

Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Two Electromagnetically Induced Transparency Windows and Cross-Phase Modulation with Four-Level Superconducting Artificial Atoms¹ HESSA ALOTAIBI, BARRY SANDERS, University of Calgary — Superconducting circuit quantum electrodynamics (SCQED) employs microwave transmission lines coupled to artificial atoms, which are typical two-level and recently three-level for electromagnetically induced transparency (EIT). We propose SCQED with a four-level tripod-configuration artificial atom to enable cross-phase modulation between two traveling-wave microwave fields. Our master-equation analysis for three driving fields (“signal,” “probe” and “coupling”) demonstrates the existence of two distinct EIT transparency windows in the spectral-response profile as a function of coupling and weak fields strength. We provide the first theoretical analysis of this unexpected second window and show its advantages over the known first EIT window. Specifically we show that this second EIT window provides both the signal and probe fields with identical response functions provided that their Rabi frequencies and detunings are the same. Exploiting the second window with judiciously chosen external flux and energy detuning result in low absorption, excellent group velocity matching, and high nonlinearity, thereby enabling strong cross-phase modulation for SCQED.

¹This work is supported by CIFAR, NSERC, and AITF

Hessa Alotaibi
University of Calgary

Date submitted: 07 Nov 2012

Electronic form version 1.4