These are a solid-state alternative to using ion-traps as qubits in the Q20:20 engine and involve making use of color defects present at an atomic scale in diamonds.

Ion:
An ion is an electrically-charged atom - an atom where an outer electron has been stripped away, leaving the whole atom with an electric charge.

Ion Trap:
This is a device that holds individual atoms, electrically-charged and levitating stably within an electric field, where they can be controlled with lasers and used for information processing.

Photon:
A photon is the elementary particle of light and electromagnetic radiation

Quantum:
In physics, a quantum is a discrete quantity of energy proportional in magnitude to the frequency of the radiation it represents, and refers to the smallest unit of a physical quantity - for example, a photon is a "quantum of light". It also refers to the field of quantum physics, which describes the fundamental interactions of particles in nature.

Quantum 2.0:

This is a term used to describe the newest wave of quantum technologies that make use of the fundamental quantum nature of particles, such as superposition and quantum entanglement. These technologies use equipment such as highly stabilized laser systems, cryogenically-cooled solid state devices and ion traps to create, manipulate and then use quantum effects for applications such as information processing, computing, simulation, secure communications, sensing and imaging.

Quantum 2.0 is distinguished from early quantum technologies, such as lasers and semi-conductors, which rely on the effects of quantum mechanics, by the way they create and manipulate quantum states.

Quantum entanglement:
This counter-intuitive phenomenon can occur when two or more particles interact with one another, directly or by using light as a mediator. When an action is performed on one of the entangled particles, it affects their mutual state, even when they are separated by great distances

Quantum Network:
A system composed of nodes and channels used to transfer quantum information. In the case of NQIT, our quantum network will be a hybrid light-matter network.

Quantum states:
A state of a quantized system which is described by a set of quantum numbers. As opposed to a classical binary system, quantum numbers can exist in multiple states at once.

Quantum technology:
Technologies that make use of the fundamental quantum nature of particles, such as superposition and quantum entanglement.

Qubit:
A qubit, or quantum bit, is a unit of quantum information, similar to a 'bit' in classical computing. However, unlike a bit, which can be either 0 or 1, a qubit can be 0 and 1 at the same time - a quantum superposition of both states. When multiple qubits are combined, they can store vastly complex data.

Superconducting qubit:
This is a cavity-based system that can be used as an alternative to ion traps as qubits in the Q20:20 engine. They offer increased network scalability that means larger, more powerful quantum computers.

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