Fluctuation-dissipation relations of a tunnel Junction driven by a quantum circuit

Olivier Parlavecchio[1], Carles Altimiras*†[1], Jean Rene Souquet[2], Pascal Simon[3], Inès Safi[3], Philippe Joyez[1], Denis Vion[1], Patrice Roche[1], Daniel Esteve[1], and Fabien Portier‡[1]

[1]Service de Physique de l'Etat Condensé (SPEC UMR 3680 CEA-CNRS) – CEA, CNRS : UMR3680 – SPEC, CEA Saclay, Orme des Merisiers, 91191 Gif-sur-Yvette, France, France

[2]McGill University – Department of Physics, McGill University, Montréal, QC, Canada, Canada

[3]Laboratoire de Physique des Solides (LPS) – CNRS : UMR8502, Université Paris XI - Paris Sud – Bat. 510 91405 Orsay cedex, France

Abstract

We derive fluctuation-dissipation relations for a tunnel junction driven through a resonator displaying strong quantum fluctuations. We find that the fluctuation-dissipation relations derived for classical external drives hold, provided the effect of the circuit's quantum fluctuations is incorporated into the modified nonlinear current voltage characteristics. We also demonstrate that all quantities measured under a time dependent bias can be reconstructed from their values measured under a dc bias using photoassisted tunneling relations. We confirm these predictions by implementing the circuit and measuring the dc current through the junction, its high frequency admittance, and its current noise at the frequency of the resonator.

*Speaker

†Corresponding author: carles.altimiras@cea.fr

‡Corresponding author: portier@cea.fr