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Overcoming charge noise decoherence by photon-assisted pair-breaking in a charge qubit SEBASTIAN DE GRAAF, JUHA LEPPÄKANGAS, ASTGHIK ADAMYAN, ANDREY DANILOV, Chalmers University of Technology, Department of Microtechnology and Nanoscience, Gothenburg, Sweden, TOBIAS LINDSTRÖM, National Physics Laboratory, Teddington, United Kingdom, MIKAEL FOGELSTRÖM, GÖRAN JOHANSSON, SERGEY KUBATKIN, Chalmers University of Technology, Department of Microtechnology and Nanoscience, Gothenburg, Sweden — We report on recent measurements [1] of a charge qubit, a Cooper-pair box, coupled to a high-Q microwave cavity in the strong driving regime. This we model using a dressed state formalism, and we find evidence for a process that involves energy transfer corresponding to a large number ($\sim$14) of photons. This energy is sufficient to break a Cooper-pair on the island, and it results in a new relaxation channel for the qubit. Specifically, this relaxation resets the qubit into a charge state determined by the static bias conditions, resulting in a sudden population inversion around each dressed state degeneracy point. At low driving strengths, decoherence is governed by charge noise in the environment, while in the discovered strong driving regime the relaxation rate due to pair-breaking can overcome the environmental charge relaxation rate. This results in a regime that is especially attractive for charge sensing since the qubit response becomes immune to non-equilibrium quasiparticle poisoning and less susceptible to its charge noise environment.

[1] S. E. de Graaf et al. PRL 111, 137002 (2013); J. Leppäkangas et al., J. Phys. B, 46, 224019

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