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Magnetic frustration in a prototypical strongly correlated electron system DAVID FOBES, Los Alamos Natl Lab, NM, S.-Z. LIN, F. RONNING, E.D. BAUER, J.D. THOMPSON, M. JANOSCHEK, Los Alamos Natl Lab, N.J. GHIMIRE, Argonne Natl Lab, C.D. BATISTA, University of Tennessee, G. EHLERS, Oak Ridge Natl Lab, V. HUTANU, Heinz Maier-Leibnitz Zentrum, L. HARRIGER, NIST Center for Neutron Research, R. BEWLEY, ISIS Neutron and Muon Source — Near-degenerate ground states are a common theme in quantum materials, e.g. near a quantum critical point (QCP) emergent phases such as superconductivity (SC) typically compete with other ordered phases. Alternatively, frustrated magnetic interactions may result in degenerate magnetic configurations. In the heavy fermion material $CeRhIn_5$, in which SC emerges near a QCP, we additionally observe frustrated magnetic interactions. Utilizing the Axial Next-Nearest-Neighbor Ising (ANNNI) model, where uniaxial magnetic anisotropy can be induced via the application of magnetic fields, we have quantitatively reproduced the experimental temperature vs. magnetic field phase diagram and spin wave exception spectra. To reproduce this phase diagram we obtained the field-dependent exchange integrals and anisotropy-induced spin wave gaps via neutron spectroscopy and the ordered magnetic moment via hot-neutron-optimized neutron diffraction. An essential consequence of the ANNNI model are nearly-degenerate magnetic microphases near the magnetic ordering temperature, which we confirm via high-resolution neutron diffraction. These results suggest that a complete model of quantum criticality should include magnetic frustration.

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