Abstract submitted to the
Conference on Concepts in Electron Correlation
September 24 - 30, 2008 Hvar, Croatia

Magnetism and Unconventional Superconductivity in Strongly Correlated $CeRhIn_5$ and $CeCoIn_5$[1]

J. D. Thompson
Los Alamos National Laboratory, Los Alamos, MN 87545 USA
Submitted : 04-17-2008
Keywords : unconventional superconductivty, quantum critical, $CeRhIn_5$, $CeCoIn_5$

Magnetism and evidence for a superconducting gap with d-wave symmetry occur simultaneously in both $CeRhIn_5$ and $CeCoIn_5$. In superconducting $CeCoIn_5$, coexisting magnetism is induced either by a magnetic field or by replacing a small number of In atoms by Cd. On the other hand, superconductivity is induced to coexist with antiferromagnetism by applying pressure to $CeRhIn_5$, and at sufficiently high pressures, where there is only superconductivity, a magnetic field induces coexisting magnetism again. The Śtunabilityŝ of these very pure materials is remarkable and has allowed progress in revealing the interplay among magnetism, quantum criticality and superconductivity. In spite of this progress, many questions remain unanswered, and these become apparent from a brief review of evidence for an unconventional superconducting gap and of relationships between magnetism and superconductivity in these materials. Perhaps, the most interesting open question is the nature of bosonic excitations involved in Cooper pairing. Growing evidence points to a magnetic origin and an enhanced susceptibility to a pairing instability near the quantum-critical regimes in these systems, but additional experiments, coupled with theoretical modeling, will be necessary to provide definitive answers.

[1] In collaboration with Tuson Park, R. Movshovich, V. A. Sidorov, Z. Fisk, L. Pham, N. J. Curro, R. R. Urbano, W. K. Park, L. H. Greene, A. Bianchi, M. Nicklas, O. Stockert and M. Kenzelmann