	Experiment title: Iron-partial lattice dynamics in amorphous and quasicrystalline Al-Cu-Fe films	**Experiment number**: HS 2080
Beamline: ID18	**Date of experiment**: from: to:	**Date of report**: 3/2/2004
Shifts: 9	**Local contact(s)**: Dr. Aleksandr CHUMAKOV	*Received at ESRF:*

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Report:

For this experiment, we studied a free-standing sample of $Al_{62}Cu_{25.5}Fe_{12.5}$, using inelastic nuclear-resonant absorption. The sample was prepared in Chemnitz using evaporation on a Si wafer substrate at room temperature. To improve the film continuity, thick layers of AlCuFe were separated by thin Al_2O_3 layers, also produced by evaporation. The resulting composite film was thick enough to be peeled off of the wafer. This sample was produced from a sample containing pure ^{57}Fe, and was used both for this experiment and for a parallel one using inelastic x-ray scattering (HS2211). The results are compared to those previously obtained for quasicrystalline (QC) i-$Al_{62}Cu_{25.5}Fe_{12.5}$, which we previously obtained. We measured the static structure factor of the amorphous sample both on the instrument (channel plate detector) and using electron diffraction (thanks to Marc Audier, INPG Grenoble, for these studies). We showed that the film from Chemnitz is truly in an amorphous state, and that the static structure factor shows maxima at the same Q values as important reflections of the quasicrystal. Thus the amorphous structure has a similar local order as the quasicrystalline one.

The sample was studied at room temperature in the inelastic sample holder of ID18. The resulting iron-partial vibrational density of states g(E) is shown in the upper panel of the figure, as compared to those for the QC previously (at exactly the same composition). There is very little difference between the amorphous (a-) and the QC states (i-). The single maximum is at the same energy, contrary to that which we found for the x-ray-weighted g(E) (HS2211). In the lower panel we show $g(E)/E^2$ vs. E^2. This plot is chosen to emphasise any low energy deviation from a Debye law (which would be a constant). We see a slightly larger deviation for the amorphous state than for the QC one, but both much smaller than those

found for the x-ray-weighted g(E). It is quite surprising, that the almost Debye-like behaviour of the vibrational DOS at iron is obtained not only in the QC state, but in the amorphous state as well.