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4f metals (compounds) under High Pressure (and Temperature): f-electron Correlation Physics MAGNUS LIPP, ZSOLT JENEI, HYUNCHAE CYNN, WILLIAM EVANS, Lawrence Livermore National Laboratory, PHYSICS DIVISION TEAM — The physics of 4f-electron correlation governs the behavior of the most interesting group in the periodic table, the rare-earth elements. Arguably the most celebrated example is cerium with its iso-structural (fcc) volume collapse (VC) from the γ- to the α-phase ending in a critical point. Close to the VC cerium is even auxetic since its Poisson's ratio becomes negative. Radiography tells us that both phases continue on into the melt, possibly separated by a first order transition. The presence of the f-electron can be interrogated via X-ray emission spectroscopy of the satellite intensity of the Lγ radiation. Across the VC it experiences a step-like drop which could be interpreted as a discontinuous decrease of the $4f$-moment or occupancy. The theoretical models (Hubbard-Mott or Kondo) explain these phenomena with the behavior of the f-electrons themselves or their spin but the contribution of the lattice-phonons also plays an important part. However, its share in the entropy change across the VC decreases with temperature. This work was performed under the auspices of the US DOE by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. The X-ray studies were performed at HPCAT (Sector 16), APS/ANL. HPCAT is supported by CIW, CDAC, UNLV and LLNL through funding from DOE-NNSA, DOE-BES and NSF. APS is supported by DOE-BES, under Contract No. DE-AC02-06CH11357.

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