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Closing the gap in the Andreev spectrum in a three-terminal superconducting junction CIPRIAN PADURARIU, RÉGIS MELIN, Institut Néel CNRS, Grenoble, France, THIBAUT JONCKHEERE, JÉRÔME RECH, THIERRY MARTIN, Centre de Physique Théorique CNRS, Marseille, France, DENIS FEINBERG, Institut Néel CNRS, Grenoble, France, BENOÎT DOUÇOT, Laboratoire de Physique Théorique et Hautes Energies CNRS, Paris, France, YULI NAZAROV, Kavli Institute of Nanoscience, TU Delft, The Netherlands — Quasiclassical circuit theory [1] is used to investigate transport in a mesoscopic junction with three superconducting terminals. Our study reveals the closing of the gap in the Andreev spectrum for a wide range of phase-biases and transparencies, in agreement with previous work [2]. In this regime a superconducting current flows in the junction, while the proximity mini-gap is closed. The corresponding parameter region is studied systematically, both analytically in the low transparency limit and numerically. We provide a microscopic explanation for the closing of the gap in terms of multiple pair processes that correlate the superconducting currents flowing between different pairs of terminals [3]. We show that multi-terminal superconducting junctions provide unique opportunities for applications in quantum devices based on Josephson and/or Majorana physics.

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