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Poissons ratio: key to electron localization in plutonium ALBERT MIGLIORI, HASSEL LEDBETTER, Los Alamos National Laboratory, Los Alamos, NM 87545 — Focusing on plutonium, we show that a familiar usually-ignored elastic parameter—the dimensionless Poisson ratio (ν)—helps understand a knotty unsolved problem: itinerant-localized 5f electrons. A simple electrostatic electron-gas model predicts that the bulk modulus B and shear modulus G decrease as electrons change from itinerant to localized (the free-electron-gas density decreases), but that the Poisson ratio remains unchanged. From the bulk modulus, the model predicts approximate divalency for plutonium, implying a $5f^4$ localized-electron configuration. We deduce that warming plutonium from 0 to 300 K causes 0.24 electrons/atom to change from itinerant state to localized. Sufficient alloying with Ga or Al suppresses the itinerant—localized transition, causing the Poisson ratio to show near-typical temperature dependence. This work was carried out at the National High Magnetic Field Laboratory, which is supported by the National Science Foundation, the State of Florida and DOE.

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