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**Coherent Population Trapping in a Superconducting Phase Qubit** WILLIAM R. KELLY, ZACHARY DUTTON, THOMAS A. OHKI, JOHN SCHLAFER, BHASKAR MOOKERJI, BBN Technologies, Cambridge, MA 02138, USA, JEFFERY S. KLINE, DAVID P. PAPPAS, National Institute of Standards and Technology, Boulder, CO 80305, USA — The phenomenon of Coherent Population Trapping (CPT) of an atom (or solid state "artificial atom"), and the associated effect of Electromagnetically Induced Transparency (EIT), are clear demonstrations of quantum interference due to coherence in multi-level quantum systems. We report observation of CPT in a superconducting phase qubit by simultaneously driving two coherent transitions in a $\Lambda$-type configuration, utilizing the three lowest lying levels of a local minimum of the phase qubit. We observe $\sim 60\%$ suppression of excited state population under conditions of two-photon resonance, where EIT and CPT are expected to occur. We present data and matching theoretical simulations showing the development of CPT in time. We also used the observed time dependence of the excited state population to characterize quantum dephasing times of the system, as predicted in [1]. [1] K.V. Murali, Z. Dutton, W.D. Oliver, D.S. Crankshaw, and T.P.Orlando, Phys. Rev. Lett. **93**, 087003 (2004).

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