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| ESRF | **Experiment title:**<br>Hypersatellite Emission Spectra of Medium- Z Hollow Atoms | **Experiment number**:<br>HE-908 |
| **Beamline**:<br>ID15B | **Date of experiment**:<br>from: 26 January 2001 to: 6 February 2001 | **Date of report**:<br>18 April 2001 |
| **Shifts:**<br>21 | **Local contact(s)**:<br>Veijo Honkimaki | *Received at ESRF:* |

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**Report:**

As a part of a comprehensive research on hypersatellites emission lines, done at ESRF and NSLS, we measured during this run the $K^h\alpha_{1,2}$ hypersatellite spectra of several elements in the medium-Z range. These spectra are important for studying the variations of the atomic coupling schemes with Z, intra-shell electronic corralations, the Breit interaction and quantum-electrodynamic corrections to the atomic structure. At this Z regime the hypersatellites are practically sitting on the tails of the diagram lines, as shown in Fig. 1. Being able to measure both, the diagram and hypersatellite lines with the same setup, allows us to measure accurately the relative cross sections of these spectra.

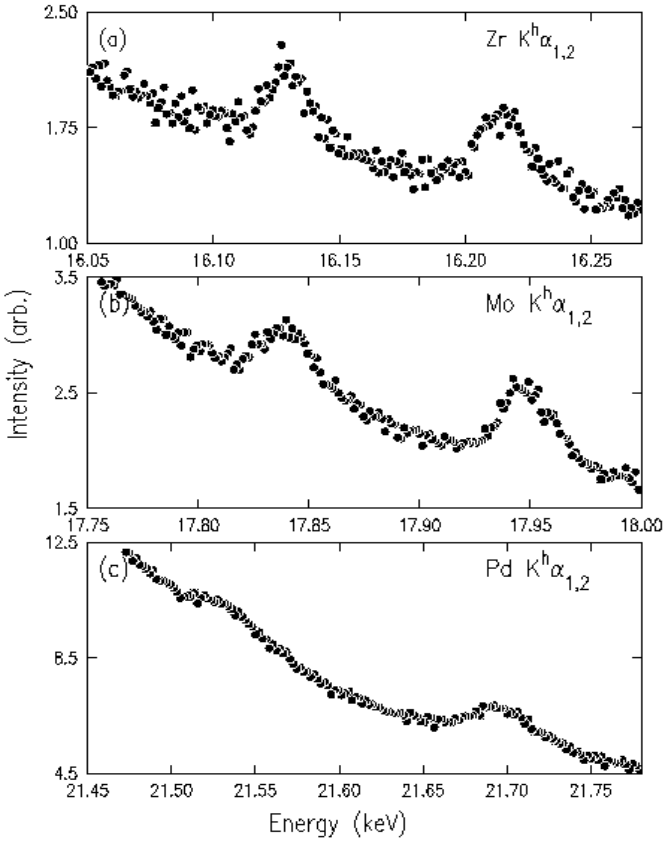


Fig. 1 : Raw measured hypersatellite spectra.

Three of the elements that were measured during this run are shown in Fig1: (a) Zirconium, (b) Molybdenium and (c) Palladium $K^h\alpha_{1,2}$ hypersatellites lines sitting on the slope of their Kα diagram lines. The data is now being analyzed to obtain the lines intensity ratio, splittings and shifts from the diagram lines. These quantities depend sensitively on the effects discussed above and allow their study. After subtracting the diagram line to get the pure hypersatellite spectrum we can compare the various spectra. The phenomenological parameters determind from the measured data agree well with the theoretical predictions obtained by us using *ab-initio* ralativistic Dirac-Fock calculations. In Fig.2 one can clearly see the increase in splitting with Z. When corrected for the variation of crystal reflectivity, resolution etc. with incident energy, the variation of the intensity ratio of the two lines $K^h\alpha_1$/ $K^h\alpha_2$ , yields information on the level of intermediacy of the coupling prevailing for these elements. Such an analysis is now in progress.

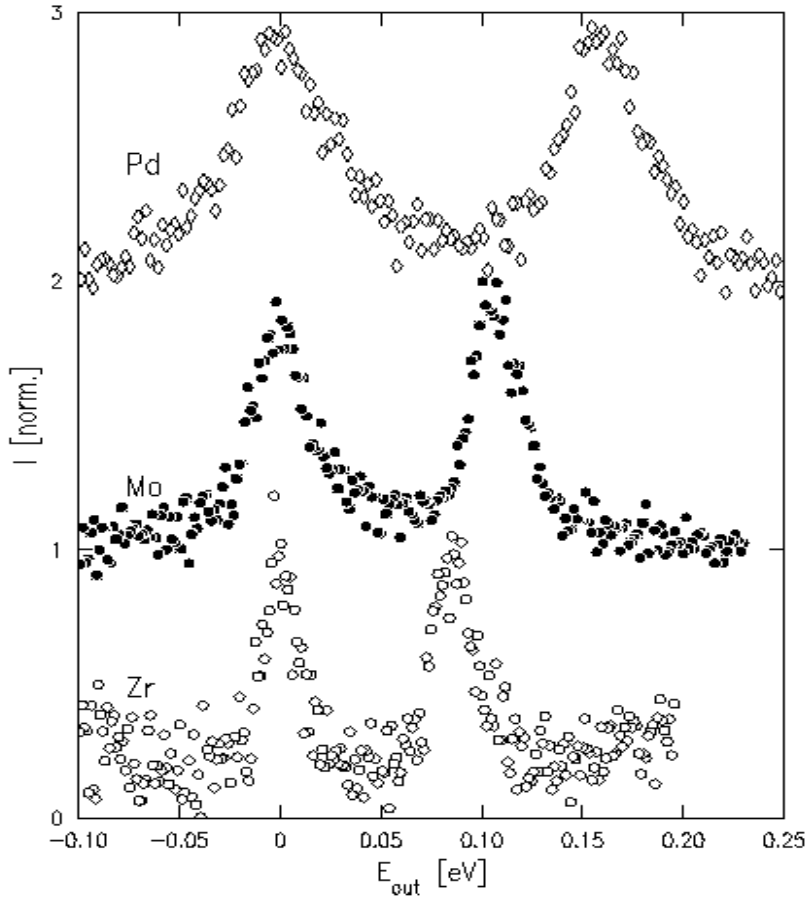


Fig. 2 : Background-subtracted, but otherwise uncorrected Kα hypersatellite spectra of the indicated elements.