

New Research gives Schrödinger's Cat 50% survival chances within new quantum computer logic

TII Researchers have demonstrated a new quantum computational technique in which switching the order of events can help find solutions to new types of problems.

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Researchers at the UAE's Technology Innovation Institute (TII) have demonstrated a new quantum computational technique in which switching the order of events can help find solutions to new types of problems. This is a new take on the [quantum superposition phenomenon](#) that has previously been applied to the state of quantum bits in qubits, but not to the order of events.



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Technically speaking, this does not reverse the causal order for events that have already occurred. “That would be like time travel towards the past, which is impossible,” said TII’s Leandro Aolita, Executive Director of Quantum Algorithms, who co-authored the research paper. Technology Innovation Institute worked collaboratively on this paper with an international team of researchers from Chile, Brazil, France, Spain, and Switzerland.

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at the same time,” he explained.

Strange new logic

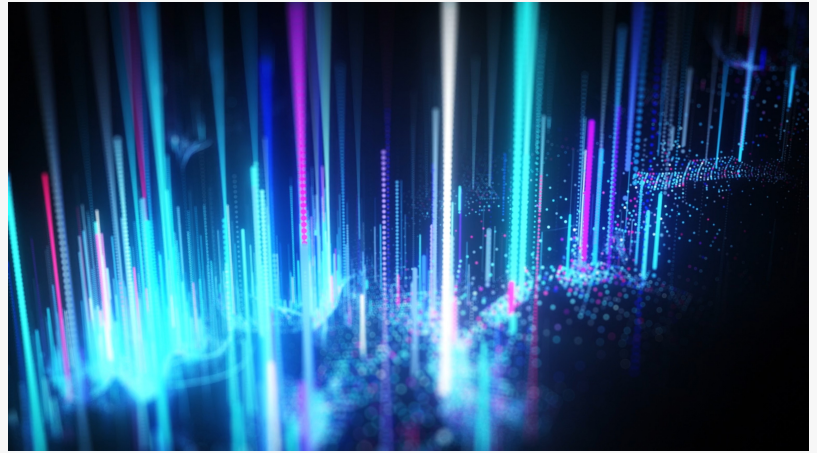
Conventional quantum computers (where quantum gates have a definite temporal order) are also based on quantum superpositions. The difference is that they use superpositions of different qubit states but not superpositions of different gate orders. This new approach implements a circuit where the connections between the different gates (the quantum equivalent of cables connecting different transistors in a circuit) are themselves in a state of quantum superposition.

Aolita said: "It's like taking superpositions and entanglement one level higher in the hierarchy. Conventional quantum computers use superpositions of qubit states. What we do uses entanglement of qubit states plus entanglement of the orders in which the operations in a quantum circuit are applied to the qubits."

Now that researchers have demonstrated its viability in practice, the scientific community can start finding a way to put it to use. People have studied causal superpositioning in theory and demonstrated how it might work for the simplest use case of just two events in the superposition. However, no one has considered more events where there is the greatest potential for new applications.

This research takes the classic example of Schrödinger's cat to a new level. In existing quantum computers, the qubits are like a cat locked in a box with a poison that has a 50% chance of being released and is hence both "alive" and "dead" until opened. The latest experiments can be compared to a situation where four events "cat dies or not," "poison is released or not," "the photon is emitted or not," and "atom is excited or not" take place in a superposition of four different temporal orderings at the same time.

Aolita hopes that research efforts to demonstrate these processes in a working device will



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inspire mathematicians and computer scientists to discover a useful application of this new effect. He said: "Our new method serves as a launchpad to explore new algorithm applications in this novel, non-conventional [quantum computing](#) paradigm, where we anticipate useful applications will arise."

Research on quantum superpositions of causal orders is at the same stage where quantum computing was before Peter Shor discovered a practical algorithm for prime factorisation, with applications like breaking encryption codes. "We want to find the Shor's algorithm of quantum superpositions of causal orderings," Aolita said.

About Technology Innovation Institute (TII)

Technology Innovation Institute (TII) is the dedicated 'applied research' pillar of Advanced Technology Research Council (ATRC). TII is a pioneering global research and development centre that focuses on applied research and new-age technology capabilities. The Institute has seven initial dedicated research centres in quantum, autonomous robotics, cryptography, advanced materials, digital security, directed energy and secure systems. By working with exceptional talent, universities, research institutions and industry partners from all over the world, the Institute connects an intellectual community and contributes to building an R&D ecosystem reinforcing Abu Dhabi and the UAE's status as a global hub for innovation.

For more information, visit www.tii.ae

About Quantum Research Centre (QRC)

Quantum Research Centre – at Technology Innovation Institute (TII) – has been created to develop world-class quantum-theoretical and experimental research by building and operating the first quantum computer in the MENA region while advancing quantum communications and quantum sensors. The Centre aims to develop pioneering technologies backed by the expertise of an international team of leading researchers, dedicated to achieving a 'Quantum Advantage' which will transform the power and scope of computers.

For more information, visit <https://quantum.tii.ae/>

Tania Ameer

APCO Worldwide

+971 52 672 5138

tameer@apcoworldwide.com

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