MAR09-2008-006986

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

ARPES Clues to the Hidden Order in URu_2Si_2[1]

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The three-dimensional electronic structure of UHV-cleaved URu_2Si_2 is investigated using photon-dependent angle-resolved photoemission (ARPES). Wide angle Fermi-surface (FS) maps as well as high-resolution spectroscopy focused on key high symmetry points reveal high U $5f$ spectral weight at the hole-like regions of the Γ and Z-points. The small hole-surface FS topologies have good size correspondence to dHvA FS orbit frequencies, but do not agree well with LDA band structure calculations. More favorable correspondence of the URu_2Si_2 ARPES is made to LDA+DMFT calculations as well as to detailed ARPES measurements of $5f^0$ $ThRu_2Si_2$. Special attention was given to spatial-dependent characterization of the cleave surface in order to understand the possible cleave terminations and to avoid surface effects related to disorder or non-bulk coordinated U-termination. Theoretical surface slab calculations assist in identifying surface-termination related features at the X-point. In addition, we propose a model for the incommensurate nesting vectors, 0.6a* and 1.4a*, observed by inelastic neutron scattering[3] to be characteristic of the hidden order phase of URu_2Si_2. Finally, preliminary ARPES results for $URu_{2-x}Re_xSi_2$ give a clue as to the mechanism by which Re doping suppresses the hidden order phase in favor of ferromagnetism.

[1]Supported by the U.S. DOE at the Advanced Light Source (DE-AC02-05CH11231), at UM (DE-FG02-07ER46379) and UCSD (FG02-04ER46105 & FG02-04ER46178), and by the NSF at UCSD (DMR08-02478).

[2]In collaboration with O. Krupin, B.J. Kim, R.S. Singh, F. Wang, J.W. Allen, K. Haule, J.H. Shim, G. Kotliar, J.L. Sarrao, N.P. Butch and M.B. Maple.

[3]C. Wiebe *et al.*, Nat Phys. **3**, 96 (2007)