ESRF	**Experiment title:** Electronic excitations in heavy fermion compounds : $CeRu_2Si_2$, a case study**.**	**Experiment number**: HE-688
Beamline: ID 16	**Date of experiment**: from: 17/9/99 to: 26/9/99	**Date of report**: 08/02/2000
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Names and affiliations of applicants (* indicates experimentalists):

Stéphane Raymond, University of Geneva, DPMC, Genève (Suisse)

Jean-Pascal Rueff, ESRF, Grenoble

Jacques Flouquet, CEA-Grenoble, DRFMC/SPSMS, Grenoble

Pascal Lejay, CNRS-CRTBT, Grenoble

Report:

Among strongly correlated electron systems, heavy fermion compounds [1] exhibit, below their coherence temperature T*, a Fermi liquid behavior with strongly renormalized effective masses m* (m*/m=100-1000, m being the free electron mass). This is well established from a phenomenological point of view with the resistivity being in AT^2, the specific heat in γT and a constant Pauli susceptibility χ_0 with large values of A, γ and χ_0. From a microscopic point of view, it is mainly the observation of de Haas van Alphen oscillations that prove the existence of a Fermi surface with large electron masses. Furthermore, anomalies in the phonon spectra due to electron-phonon coupling, such as broadening of the phonon lineshape and/or softening of the acoustic longitudinal mode are expected when approaching the transition temperature to the Fermi liquid state. For such a study, $CeRu_2Si_2$ is a good candidate being one of the most studied compound [2].

Longitudinal acoustic mode have been measured in the heavy fermion compound $CeRu_2Si_2$ by inelastic x-ray scattering (IXS) on ID 16 at ESRF at temperatures between 300 K and 10 K. The measurements were performed with a resolution of 2.5 meV achieved thanks to the extreme backscattering geometry of the spectrometer. A 100-microns thick

single-crystal of $CeRu_2Si_2$ used in the experiment was mounted in a He cryostat so that the **Q**-vector was oriented along the [100] direction. A typical IXS spectrum is represented on figure 1 (left panel). A well defined phonon peak can be identified about 10 meV above the elastic peak. A series of IXS spectra were measured over a Q-range of about 10 nm^{-1}. All the spectra were then fitted using a DHO model by usual least-square technique. The resulting phonon dispersion curves are shown on the right panel of figure 1 at two different temperatures.

Anomalous lattice effect has previously been observed at low temperature in this system, both in the Kondo regime around 20 K and in the Fermi liquid state below 2 K. Here, no clear indications of a broadening/softening have been found in the 10 K IXS spectra; however, the well-resolved phonon peaks observed in the present experiment, even at 10 K, give the possibility to investigate further down in temperature the Fermi liquid state in this system. Furthermore, this investigation of the dynamical structure factor in strongly absorbing materials opens up a new field of research dedicated to strongly correlated electron systems in inelastic x-ray scattering, constrained so far to light systems mostly.

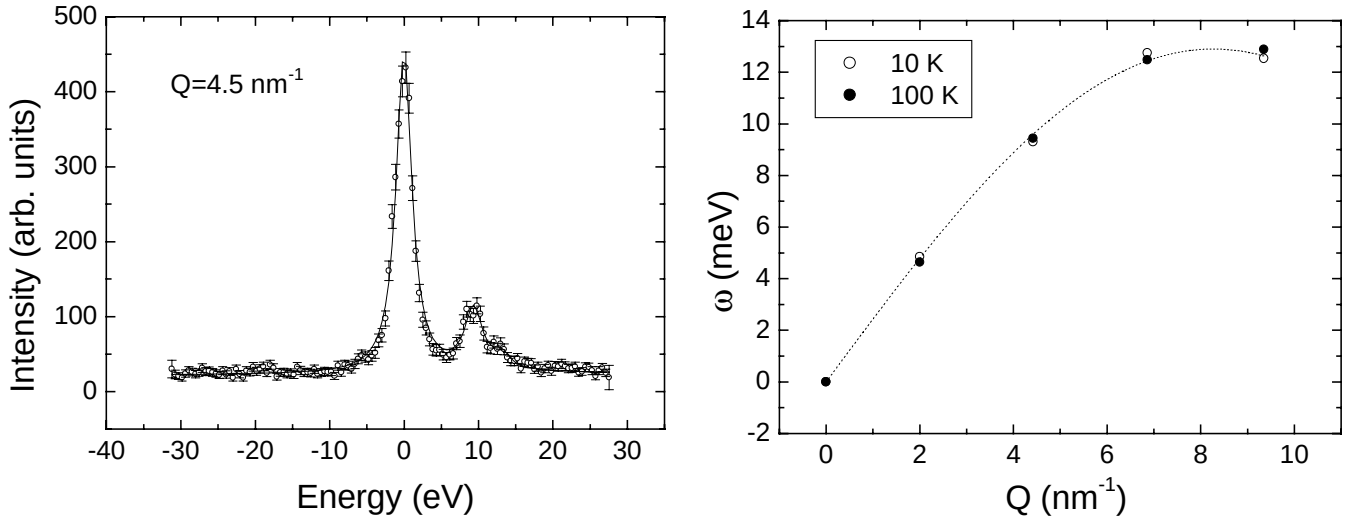

Figure 1 :Left panel : typical IXS spectra at 10 K (○) in $CeRu_2Si_2$; the DHO fit to the data is also shown (solid line). Right panel : phonon dispersion curves at 10 K and 100 K. The dashed line is a guide to the eyes.

[1] For a simple introduction, see Z. Fisk et al., Nature 320 (1986) 124.

[2] For a review on the compound, see J. Flouquet et al., Physica B 215 (1995) 77.