Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Coherent control of a transmon qubit with a nanowire-based Josephson junction[1] T.W. LARSEN, K.D. PETERSSON, F. KUEMMETH, T.S. JESPERSEN, P. KROGSTRUP, J. NYGÅRD, C.M. MARCUS, Center for Quantum Devices, Niels Bohr Institute, Denmark — Transmon qubits[2] have taken great leaps towards realizing a quantum processor[3]. Here we present measurements on a novel, gateable transmon. By tuning the electron density in a semiconducting nanowire[4] Josephson junction[5] we can control the qubit frequency from ∼3 GHz to ∼8 GHz. The transmon was embedded into an aluminum coplanar waveguide cavity for readout and qubit control. In the resonant regime we observe strong cavity-qubit coupling. In the dispersive regime we demonstrate coherent control on the Bloch sphere. The life- and coherence times were measured to $T_2^* \sim 2T_1 \sim 1$ μs. The coherence time was measured to almost 1μs. Fast gate operations facilitate z-rotations as well as promising fast two-qubit operations in future multiple-qubit devices. These measurements open new possibilities for gateable superconducting qubits and promise a plausible system for Majorana hybrid devices.

[1]Research supported by Microsoft Station Q, Danish National Research Foundation, Villum Foundation, Lundbeck Foundation, and the European Commission.
[2]Koch, J. et al. *Phys. Rev. A* **76**, 042319 (2007)
[3]Barends, R. et al. *Nature* **508**, 500 (2014)
[4]Krogstrup, P. et al. *Nature Materials*, In press
[5]Doh, Y. J. et al. *Science* **309**, 272 (2005)

T. W. Larsen
Center for Quantum Devices, Niels Bohr Institute, Denmark

Date submitted: 14 Nov 2014 Electronic form version 1.4