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The Exponential Downfall of the Weak-Coupling SDW State in Chromium YEJUN FENG, Argonne National Lab, R. JARAMILLO, T.F. ROSENBAUM, Univ. of Chicago, J.C. LANG, Z. ISLAM, G. SRAJER, Argonne National Lab, P.B. LITTLEWOOD, Univ. of Cambridge — Elemental chromium is the archetypical model system for itinerant antiferromagnetism. The incommensurate spin density wave ground state, originating from the nested Fermi surface, is readily observable with direct scattering probes. Through a combination of low temperature cryogenic, diamond anvil cell, and synchrotron x-ray diffraction techniques, we measure directly the spin and charge order in the pure metal as it is driven towards its quantum critical point under pressure. We observe that both the spin and charge order are suppressed exponentially with pressure, well beyond the region where disorder cuts off such a simple evolution, and they maintain a harmonic scaling relationship over decades in scattering intensity. The observed exponential behavior of the order parameter follows a weak-coupling BCS theory for the ground state, even in the presence of strong pairing correlations that survive to surprisingly high temperatures and energies, as observed by inelastic scattering, transport, and thermal expansion measurements. This duality points to the fundamental issue of how mean-field behavior can describe so successfully important aspects of strongly coupled electron systems.

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