Josephson SFS π-junctions. Potential Applications in Computing

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Novel superconducting weak links, 'π-junctions', were realized recently. The origin of the π-state in a Superconductor - Ferromagnet - Superconductor (SFS) junction is an oscillating and sign-reversing superconducting order parameter induced in the ferromagnet close to the SF-interface. The π-behavior in SFS sandwiches was first observed in our group in 2000 [1]. Our recent result was detection of the transitions to π-state and back to the 0-state, i.e. nonmonotonic (with two nodes) behavior of the junction critical currents vs. F-layer thickness. The π-junctions with critical current density up to 2000 A/cm^2 were achieved that are suitable for applications in future superconducting digital and quantum electronics [2]. The junctions are based on a niobium thin film technology so they can be incorporated directly into existing architectures of superconducting electronics. Recently a key experiment related to SFS π-junction insertion in a typical cell of Josephson electronics (dc-SQUID) like a phase inverter was carried out successfully by us.

1. V. V. Ryazanov et al, *Phys. Rev. Lett.* **86**, 2427 (2001); V. V. Ryazanov et al, *J. Low Temp. Phys.* **136**, 385 (2004).
2. G. Blatter et al, *Phys. Rev. B* **63**, 174511 (2001); E. Terzioglu, and M. R. Beasley, *IEEE Trans. On Appl. Supercond.* **8** 48 (1998); A. V. Ustinov, V. K. Kaplunenko, *J. Appl. Phys.* **94**, 5405 (2003).

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