Inelastic X-Ray Study of Elemental 4f Metals under High Pressure

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Keywords: Inelastic X-Ray, high pressure, 4f metals

The behaviour of 4f electrons plays a crucial role in elucidating various physical phenomena, such as valence fluctuation, insulator-metal, nonmagnetic-magnetic, and superconducting transitions in lanthanide metals and compounds. However, understanding the electrodynamics of 4f electrons remains a significant challenge in many-body quantum physics. Applying external pressure to convert localized 4f states to delocalized ones provides a unique opportunity to explore this phenomenon. In this work, we utilized inelastic x-ray scattering and resonant x-ray emission spectroscopy to investigate changes in 4f states during the volume collapse transition in cerium [1] and the valence transition in europium [2] under high pressure. Our findings shed light on the underlying mechanism of these transitions.