Dissipation and Supercurrent Fluctuations in a Diffusive Normal-Metal–Superconductor Ring

Helene Bouchiat*[1] and Meydi Ferrier*

[1]LPS – CNRS : UMR8502 – UPS 91405 Orsay France, France

Abstract

A mesoscopic hybrid normal-metal–superconductor ring is characterized by a dense Andreev spectrum with a flux dependent minigap. To probe the dynamics of such a ring, we measure its linear response to a high frequency flux, in a wide frequency range, with a multimode superconducting resonator. We find that the current response contains, besides the well-known dissipationless Josephson contribution, a large dissipative component. At high frequency compared to the minigap and low temperature, we find that the dissipation is due to transitions across the minigap. In contrast, at lower frequency there is a range of temperature for which dissipation is caused predominantly by the relaxation of the Andreev states' population. This dissipative response, related via the fluctuation dissipation theorem to a nonintuitive zero frequency thermal noise of supercurrent, is characterized by a phase dependence dominated by its second harmonic, as predicted long ago but never observed so far.

*Speaker