Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Circuit QED with a new type of qubit: The transmon coupled to a transmission line resonator JENS KOCH, TERRI M. YU, JAY GAMBETTA, ANDREW A. HOUCK, DAVID I. SCHUSTER, JOHANNES MAJER, ROBERT J. SCHOELKOPF, STEVEN M. GIRVIN, Yale University — The idea of coupling a superconducting qubit to a one-dimensional transmission line resonator, termed circuit QED [1], has evolved into an important paradigm in the ongoing pursuit of quantum computing. Recent experiments using Cooper pair boxes (CPBs) have revealed impressive results ranging from the realization of the strong-coupling limit [2] to the observation of the ac Stark shift and measurement-induced dephasing [3]. Here, we present theoretical and experimental results on the circuit-QED physics of a new type of qubit - the transmon. We show that the reduced anharmonicity gives rise to a generalized Jaynes-Cummings model, whose coupling strength can be even larger as compared to typical CPB qubits. In the dispersive limit, the transmon displays an intriguing regime of large positive dispersive shifts.
[1] A. Blais et al., Phys. Rev. A 69, 062320 (2004)
[2] A. Wallraff et al., Nature (London) 431, 162 (2004)
[3] D. I. Schuster et al., Phys. Rev. Lett. 94, 123602 (2005)

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Date submitted: 01 Dec 2006 Electronic form version 1.4