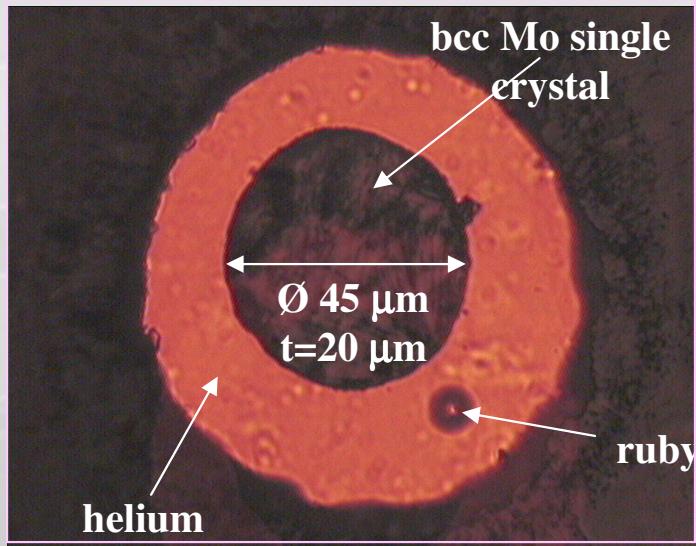
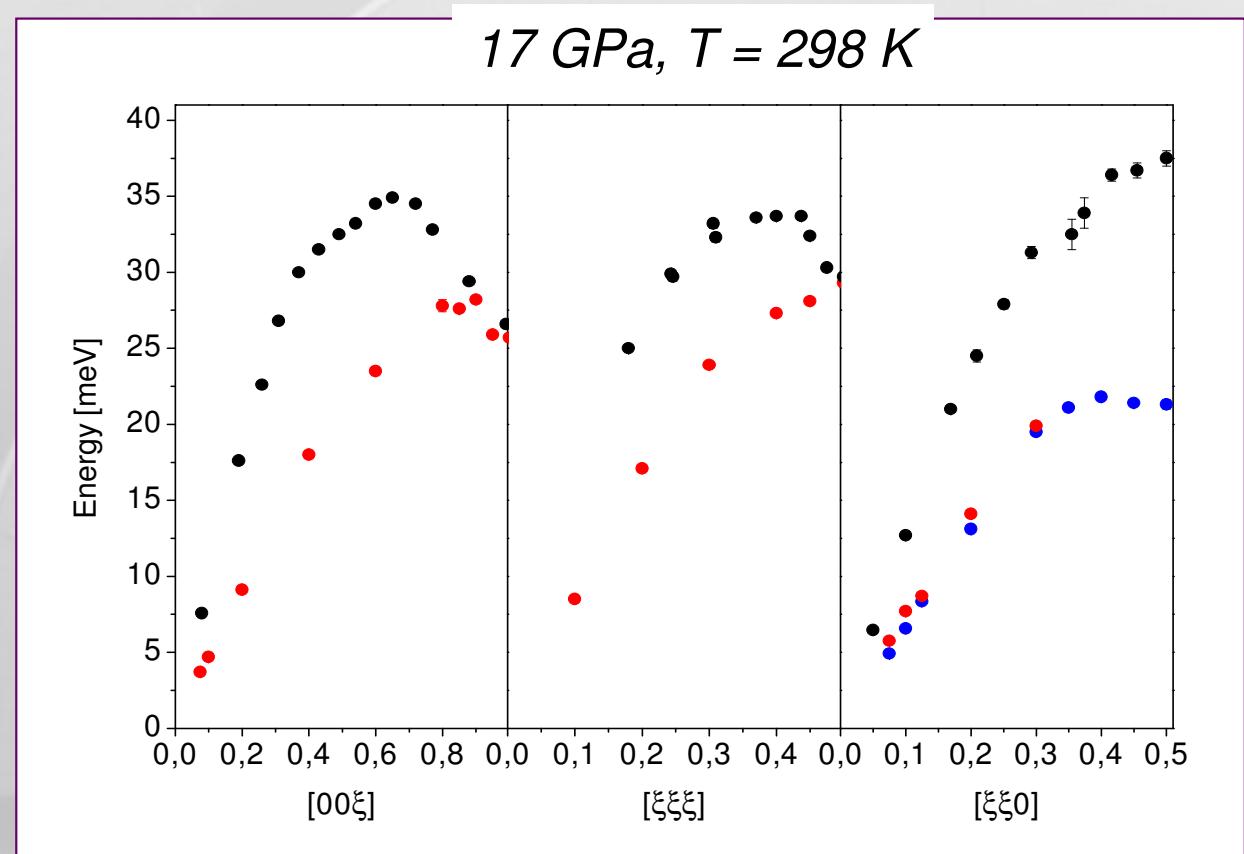


