Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Probing quantum contextuality with superconducting circuits[1]
ARKADY FEDOROV, MARKUS JERGER, YAREMA RESHITNYK, The University of Queensland, MARKUS OPPLIGER, ANTON POTOCNIK, MINTU MONDAL, ANDREAS WALLRAFF, ETH Zurich, KENNETH GOODENOUGH, STEPHANIE WEHNER, Delft University of Technology, KRISTINN JULIUSSON, Quantronics, SPEC, IRAMIS, DSM, CEA Saclay, NATHAN K. LANGFORD, Delft University of Technology — Quantum physics cannot be reconciled with the classical philosophy of noncontextual realism. Realism demands that system properties exist independently of whether they are measured, while noncontextuality demands that they do not depend on the order in which different measurements are made. The Bell-Kochen-Specker theorem states that noncontextual realism cannot reproduce the measurement statistics of a single three-level quantum system (qutrit). Noncontextual realistic models may thus be tested using a single qutrit without relying on the notion of quantum entanglement which enables the better-known Bell violations. Using a superconducting qutrit with deterministic, binary-outcome readouts, we violate a noncontextuality inequality while addressing the detection, individual-existence and compatibility loopholes. Demonstrating state-dependent contextuality of a solid-state system is also an important conceptual ingredient for universal quantum computation in surface-code architectures.

[1]Work was supported by the ARC Centre of Excellence CE110001013, ARC DP150101033, ARC Future Fellowship, FT140100338, CCQED network, STW, and NWO VIDI Grant

Arkady Fedorov
The University of Queensland

Date submitted: 14 Nov 2016 Electronic form version 1.4