

Abstract Submitted  
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**Leggett's collective modes in multi-band superconductors: multiple dynamical classes** YUKIHIRO OTA<sup>1</sup>, MASAHIKO MACHIDA<sup>2</sup>, CCSE, JAEA, TOMIO KOYAMA<sup>3</sup>, IMR, Tohoku Univ., HIDEO AOKI<sup>4</sup>, Dept. of Physics, Univ. of Tokyo — One important way to characterize multi-band superconductors should be to look at their collective modes, which are expected to reflect the broken gauge symmetry that involves multi-bands. We extend Leggett's 1966 analysis for a massive out-of-phase mode coexisting with the Nambu-Goldstone mode in two-band superconductors to the case where there are three or more bands. Crucial, as we find here, is to classify the inter-band Josephson coupling energy which is the origin of the Leggett's modes. Namely, three-band superconductors are shown to accommodate more than one collective modes, which are classified in terms of the "dynamical class" that distinguishes the action of the inter-band Josephson coupling. The mass of the multiple Leggett's modes is then shown to dramatically depend on the class. We expect that the present prediction can be tested in the iron-based superconductor (with a gap function involving three bands) and ultracold fermionic atom gases with multiple atomic species.

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