

## Pu photoemission studies at LANL

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Results of Pu and Pu compounds photoemission studies performed within the last 2 years at MST-10 group at the Los Alamos National Laboratory will be presented. We will focus on  $\delta$ -Pu metal and the recently discovered, first Pu-based superconductor PuCoGa<sub>5</sub>.

The photoemission spectra of clean and ‘nearly’ clean delta phase Pu metal are shown in Fig. 1. The difference in valence band width results from the small amount of Pu oxide emission superpositioned on the clean metal signal in the case of the ‘nearly’ clean  $\delta$ -Pu spectrum. The binding energy and linewidth of the peak at the Fermi level is not influenced by the oxide contamination.

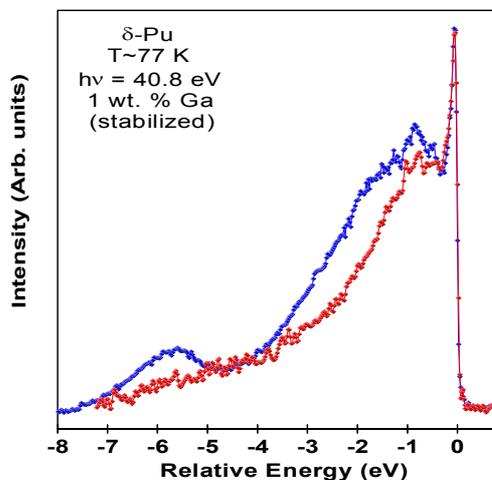


Fig. 1.  $\delta$ -Pu PES spectra. Blue line represents our data obtained in 1997 and often reproduced. Red line (lower curve) is the spectrum obtained in December 2001, with residual oxides completely removed.

It took numerous samples and adjustments in the laser ablation cleaning to progress from nearly clean to clean  $\delta$ -Pu. The role of impurities was initially not clear and hampered the understanding of the electronic properties of delta phase Pu metal. Comparison of the clean  $\delta$ -Pu photoemission spectrum and a mixed level model (MLM)

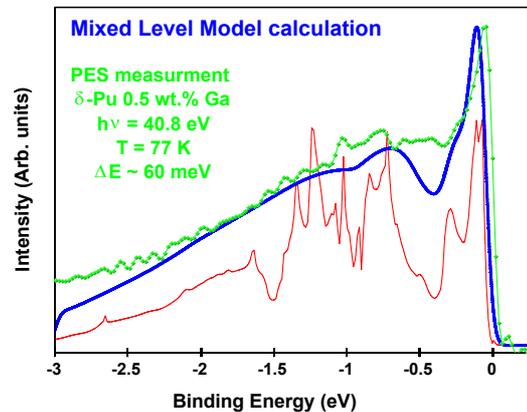


Fig. 2. The ‘‘cleanest-ever’’  $\delta$ -Pu PES spectrum (dots and line) compared with MLM calculation (lines).

Calculation with appropriate broadenings is shown in Fig. 2. The calculation shows good agreement though the peak at EF is shifted by 50 meV in the calculation compared to experiment.

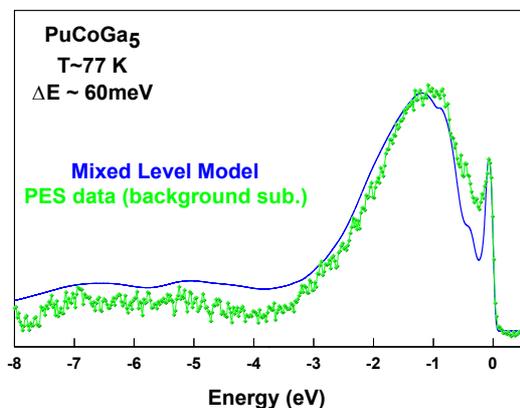


Fig. 3. Comparison of MLM calculation with PES spectrum for PuCoGa<sub>5</sub>.

In Fig 3 we show the MLM calculation compared with PES for PuCoGa<sub>5</sub>. Both for  $\delta$ -Pu and PuCoGa<sub>5</sub> the MLM assumes four out of five 5f electrons to be localized. From the photon energy dependence it appears that the 5f feature near the Fermi level in PuCoGa<sub>5</sub> is hybridized with conduction electrons while the main 5f manifold indicates localized 5f characteristics.