The bright side of charge transfer through Josephson junctions

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The coupling of photonic and charge degrees of freedom has recently been explored in experiments [1,2] where voltage-biased Josephson junctions (JJ) strongly interact with microwave cavities. The JJ can either be operated in the Coulomb blockade regime (incoherent transfer of Cooper pairs) with low photon population in the cavity or in the coherent domain with high photon population and strong emitted radiation. This is related to a quantum-classical correspondence of the JJ-cavity system. In this talk we present a theoretical description and specific results for various observables of experimental relevance such as current, current noise, photon distribution, emitted radiation [3]. Further, extensions of present set-ups towards the generation of entangled photon pairs are discussed.

[1] M. Hofheinz et al, Phys. Rev. Lett. 106, 217005 (2011)

[2] M. P. Blencowe et al, in: Fluctuating Nonlinear Oscillators, M. Dykman (ed.), 33 (2012)

[3] V. Gramich, S. Rohrer, B. Kubala and J. Ankerhold, in preparation