



Contribution ID: 40

Type: Poster Presentation

# $\text{Ce}_{1-x}\text{La}_x\text{Cu}_4\text{Al}$ as a case study for the investigation of Ce $4f$ wave function evolution from a coherent to a local Kondo effect

Tuesday, 5 July 2016 16:10 (1h 50m)

**Abstract content** (Max 300 words) **Formatting** **Special chars**

$\text{CeCu}_4\text{Al}$  is a heavy fermion system as well as a dense Kondo lattice, where long-range antiferromagnetic correlations emerge as a result of the strong hybridization between the Ce  $4f$  and conduction electrons. The gradual replacement of Ce by La in the diluted series  $\text{Ce}_{1-x}\text{La}_x\text{Cu}_4\text{Al}$  leads to an increase of the lattice parameters due to the larger ionic radius of La, which results in the gradual decrease of the Ce  $4f$  hybridization strength. Consequently, the Kondo exchange coupling goes from being fully coherent towards a local/incoherent on-site effect as the La content increases.

We have used  $\text{Ce}_{1-x}\text{La}_x\text{Cu}_4\text{Al}$  as a case study for the investigation of the changes in the electronic structure during the coherent-to-incoherent transition of the character of the Ce  $4f$  wave function. We have exploited synchrotron-based x-ray absorption and (resonant) photoemission spectroscopies as ideal probing tools of the dual character of the  $4f$  electrons and the extent of the  $4f$  hybridization.

Among other findings, our results show that, while the incoherent part of the Ce  $4f$  wave function is virtually unmodified throughout the series, the effect of La doping is to suppress the coherent Kondo resonance peak at the Fermi level, as well as to shift both the Kondo resonance peak and its spin-orbit counterpart towards the Fermi level. This is in agreement with the trend found in thermoelectric power measurements, and provides the electronic structure fingerprint of the effects of the fine-tuning of the  $4f$  electron hybridization on the Kondo lattice properties in this series of diluted alloys.

**Apply to be considered for a student award (Yes / No)?**

No

**Level for award (Hons, MSc, PhD, N/A)?**

N/A

**Main supervisor (name and email) and his / her institution**

N/A

**Would you like to <br> submit a short paper <br> for the Conference <br> Proceedings (Yes / No)?**

Yes

**Please indicate whether<br>this abstract may be<br>published online<br>(Yes / No)**

Yes

**Primary author:** Dr CARLESCHI, Emanuela (Department of Physics, University of Johannesburg, PO Box 524, Auckland Park 2006, South Africa)

**Co-authors:** Prof. KOWALCZYK, Andrzej (Institute of Molecular Physics, Polish Academy of Sciences, Smoluchowskiego 17, 60-179 Poznan, Poland); Dr DOYLE, Bryan (Department of Physics, University of Johannesburg, PO Box 524, Auckland Park 2006, South Africa); Dr MAGNANO, Elena (IOM-CNR Laboratorio TASC, S.S. 14 km 163.5, Area Science Park, 34012 Basovizza (TS), Italy; Department of Physics, University of Johannesburg, PO Box 524, Auckland Park 2006, South Africa); Dr FALKOWSKI, Michal (Institute of Molecular Physics, Polish Academy of Sciences, Smoluchowskiego 17, 60-179 Poznan, Poland); Dr NAPPINI, Silvia (IOM-CNR Laboratorio TASC, S.S. 14 km 163.5, Area Science Park, 34012 Basovizza (TS), Italy)

**Presenter:** Dr CARLESCHI, Emanuela (Department of Physics, University of Johannesburg, PO Box 524, Auckland Park 2006, South Africa)

**Session Classification:** Poster Session (1)

**Track Classification:** Track A - Division for Physics of Condensed Matter and Materials