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Investigation of the Orbital Ordering Transition in $\text{La}_4\text{Ru}_2\text{O}_{10}$ using the Mossbauer Effect¹ MICHAEL DE MARCO, RYAN HEARY, DERMOT COFFEY, Dept. of Physics, Buffalo State College, NY 14222, PETER KHALIFAH, Dept. of Chemistry, University of Massachusetts, MA 01003, BRIAN SALES, DAVID MANDRUS, Solid State Division, ORNL, TN 37831, STEVE TOORONGIAN, MICHAEL HAKA, Nuclear Medicine Dept., SUNY Buffalo, NY 14260 — There is a structural phase transition in $\text{La}_4\text{Ru}_2\text{O}_{10}$ from a triclinic phase starting at 140K to a monoclinic phase which is complete by 190K. This is accompanied by the development of a local moment from $\mu_{eff} \simeq 0.4\mu_B$ to $\mu_{eff} \simeq 2.5\mu_B$ which leads to the identification of this transition with orbital ordering. The Mossbauer Effect (ME) has been measured from 4.2K to 196K in a sample prepared with enriched ^{99}Ru (97%). The ME spectrum is fit with two sites consistent with the triclinic structure. The spectra for the two sites are characterized by a quadrupole splitting (QS) and an isomer shift (IS): $\text{QS}_1=0.51\text{mm/s}$ and $\text{IS}_1=-0.27\text{mm/s}$ and $\text{QS}_2=0.38\text{mm/s}$ and $\text{IS}_2=-0.32\text{mm/s}$. At 171K the sample is mostly in the monoclinic phase which has a single-site ME spectrum with $\text{QS}=0.38\text{mm/s}$ and $\text{IS}=-0.31\text{mm/s}$. The less symmetric site with the larger QS has disappeared. Throughout the transition the IS is consistent with a +4 charge state for the Ru site. The Debye temperature is 307K.

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