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Structural Complexity in Dense Magnesium JON EGGERT, MARTIN GORMAN, AMY LAZICKI, LLNL, DAVID MCGONEGLE, Oxford University, STANIMIR BONEV, LLNL, SABRI ELATRESH, Cornell University, JUSTIN WARK, Oxford University, MARC CORMIER, RICHARD BRIGGS, AMY COLEMAN, LLNL, STEVE ROTHMAN, A.W.E, RICHARD KRAUS, DAVID BRAUN, LLNL, GILBERT COLLINS, University of Rochester, PATRICK HEIGHWAY, Oxford University, LISA PEACOCK, A.W.E, FEDERICA COPPARI, LLNL, RYAN RYGG, University of Rochester, MALCOLM MCMAHON, Edinburgh University — As compression increases, the electronic wave functions of the valence electrons begin to overlap and interact with those of the core electrons, resulting in exotic electronic and complex structural behavior. Here we report *in situ* X-ray diffraction measurements of solid magnesium which has been dynamically compressed to pressures up to 1.3 TPa (corresponding to 5.5-fold compression). Our experimental observations show that Mg adopts a series of distorted structures at 0.3, 0.5 and 0.8 TPa, contrary to previous *ab-initio* simulations which find the higher symmetry body centered cubic, face centered cubic and primitive hexagonal structures to be the most stable structures over this pressure range. Our results demonstrate how dynamic compression can be utilized to test theoretical structure calculations at conditions inaccessible by static or shock compression techniques. This work was performed under the auspices of the US Department of Energy by Lawrence Livermore National Laboratory under Contract No. DE-AC52-07NA27344

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