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Origin of the Pressure-Induced Volume Collapse in Tb^1 GILBERTO FABBRIS, Argonne National Laboratory / Washington University in St. Louis, JINHYUK LIM, Washington University in St. Louis, JOSE RENATO MARDEGAN, Universidade Estadual de Campinas / Argonne National Laboratory, DANIEL HASKEL, Argonne National Laboratory, JAMES SCHILLING, Washington University in St. Louis — The mechanism responsible for the high-pressure volume collapse in most elemental rare-earth metals is still a matter of debate. Models attempting to explain this collapse include: (i) valence transition, (ii) 4flocal-to-band transition (Mott-Hubbard), (iii) f-d hybridization (Kondo), and (iv) $sp \rightarrow d$ transfer. We focus on Tb metal which displays a 5% volume collapse at 53 GPa. X-ray absorption spectroscopy shows persistence of Tb's $4f^8$ state across the volume collapse, excluding (i) as a mechanism. Furthermore, x-ray emission spectroscopy shows that 4f states retain their localized nature to at least 70 GPa, ruling out (ii). On the other hand, the suppression of the x-ray absorption "white line" with pressure indicates that $sp \rightarrow d$ transfer is active. To probe for Kondo interactions, the pressure dependence of the superconducting $T_{\rm c}$ in pure Y is compared to that in a Y(0.5 at% Tb) alloy. We observe a strong suppression of T_c at pressures near terbium's volume collapse, an indication of a rapid increase of the Kondo temperature, in agreement with (iii). We argue that a Kondo model in the presence of $sp \rightarrow d$ transfer best describes the volume collapse in Tb metal.

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