Superharmonic Josephsons Relations in Unconventional Superconductor Junctions with Ferromagnetic Barrier

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Abstract. The recent experimental progress provides the possibility of fabrication of clean d-wave superconductor/ferromagnetic metal/d-wave superconductor junctions with the large degree of barrier transparency. For misorientation 0-45^o of superconducting electrodes in the *a-b* plane we predict the coexistence of 0 and π stable phases (double degenerate state) in finite intervals of the magnetic barrier strength, alternating with the intervals of $\pi/2$ stable states. At low temperature there are also triple-degenerate states $(0,\pi/2,\pi)$ at the limits of above intervals. The corresponding current-phase relations (CPR) are quite unconventional: at low T for (0-π state) CPR is close to the second harmonic, $I_C \approx \sin 2\phi$, whereas for $\pi/2$ state the sign is changed, $I_C \approx -\sin 2\phi$, and for $(0,\pi/2, \pi)$ state CPR is close to the forth harmonic, $I_C \approx \sin 4\phi$. These unusual features open new possibilities for superharmonic squids with doubly and triply degenerate ground state.

REFERENCES

1. J. Q. You and F. Nori, *APhysics Today* **58**, 42 (2005).
2. R. Zikic and Lj. Dobrosavljevic-Grujic, *Phys. Rev. B* **75**, 100502 (2007), RC.
3. R. Zikic and Lj. Dobrosavljevic-Grujic, chapter in *"Josephson Junction and Superconductivity Research"*, Nova Science Publishers, NY 2007.