Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

**Emergent Non-Adiabatic Wavefunctions for Strongly Dissipative Qubits** SOUMYA BERA, SERGE FLORENS, Institute Neel, Grenoble, HAROLD BARANGER, Duke University, NICOLAS ROCH, ENS, Paris, AHSAN NAZIR, Imperial College London, ALEX W. CHIN, University of Cambridge — We show that a qubit strongly interacting with its environment leads to highly entangled states with emerging non-adiabatic features (Schrodinger-cat-like states of the environment). The model we consider is a two-level-system (qubit) coupled to a continuum of quantum oscillators (bosons), which can be realized, for instance, by a superconducting qubit coupled to a transmission line of photons. We show that the joint system is remarkably well described by a generalized variational coherent state ansatz, an ansatz which is justified by comparing with exact quantum tomography of the states found through Numerical Renormalization Group (NRG) calculations. Our coherent state ansatz includes not only the well-known polaronic contributions but also non-adiabatic anti-polaron contributions; these later contributions are critical for an accurate description of the strong coupling regime. We calculate the entanglement entropy of the qubit plus a single bosonic mode with the rest of the system; this joint entropy peaks for a bosonic mode around the Kondo scale, an effect due to the anti-polaronic contribution.

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Date submitted: 09 Nov 2012 Electronic form version 1.4