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Analog approaches to quantum computation using highly-controllable superconducting qubits C. NEILL, UCSB, P. ROUSHAN, R. BARENDS, Google Inc., B. CAMPBELL, UCSB, Y. CHEN, Google Inc., Z. CHEN, B. CHIARO, A. DUNSWORTH, UCSB, A. FOWLER, E. JEFFREY, J. KELLY, E. LUCERO, A. MEGRANT, J. MUTUS, M. NEELEY, Google Inc., P. O'MALLEY, C. QUINTANA, UCSB, D. SANK, Google Inc., J. WENNER, UCSB, T. WHITE, J. MARTINIS, Google Inc. — The first generation of quantum hardware that outperforms classical computers will likely be analog in nature. In an effort to realize such a platform, we have built a one-dimensional chain of 9 superconducting gmon qubits. This device provides individual time-dependent control over all nearest-neighbor couplings and local fields (X, Y, Z) in the multi-qubit Hamiltonian. In this talk, I will focus on open problems in non-equilibrium statistical mechanics where dynamical properties become impossible to compute for only a few 10s of qubits. In particular, I will review device performance and the scaling of analog errors with system size. By studying how errors scale during practical applications, we aim to predict if otherwise-intractable computations could be carried out with 30 to 40 qubits.

Charles Neill
UCSB

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