

cQED@Tn - "Circuit QED: From Quantum Devices to Analogues on Superconducting Circuits"



Contribution ID: 31

Type: ORAL

Evidence of dual Shapiro steps in a Josephson junctions array

Tuesday, 4 October 2022 17:30 (30 minutes)

The accuracy with which electromagnetic waves of specific frequencies can be both measured and produced have made frequency the basis for the definition of most physical units, including time, distance, and voltage. The modern primary voltage standard is based on the phenomena of Shapiro steps, where a tone applied to a Josephson junction yields a constant voltage determined by only the frequency of the light and fundamental constants. The duality of current and voltage has long suggested the possibility of dual Shapiro steps—that a Josephson junction device could produce current steps with heights determined only on the applied frequency. In this report, we embed an ultrasmall Josephson junction in a high impedance array of larger junctions to observe dual Shapiro steps resulting directly from microwave synchronised transport of Cooper pairs through the device. For multiple frequencies, we detect the presence of a RF mode in-phase with the tone at frequency f , and the corresponding emergence of flat steps in the IV curve with current $2ef$, equal to the tunnelling of a Cooper pair with charge $2e$ per tone period. The observation of dual Shapiro steps opens a broad range of possibilities for future experiments, e. g. in the field of circuit quantum electrodynamics, many body quantum optics and quantum metrology.

Primary author: CRESCINI, Nicolo'

Co-authors: CÉCILE, Naud (Institut Néel); BASKO, Denis (Institut Néel); GUICHARD, Wiebke (Institut Néel); BUISSON, Olivier (Institut Néel); MURCH, Kater (Institut Néel); CAILLEAUX, Samuel (Institut Néel); ROCH, Nicolas (Institut Néel)

Presenter: CRESCINI, Nicolo'

Session Classification: Talks