ESRF	**Experiment title:** Inelastic X-ray scattering of ice VII in a diamond anvil Cell.	**Experiment number**: HS-995
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Report:

We have performed inelastic x-ray scattering on a single-crystal of ice VII at 2.6 GPa. The single-crystal of ice VII was grown in a diamond anvil cell that has a large x-ray aperture (use of boron seats to support the diamond anvil). This large x-ray aperture was needed: - to determine the orientation matrix of the crystal, on ID30. - to perform inelastic scattering for large momentum transfer. Large diamond culets, 800 µm in diameter, were used in order to have an unusually large sample for a DAC study: 300 µm in diameter and 150 µm thick. The inelastic scattering was carried out on ID28. The spectra for five constant momentum transfers and as a function of energy were measured in parallel with five analyzers. The measurements were performed using the silicon (9,9,9) reflection order with 3 meV energy resolution. Spectra corresponding to momentum transfer of 40 nm^{-1} were collected in order to be in the second Brillouin zone and therefore to have the correct polarization selection rule to observe the transverse phonon mode.

The essential data are summarised in the figure below: - In figure 1, it is clearly seen that the longitudinal and transverse modes can be clearly measured (6 shifts of accumulation were needed). - In figure 2, the dispersion curve at 2.6 GPa is presented. The longitudinal and transverse sound velocities along the 100 direction, V_{LA}=4660 m/s and V_{TA}=3820m/s are in reasonable agreement with a previous Brillouin scattering experiment (7% discrepancy) but the present data should be more accurate. - In figure 3, the dispersion along the 111 branch is

presented. The thermal effect up to melting on the higher momentum transfer part of this branch has been also studied. A very small temperature effect is observed on the cusp. That rules out a possible L_{111} phonon instability associated to melting.

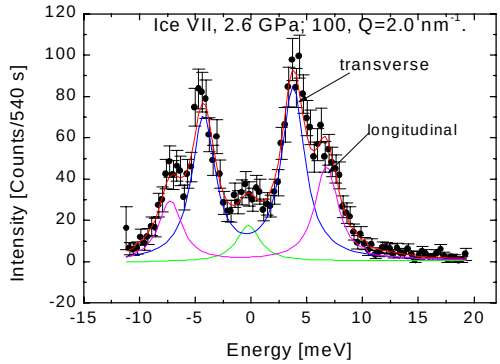

Figure 1: INXS spectra of a single crystal of ice VII at 2.6 GPa. The data are collected in the second Brillouin zone, hence longitudinal and transverse phonons are clearly observed.

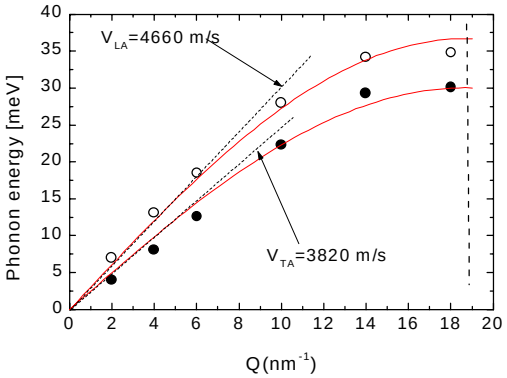

Figure 2: Dispersion curve of the 100 branch of ice VII at 2.6 GPa.

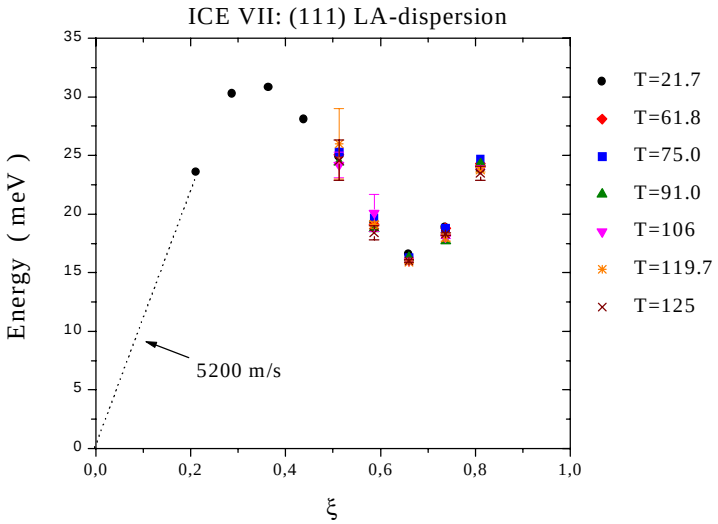

Figure 3: The 111 branch of ice VII at 2.6 GPa. A very small change with temperature is observed.