

Abstract Submitted
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In-gap States of Josephson Junction with Two-gap Superconductors JU KIM, LADAN BAHRAINIRAD, University of North Dakota — We investigate the transport property of SIS junctions with two-gap superconductors. The effects of two superconducting condensates on critical current density is estimated by studying the microscopic structure of Josephson current density in a dual-mode tunnel junction with a narrow quasi-classical tunnel barrier. Following the suggestion by Golubov and coworkers [1], we use two Bloch functions to describe the condensates in the two-band superconductors. In this junction, the in-gap states which include the interband interference effect appear at the interfaces due to the discontinuity of the superconducting phase. Also, similar to a Josephson junction [2] involving one-gap and two-gap superconductors, novel broken time-reversal symmetry states are found. We estimate the effects of interband interference and broken time-reversal symmetry on the in-gap bound states and critical Josephson current density.

[1] A. A. Golubov *et al.*, Phys. Rev. Lett. **103**, 3398 (2009).

[2] T. K. Ng and N. Nagaosa, EPL **87**, 17003 (2009).

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