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NTU Q

RELEVANT EVENTS

NTU-IBM Quantum System User Conference& Qiskit Hackathon Taiwan 2024

Date: 19-21, Aug, 2024

Place: Taipei, Taiwan

Registration is about to start! Pay close attention to our official website!

HIGHLIGHTING NEWS

PROBING SINGLE ELECTRONS ACROSS 300-MM SPIN QUBIT WAFERS

Abstract: Building a fault-tolerant quantum computer will require vast numbers of physical qubits. For qubit technologies based on solid-state electronic devices, integrating millions of qubits in a single processor will require device fabrication to reach a scale comparable to that of the modern complementary metal–oxide–semiconductor (CMOS) industry. Equally important, the scale of cryogenic device testing must keep pace to enable efficient device screening and to improve statistical metrics such as qubit yield and voltage variation. Spin qubits based on electrons in Si have shown impressive control fidelities but have historically been challenged by yield and process variation. Here we present a testing process using a cryogenic 300-mm wafer prober to collect high-volume data on the performance of hundreds of industry-manufactured spin qubit devices at 1.6 K. This testing method provides fast feedback to enable optimization of the CMOS-compatible fabrication process, leading to high yield and low process variation. Using this system, we automate measurements of the operating point of spin qubits and investigate the transitions of single electrons across full wafers. We analyse the random variation in single-electron operating voltages and find that the optimized

fabrication process leads to low levels of disorder at the 300-mm scale. Together, these results demonstrate the advances that can be achieved through the application of CMOS-industry techniques to the fabrication and measurement of spin qubit devices.

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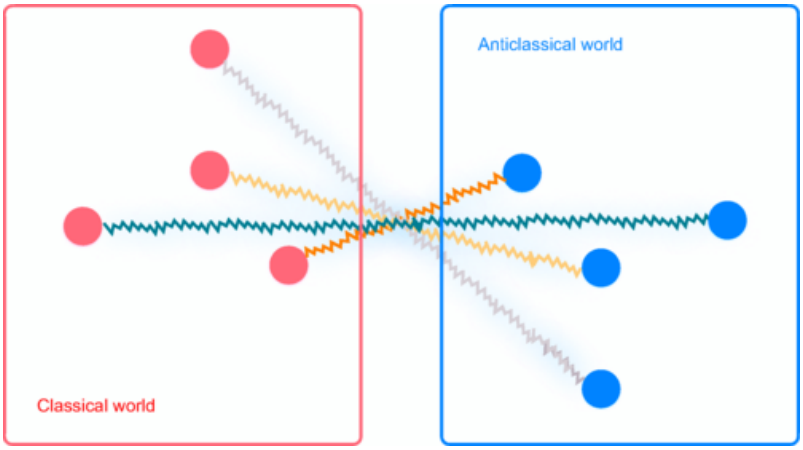
BELL NONLOCALITY IN CLASSICAL SYSTEMS COEXISTING WITH OTHER SYSTEM TYPES

Abstract: The realistic interpretation of classical theory assumes that every classical system has well-defined properties, which may be unknown to the observer but are nevertheless part of reality and can, in principle, be revealed by measurements. Here we show that this interpretation can, in principle, be falsified if classical systems coexist with other types of physical systems. To make this point, we construct a toy theory that (i) includes classical theory as a subtheory and (ii) allows classical systems to be entangled with another type of system, called anticlassical. We show that our toy theory allows for the violation of Bell inequalities in two-party scenarios where one of the settings corresponds to a local measurement performed on a classical system alone. Building on this fact, we show that measurement outcomes in classical theory cannot, in general, be regarded as predetermined by the state of an underlying reality.



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IBM Quantum Computer Hub at National Taiwan University

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