ESRF	**Experiment title:** Study of Local Lattice and Electronic Correlations in Laves Phase La1-xCexRu2	**Experiment number**: HS1656
Beamline: BM29	**Date of experiment**: from: 26 September 2001 to: 29 September 2001	**Date of report**: 29.08.02
Shifts: 9	**Local contact(s)**: Michael BOROWSKI	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

Stefano Agrestini

*Naurang L. Saini

Antonio Bianconi

*Daniele Di Castro

*Valerio Scagnoli

*Matteo Filippi

Report:

The work was aimed to explore the role of local atomic displacement and local density of states in the anomalies of superconducting and normal state properties, as a function of Ce substitution, in the $La_{1-x}Ce_xRu_2$ system by high resolution Ru K-edge absorption measurements. During the assigned beamtime, we could measure high resolution Ru K-edge XANES and EXAFS on powder sample of the $La_{1-x}Ce_xRu_2$ system at eight different Ce concentraion using using 13 element fluorescence detector at variable temperature between 15-300 K. The emphasis was to obtain the EXAFS data with high signal to noise ratio and several scans were collected to limit the noise level to the order of 10^{-4} in order to pin point small displacements which could enlighten the role of local electron-lattice interaction in the superconductivity of these short coherence length superconductors. In this study we focussed on high Ce concentration regime to investigate the origin of anomalous T_c dependenece on the Ce concentarion..

Standard procedure was used to extract the EXAFS signal and corrected for the x-ray fluorescence self-absorption before the analysis. Fig. 1 shows the Fourier transforms (FT) of the EXAFS spectrum measured at representative Ce concentrations. The Ru K-edge EXAFS data provide a clear evidence of an intimate relationship between the local lattice displacements aound the Ru atoms and the superconducting transition

tempeture. This relationship is clear from the raw data itself as shown in Fig. 2 where we have plotted the FT peak intensity as a function of Ce concentration. We have also shown the T_c of the studied system as a function of Ce concentration (Fig. 2) revealing similar dependence as the local structure around the high Ce concentration. The EXAFS results are found to be consistent with qualitative change observed in the local gemetry of system, measured by XANES. Detailed analysis of the XANES and EXAFS data and interpretation of the anomalous behavior of the local lattice displacements are to be communicated for publication.

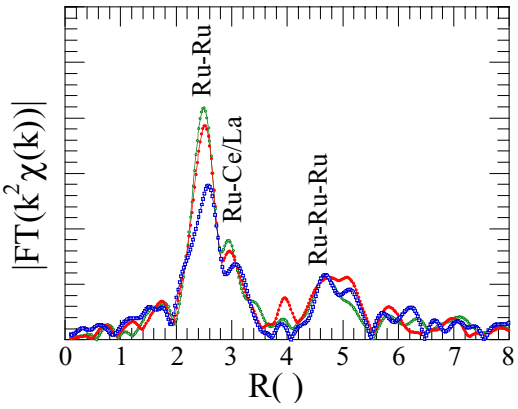

Fig. 1. Magnitude of the Fourier transforms of the Ru K-edge EXAFS spectra measured on the samples with variable Ce concentration; Ce=1.0 (green), Ce=0.8 (red) and Ce=0.25 (blue).

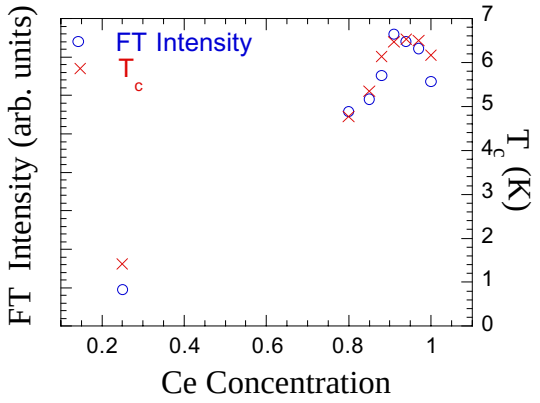

Fig. 2. FT Intensity of the Ru-Ru shell, as function of Ce concentration, in the $La_{1-x}Ce_xRu_2$ system (blue circles). The Tc is shown by red crosses revealing an intimate relationship between the two.

It should be mentioned that the *$CeRu_2$* is a small coherence length .superconductor with strong eelectron-phonon coupling. Indeed, the present results provide a clear way to undestand the low T_c superconductivity with strong coupling, as the pairing seems to be local. In fact, even though there is a strong coupling, the pairing is largly influenced by the local lattice displacements, and hence the low T_c. The present work uncover the fact that the local structure plays a key role in the superconductivity of this intermetallic superconductor.

Due to insufficient time, the measurements were performed only at at variable Ce concentration focussing on the Tc anolaly near the high Ce concentration. The temperature dependent measurements were performed only on the stochiometric $CeRu_2$ compound. The measurements as a function of temperature at different Ce concentrations are due to attain the objectives of the propsed work and to explore the interplay between electronic, magnetic and lattice degrees of freedoms responsible for the anomalous superconductivity in the title system.