Pressure evolution of the high-frequency sound velocity in liquid water

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Inelastic x-ray scattering (IXS) results on the high-frequency sound velocity, v_∞, in liquid water are reported to pressures of 2.7 GPa [1]. Comparison with results on the zero-frequency sound velocity, v_0, reveals a significantly weaker pressure dependence of v_∞. Moreover, we observe an anomaly in the density dependence of v_∞ at densities around ρ=1.12 g/cm^3. Based on the interpretation of previous IXS experiments [2], our results indicate the decreasing role of the hydrogen-bond network in the high-frequency dynamics of water, and the evolution of water from an associated to a simple liquid.
Besides the results on liquid water, the present state and the perspectives for IXS studies of disordered systems under high pressure shall be discussed.

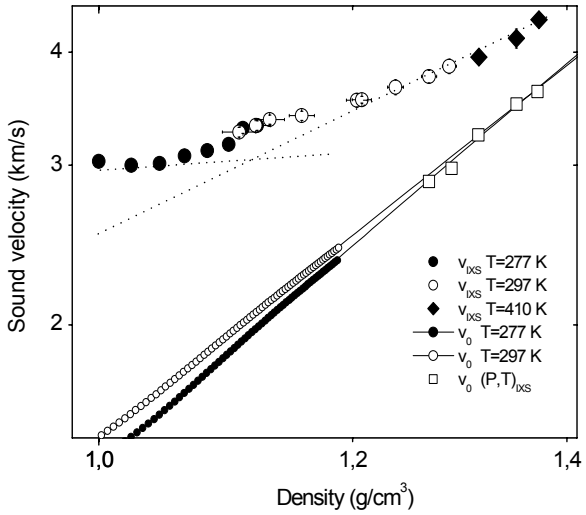

Figure 1: Density dependence of v_∞ (v_{IXS}) on a logarithmic scale. The density evolution of v_0 at 277 K and 297 K was obtained from the water equation of state [3]. The solid lines show their extrapolation to higher densities where water would freeze. The squares indicate the value of v_0 at the P,T points of the IXS experiment. The two dotted lines emphasize the different low and high-density behaviours of v_∞.

References

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