Title
Non-thermal lattice disorder in UCu_(5-x)Pd_(x)

Authors
Booth, C.H.
Bauer, E.D.
Maple, M.B.
et al.

Publication Date
2001-03-01

Abstract Submitted to the
International Conference on Strongly Correlated Electron Systems
University of Michigan, Ann Arbor
August 6-10, 2001

Non-thermal lattice disorder in $UCu_{5-x}Pd_x$

C.H. Booth[1], E. D. Bauer[2], M. B. Maple[2], R. Chau[3], G. H. Kwei[3]

[1] *Lawrence Berkeley National Laboratory, Berkeley, California, USA*
[2] *University of California, San Diego, USA*
[3] *Lawrence Livermore National Laboratory, Livermore, California, USA*

Although Pd/Cu site interchange in UCu_4Pd has been observed, the relationship between this disorder and the non-Fermi liquid (NFL) behavior remains unclear. Even within the simplest NFL model, namely the single-impurity Kondo disorder model (KDM), the measured site interchange is insufficient to explain the observed logarithmic divergences in the magnetic susceptibility. If lattice disorder is the sole microscopic origin of the NFL behavior, the KDM then requires that some other kind of local lattice disorder exist around the uranium sites. We have performed detailed, temperature-dependent x-ray absorption fine structure (XAFS) experiments on the $UCu_{5-x}Pd_x$ series ($x = 0-2.2$) at temperatures between $15-300$ K that determine the non-thermal contribution to the local bond distribution widths around the uranium, palladium and copper sites. All data fit a site-interchange model very well. The degree of site interchange is always above the nominal value. However, there appears to be relatively more site interchange in the NFL materials. Most importantly, the amount of non-thermal disorder in the nearest-neighbor U-Cu bonds is smaller than the amount estimated to be necessary within the KDM for all samples measured. These results are therefore strong evidence that, although lattice disorder appears to be important for generating NFL behavior, the KDM model does not contain all of the necessary physics. These results are, however, consistent with the Griffiths' phase models, either based on a quantum critical point or on Anderson localization.

Keywords : non-Fermi liquids, lattice disorder, XAFS

Submitted : March 1, 2001

Preferred presentation : oral [×]
poster [ ]

Corwin H. Booth
Lawrence Berkeley National Laboratory
MS 70A-1150
Berkeley, CA 94720
USA

Email: chbooth@lbl.gov
Tel: 510-486-6079
Fax: 510-486-5596