

Real-time observation of discrete Andreev tunneling events - influence on a single-electron turnstile and electron coolers

J. P. Pekola^a, V. F. Maisi^b, O.-P. Saira^a, Yu. A. Pashkin^c, J. S. Tsai^c, and D. V. Averin^d

^aLow Temperature Laboratory, Aalto University, P.O. Box 13500, 00076 Aalto, Finland

^bCentre for Metrology and Accreditation (MIKES), P.O. Box 9, 02151 Espoo, Finland

^cNEC Green Innovation Research Laboratories and RIKEN Advanced Science Institute, 34 Miyukigaoka, Tsukuba, Ibaraki 305-8501, Japan

^dDepartment of Physics and Astronomy, Stony Brook University, SUNY, Stony Brook, NY 11794-3800, USA

We provide a direct proof of two-electron Andreev transitions in a superconductor - normal metal tunnel junction by detecting them in a real-time electron counting experiment¹. Our results are consistent with ballistic Andreev transport with an order of magnitude higher rate than expected for a uniform barrier, suggesting that only part of the interface is effectively contributing to the transport. These findings are quantitatively supported by our direct current measurements in single-electron transistors with similar tunnel barriers. We assess the influence of Andreev current on single-electron transport and electronic cooling.

¹V. F. Maisi, O.-P. Saira, Yu. A. Pashkin, J. S. Tsai, D. V. Averin, and J. P. Pekola, arXiv:1012.5750.