Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Light-matter decoupling and $A^2$ term detection in superconducting circuits JUAN JOSE GARCIA-RIPOLL, Instituto de Física Fundamental, IFF-CSIC, Madrid, BORJA PEROPADRE, Department of Chemistry and Chemical Biology, Harvard University, SIMONE DE LIBERATO, School of Physics and Astronomy, University of Southampton — We study the spontaneous emission of a qubit interacting with a one-dimensional waveguide through a realistic minimal-coupling interaction. We show that the diamagnetic term $A^2$ leads to an effective decoupling of a single qubit from the electromagnetic field. This effect is observable at any range of qubit-photon couplings. For this we study a setup consisting of a transmon that is suspended over a transmission line. Assuming a standard model of qubit-line interaction, we prove that the relative strength of the $A^2$ term is controlled with the qubit-line separation and show that, as a consequence, the spontaneous emission rate of the suspended transmon onto the line can increase with such separation, instead of decreasing.1


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Date submitted: 13 Nov 2014

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