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Recent progress towards violating the CHSH Bell inequality in Josephson phase qubits MARKUS ANSMANN, University of California at Santa Barbara, RADOSLAW BIALCZAK, MAX HOFHEINZ, NADAV KATZ, The Hebrew University of Jerusalem, ERIK LUCERO, MATTHEW NEELEY, AARON O'CONNELL, HAOHUA WANG, ANDREW CLELAND, JOHN MARTINIS — Improvements of gate fidelity and control electronics for Josephson phase qubits have provided the foundation for revisiting Bell's inequality. The violation of Bell's inequality is the primary argument against the possible existence of a hidden-variable-theory as an alternative to quantum mechanics. It also serves as a convincing demonstration that a given system behaves in a truly non-classical way. The most widely accepted form of Bell's inequality follows closely along a correlation measurement proposed by Clauser, Horne, Shimony and Holt (CHSH) in 1969. Here we present our latest attempt to implement the CHSH Bell test using Josephson phase qubits. The nature of this experiment places high demands – compared to the current state of the art in solid state qubits – on qubit performance measures such as the energy relaxation time T1, the decoherence time T2, single and two qubit gate fidelities, and measurement fidelities. We will examine these demands with respect to the number of fronts we have improved upon in our system.

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