



ESRF

Experiment title:

STUDY OF COLLECTIVE EXCITATIONS
IN WATER ---
--- AND ICEExperiment
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30

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Transition from *Normal* to *Fast* Sound in Liquid Water

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Inelastic x-ray scattering data from water at 5°C show a variation of the velocity of sound from 2000 to 3200 m/s in the momentum transfer range 1–4 nm⁻¹. The transition occurs when, at ≈4 meV, the energy of the sound excitations equals that of a second weakly dispersing mode. This mode is reminiscent of a phonon branch in ice Ih crystals, which is shown here to be of optical transverse character. The present work accounts for most of the highly debated difference between hydrodynamic (≈1500 m/s) and high-frequency (≈3200 m/s) velocities of sound in water. [S0031-9007(96)00500-51

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