

Abstract Submitted
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Complex Structural Phase Transitions in Europium at High Pressure RACHEL HUSBAND, INGO LOA, University of Edinburgh, MALCOLM MCMAHON, m.i.mcmahon@ed.ac.uk — Europium (Eu), which is divalent at ambient pressure due to its half-filled 4f electron shell, is an anomalous element in the lanthanide series, in which the majority of the elements are trivalent. Consequently, Eu does not fit in with the general trend of structural phase transitions observed in the trivalent lanthanide elements, and its behaviour is much more complex. The Eu-IV phase, stable above 31.5 GPa, is the only known incommensurate structure in the lanthanide series¹. Early spectroscopic measurements indicated that the valence of Eu increases continuously under pressure², but a recent study concluded that Eu remains nearly divalent up to 87 GPa³. We will present the results of our x-ray diffraction studies of Eu up to a pressure of 100 GPa, well into the superconducting region. Initial structural studies were greatly complicated by the presence of two pressure-induced contaminant phases^{4,5}, and so great care was taken to obtain ‘clean’ samples. We will report a transition to a second incommensurately-modulated phase, Eu-V, above 42 GPa. This transition is accompanied by an increase in modulation amplitudes and the appearance of higher-order satellite reflections, suggesting a complex modulation wave. This is the first pressure-induced incommensurate-incommensurate (non-host-guest) transition to be observed in the elements at high pressure. ¹Husband *et al.* Phys. Rev Lett. **109**, 095503 (2012). ²Röhler, Physica B+C **144**, 27 (1986). ³Bi *et al.*, Phys. Rev. B. **85**, 205134 (2012). ⁴Husband *et al.*, J Phys Conf Ser. **377**, 012030 (2012). ⁵Husband *et al.*, High Press. Res. (in Press).

Rachel Husband
University of Edinburgh

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