Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Cavity QED of individual two-level systems observed in insulating films BAHMAN SARABI, ARUNA N. RAMANAYAKA, Laboratory for Physical Sciences, ALEXANDER L. BURIN, Tulane University, FREDERICK C. WELLSTOOD, University of Maryland - College Park, KEVIN D. OSBORN, Laboratory for Physical Sciences — Previous work shows that individual two-level systems (TLS) can be observed in alumina tunnel barriers and used as quantum memory. We investigate the TLS within insulating films using superconducting microwave resonators of different electric-field volumes. The insulating film, made of hydrogenated amorphous silicon nitride, is orders of magnitude thicker than tunneling barriers and its volume is many orders of magnitude larger than that of qubit junction barriers where individual TLS are routinely observed. In the largest-volume resonators we observe bulk dielectric behavior of TLS. In the smallest-volume resonators, strong coupling to the TLS is observed and explained by cavity QED. When two resonances are observed, the data are fit to quantum theory, showing that the strongly coupled TLS have coherence times on the order of microseconds. Furthermore, the power dependence of transmission in the TLS-cavity hybrid system is measured, which shows clear saturation of the TLS near a single photon.

Bahman Sarabi
Lab. for Physical Sciences

Date submitted: 15 Nov 2013 Electronic form version 1.4