Session 22bD

Josephson Charge Qubit Experiment **22bD1**

J.S Tsai[a], Y. Nakamura[a], Yu. Pashkin[b], T. Yamamoto[a], O. Astafiev[b]

[a] *NEC Fundamental Research Laboratories, 34 Miyukigaoka, 305-8501, Tsukuba, Japan, and Frontier Research System, Riken*
[b] *Frontier Research System, Riken, Wako-shi 351-0198, Japan*

Superconducting charge qubit was demonstrated. The qubit operations were demonstrated in two different control techniques, dc electric-field gate bias and ac field bias. The dc method was unique compared with the commonly used Rabi-oscillation-type operation. Here the system was biased at the degenerate point of the two states so that the dynamical phase does not develop during the operation. Two-pulse phase rotation control was also demonstrated. The 2-bit experiment will be discussed.

Spin qubit experiments - from room temperature nuclei to mK electrons **22bD2**

Lieven M.K. Vandersypen

Dept. of Applied Physics, TU Delft, PO Box 5046, 2600 GA Delft, The Netherlands

We have experimentally realized the most complex quantum computation to date — prime factorization of the number fifteen via Shor's algorithm — using a molecule with seven coupled nuclear spins, dissolved in a liquid at room temperature. These NMR experiments have well-known scaling limitations, but offer a unique perspective on what is to come in solid-state qubit experiments. Based on this experience, we have developed a set of new ideas for step-by-step initialization, manipulation and read-out of the spin state of a single electron in a lateral GaAs/AlGaAs quantum dot. Key features are leads in the quantum Hall regime and the use of a quantum point contact for read-out. We have now begun a sequence of experiments to test each of the steps and to characterize the coherence time of the qubits.

22bD3 **Characterization and implications of low frequency noise in superconducting phase qubits**

D.J. Van Harlingen[a], B.L.T. Plourde[b], T.L. Robertson[b], P.A. Reichardt[b], R. Therrien[b], John Clarke[b]

[a] *University of Illinois at Urbana-Champaign, Urbana, IL 61801, USA*
[b] *University of California at Berkeley and Lawrence Berkeley Laboratory, Berkeley, CA 94720, USA*

We consider the effects of low frequency noise (1/f and discrete switching noise) on the performance of superconducting phase qubit devices incorporating nanoscale Josephson tunnel junctions. The dominant mechanism is thought to be charge trapping in the junction barrier, which modulates the critical current. This disrupts the quantum evolution of the qubit, degrading decoherence times by perturbing the qubit potential and generating noise in the flux readout circuit that couples back to the qubit. We present measurements of the critical current fluctuations of nanoscale Al-AlOx-Al tunnel junctions and SQUIDs employed in phase qubits and associated coupling and readout circuits.