

Abstract Submitted
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Observation of the Leggett's collective mode in MgB₂ two-band superconductor G. BLUMBERG, A. MIALITSIN, B. S. DENNIS, Bell Labs, Lucent Technologies, N. D. ZHIGADLO, J. KARPINSKI, ETH, Zurich — We report observation of novel collective mode in the multi-band MgB₂ superconductor by resonant electronic Raman spectroscopy. The mode appears below T_c in the A_{1g} scattering channel at 9.2 meV, which is in-between the two gap values, 4.5 meV for the fundamental gap in the π -band and 13.5 meV for the gap in the σ -band. We attribute this excitation to collective mode first discussed by Leggett: If a system contains two coupled superfluids a simultaneous cross tunneling of a pair of electrons become possible. The mode is caused by dynamical oscillations of the pairs between the two superfluids leading to small fluctuations of the relative phase of two superconducting condensates. For MgB₂ the the oscillations between the condensates involve scattering of a pair of σ -band electrons with momentum $(k, -k)$ into a pair of π -band electrons with momentum $(k', -k')$. The symmetry and energy of observed mode is consistent with theoretical predictions.

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