Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Two Superconducting Charge Qubits Coupled by a Josephson Inductance MICHIO WATANABE[1], TSUYOSHI YAMAMOTO[1,2,3], YURI A. PASHKIN[1,2], OLEG ASTAFIEV[1,2], YASUNOBU NAKAMURA[1,2,3], JAW-SHEN TSAI[1,2,3], [1]Frontier Research System, RIKEN, Japan, [2]NEC Fundamental Research Labs., Japan, [3]CREST-JST, Japan — When the quantum oscillations [Pashkin *et al.*, Nature **421**, 823 (2003)] and the conditional gate operation [Yamamoto *et al.*, Nature **425**, 941 (2003)] were demonstrated using superconducting charge qubits, the charge qubits were coupled capacitively, where the coupling was always on and the coupling strength was not tunable. This fixed coupling, however, is not ideal because for example, it makes unconditional gate operations difficult. In this work, we aimed to *tunably* couple two charge qubits. We fabricated circuits based on the theoretical proposal by You, Tsai, and Nori [PRB **68**, 024510 (2003)], where the inductance of a Josephson junction, which has a much larger junction area than the qubit junctions, couples the qubits and the coupling strength is controlled by the external magnetic flux. We confirmed by spectroscopy that the large Josephson junction was indeed coupled to the qubits and that the coupling was turned on and off by the external magnetic flux. In the talk, we will also discuss the quantum oscillations in the circuits.

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Date submitted: 10 Nov 2006 Electronic form version 1.4