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A.18 Current-phase relationship for practical SNS junctions

A. Golubov†, University of Twente, Enschede, The Netherlands; M.Yu.Kupriyanov, Institute of Nuclear Physics, Moscow State University, Moscow, Russia

It is well known that an optimal SQUID sensitivity is achieved if there is a sinusoidal relationship between a supercurrent J_s and a phase difference φ across a Josephson junction. However in practical SNS structures there are several reasons for deviations from this low. The first of them is the thermal effect, which in accordance with the Kulik-Omelyanchuk theory leads to shift of maximum of J_s vs φ dependence to a value of φ larger than $\pi/2$. Another one is the suppression of superconductivity in the vicinity of NS boundaries due to proximity effect, which acts in the opposite way. We present the results of calculations of current-phase relationship in a SNS junction treating the superconducting state in the S electrodes selfconsistently. We determine the effective size of the weak link region in a junction under various values of interface transparencies, transport properties and critical temperatures of N and S materials. The criteria are derived for the coexistence of a sinusoidal current-phase relationship and high values of I_cR_n products.

†E-mail: a.golubov@tn.utwente.nl

▶A.19 Non-equilibrium properties of double-barrier Josephson junctions: theory and experiment

A. Brinkman†, E. Bartolome, A.A. Golubov, and H. Rogalla, Dept. of Applied Physics, University of Twente, The Netherlands; M.Yu. Kupriyanov, Institute of Nuclear Physics, Moscow State University, Russia

New theoretical results on double-barrier SIS'IS Josephson junctions are presented (I is a tunnel barrier, S' is a superconducting thin film with critical temperature lower than that of S). The microscopic model for the stationary case is extended to the non-equilibrium regime of finite voltages by means of the Keldysh formalism.

This theoretical formalism will be used to explain the experimental current-voltage data and the dependence on barrier-parameters and interlayer properties of double-barrier junctions and double-barrier junction based dc SQUIDs. In order to apply double-barrier junctions in electronic circuitry or SQUIDs, several requirements have to be met, like optimal critical current densities, IcRn products and noise properties. The possibilities for application will be discussed on the basis of theoretical estimations and experimental findings.

†E-mail: a.brinkman@tn.utwente.nl