Fluxonium readout prevented by coherent destruction of tunneling

Alexis Jouan*[1], Joachim Cohen†[2], Alexandru Petrescu‡§[3], Réouven Assouly , Denis Benâtre , Rémy Dassonneville , Antoine Essig , Jeremy Stevens[4], Audrey Bienfait¶[5], and Benjamin Huard‖

[1]Laboratoire de Physique de l'ENS Lyon – Laboratoire de Physique, CNRS UMR 5672, Ecole Normale Supérieure de Lyon, Université de Lyon (ENS Lyon) – France

[2]Institut Quantique [Sherbrooke] – Canada

[3]Centre Automatique et Systèmes – Ecole des Mines de Paris – 60 Bd Saint-Michel, 75272 Paris, France

[4]Département de Physique [ENS Lyon] – Laboratoire de Physique de l'ENS de Lyon – France

[5]Département de Physique [ENS Lyon] – Ecole Normale Supérieure de Lyon, Université de Lyon – France

Résumé

Dispersive readout facilitates the quantum non-demolition measurement of the state of a superconducting qubit. It is expected that, as the drive amplitude is increased, readout fidelity increases. However, with increasing readout power qubit coherence can diminish, and unwanted measurement-induced transitions can occur. In this talk, we consider the sensitivity of readout to drive power in the fluxonium qubit. We observe that close to, but not at, half flux quantum, the measurement rate vanishes for a range of drive amplitudes. We attribute this disabling of the readout to a competition between the measurement and a coherent destruction of tunneling between the wells of the energy potential resulting in a localization of the computational manifold wavefunctions into the wells. We present experimental results and a theoretical model in quantitative agreement. Beyond the disabling of readout close to half flux quantum, our model captures the rate of the transitions between the first energy levels that is induced by the readout drive at half flux quantum. This research was supported by the ARO HiPS (contract No. W911-NF18-1-0146) and GASP (contract No. W911-NF23-10093) programs.

*Auteur correspondant: alexis.jouan@espci.fr

†Auteur correspondant: joachim.cohen@alice-bob.com

‡Intervenant

§Auteur correspondant: alexandru.petrescu@inria.fr

¶Auteur correspondant: audrey.bienfait@ens-lyon.fr

‖Auteur correspondant: benjamin.huard@ens-lyon.fr