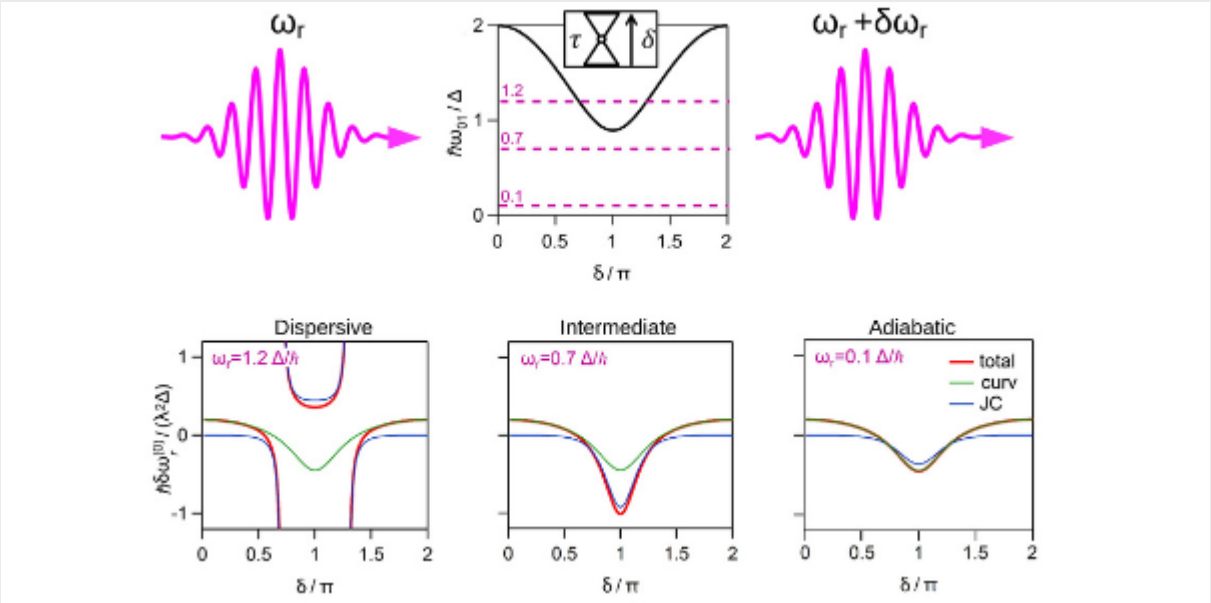
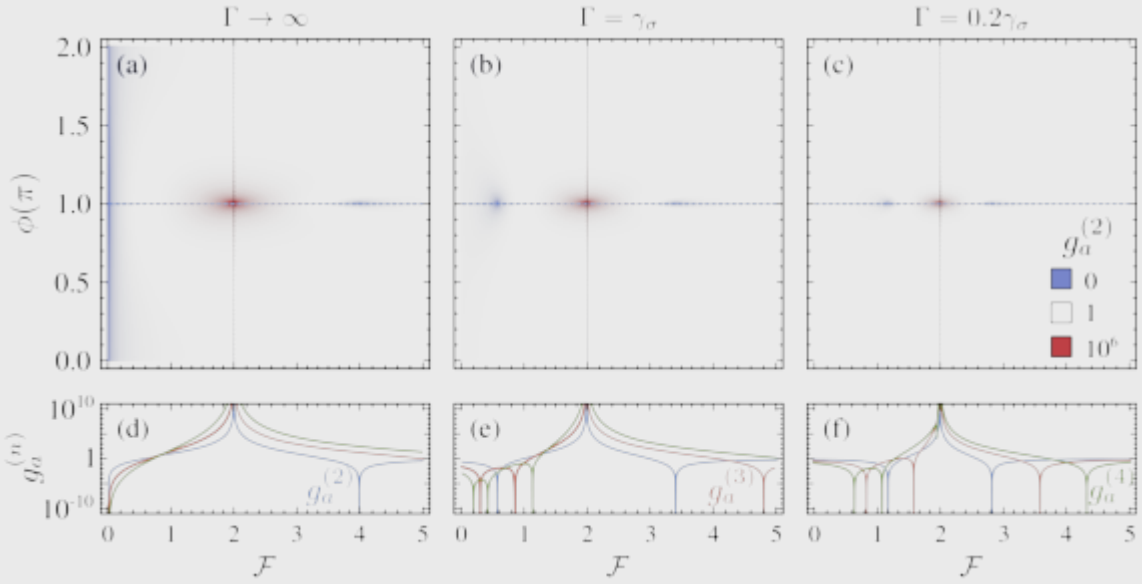
From adiabatic to dispersive readout of Quantum Circuits



Article: Published, in Physical Review Letters by Sunghun Park and Alfredo Levy Yeyati, members of the Theoretical Condensed Matter physics Department.

Circuit quantum electrodynamics (QED) allows to readout the state of a qubit or a quantum circuit by monitoring the resonance frequency shift induced in a microwave resonator coupled to it, achieving regimes and phenomena which cannot be reached within the realm of quantum optics. For the interpretation of circuit QED experiments, two disconnected theoretical approaches exist depending on whether the detuning with respect to the microwave resonator frequency is small or large. We here show that a unified description of both the large and small detuning regimes, referred to as adiabatic and dispersive regimes, respectively, and provide an expression for the resonator frequency shift up to second order in the coupling between a resonator and a quantum circuit. We further provide a set of simple examples where we illustrate the need of the full theory to account for the resonator frequency shift for a wide range of system parameters. [Full article]

Impact of Detuning and Dephasing on a Laser-corrected Subnatural-linewidth Single-photon Source



Article: published in Journal of Physics B: Atomic, Molecular and Optical Physics by J. C. López Carreño, E. Zubizarreta Casalengua and E. del Valle, members of the Department of Theoretical Condensed Matter Physics.

We discuss a scheme which makes interfere the emission from a qubit with a laser to produce single photons with subnatural linewidth (monochromatic), although having both properties seems to be in contradiction with the Heisenberg uncertainty principle. In this paper, we consider the effect of dephasing and of the detuning between the driving laser and/or the detector with the emitter. We find that our scheme brings such considerable improvement as compared to the standard schemes as to make it one of the best single-photon sources. While the scheme is particularly fragile to dephasing, its superiority holds even for subnatural-linewidth emission down to a third of the radiative lifetime. [Full article]