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Leggett modes in the multi-band superconductor Sr2RuO4[1] WEN HUANG, McMaster University, MANFRED SIGRIST, Institute for Theoretical Physics, ETH Zurich, CATHERINE KALLIN, McMaster University — Sr_2RuO_4 is a prototypical multi-band superconductor, with three bands crossing the Fermi level. These bands exhibit distinct dimensional characteristics, with one quasi-2D γ-band and two quasi-1D α- and β- bands. As a consequence, the superconducting order parameter on the γ- and α/β-bands may only be weakly Josephson-coupled, in contrast to the stronger coupling between the quasi-1D bands. In this work, we study the Leggett modes associated with the relative phase fluctuations between the bands. We show that a soft Leggett mode exists in the case of comparatively weaker inter-band Josephson coupling between the γ- and α/β-bands. We further analyze the dependence of the inter-band Josephson coupling on spin-orbit coupling, and discuss the possibility of an exotic time-reversal symmetry breaking phase when the Josephson coupling is comparable between all pairs of bands.

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