Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Eliminating Junction Fluctuators using Epitaxial Barrier in Josephson Qubit SEONGSHIK OH, K. CICAK, M. S. ALLMAN, JEFFREY S. KLINE, K. D. OSBORN, G. PROKOPENKO, M. A. SILLANPAA, A. J. SIROIS, J. A. STRONG, J. D. WHITTAKER, R. W. SIMMONDS, D. P. PAPPAS, NIST, Boulder, R. MCDERMOTT, JOHN M. MARTINIS, UC, Santa Barbara — Before a multi-qubit solid-state quantum computer is realized, many obstacles need to be overcome. The most significant problem with any solid- state qubit implementation is strong coupling to sources of decoherence in the environment. Accordingly, identifying and removing these sources is an important prerequisite for construction of a solid-state quantum computer. Among other things, all the present-day superconducting qubits use amorphous AlO_x as a tunnel barrier. However, there is growing evidence that the amorphous AlO_x tunnel barriers have undesirable two-level fluctuators that adversely affect the qubit. Along this line, we have fabricated the first epitaxial Josephson phase qubit with single-crystal Al_2O_3 barrier and observed substantially reduced density of two-level fluctuators in this new type of qubit. This is the first clear evidence showing the relationship between crystallinity of the tunnel barrier and the two-level fluctuators. With this new epitaxial Josephson qubit technology, we are one-step closer to realization of a practical multi-qubit solid-state quantum computer. This talk will be focused more on the fabrication side of the epitaxial qubit and the following talk will discuss the details of its measurement.

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Date submitted: 06 Dec 2005 Electronic form version 1.4