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Josephson plasma excitation in vortex states

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Abstract

The Josephson Plasma resonance in single crystalling Bi2Sr2CaCu2O8 has been investigated at a microwave frequency of 35 GHz in a cavity resonator. A sharp resonance is observed in a perpendicular oscillating magnetic field. The former is independent of the sample dimension, shile the latter shift to higher field as the sample size L is reduced, and it disappears when L becomes smaller than the critical length. The longitudinal plasma mode is a Nambu-Goldston mode in a superconductor, the experimental distinction between the longitudinal and the transverse mode leads to the conclusion that the existence of the Nambu-Goldston mod as predicted by Anderson was experimentally confirmed by direct observation of the Josephson plasma resonance with longitudinal excitations. The finite gap found in Josephson plasma resonance also provides a direct proof of the Anderson-Higgs mechanism within the context of the spontaneously broken phase symmetry of the Gauge-field theory in a superconductor.