Phonon dispersion of Molybdenum

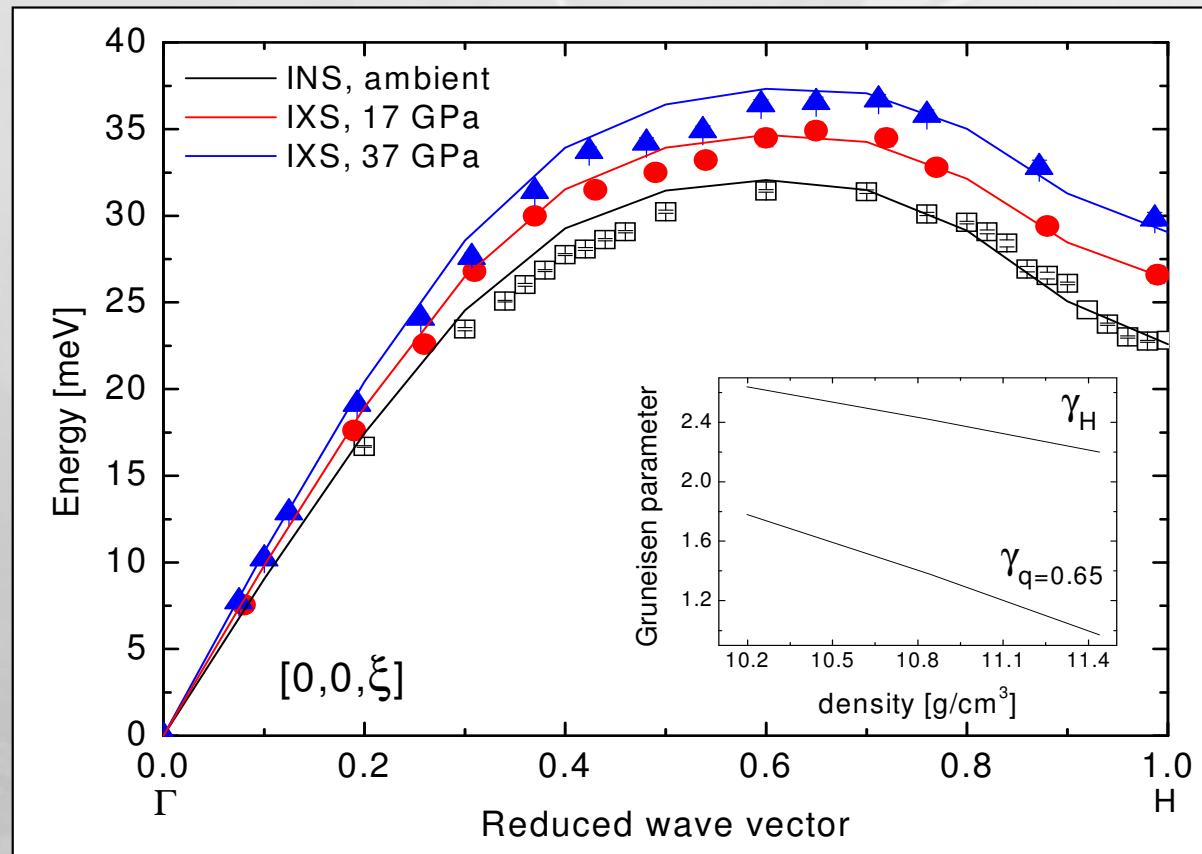


Rocking curve width:
0.1 – 0.3 degrees



Origin of H-point anomaly?

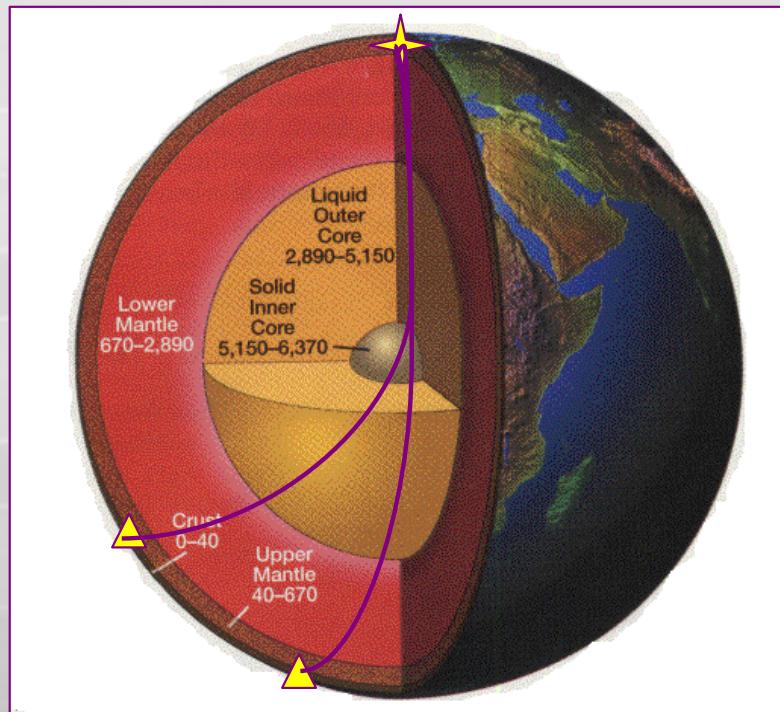
Pressure evolution of the H-point anomaly: experiment and theory



Gradual disappearance of H-point anomaly

- reduced electron-phonon coupling
- shift of Fermi level with respect to p-like bands

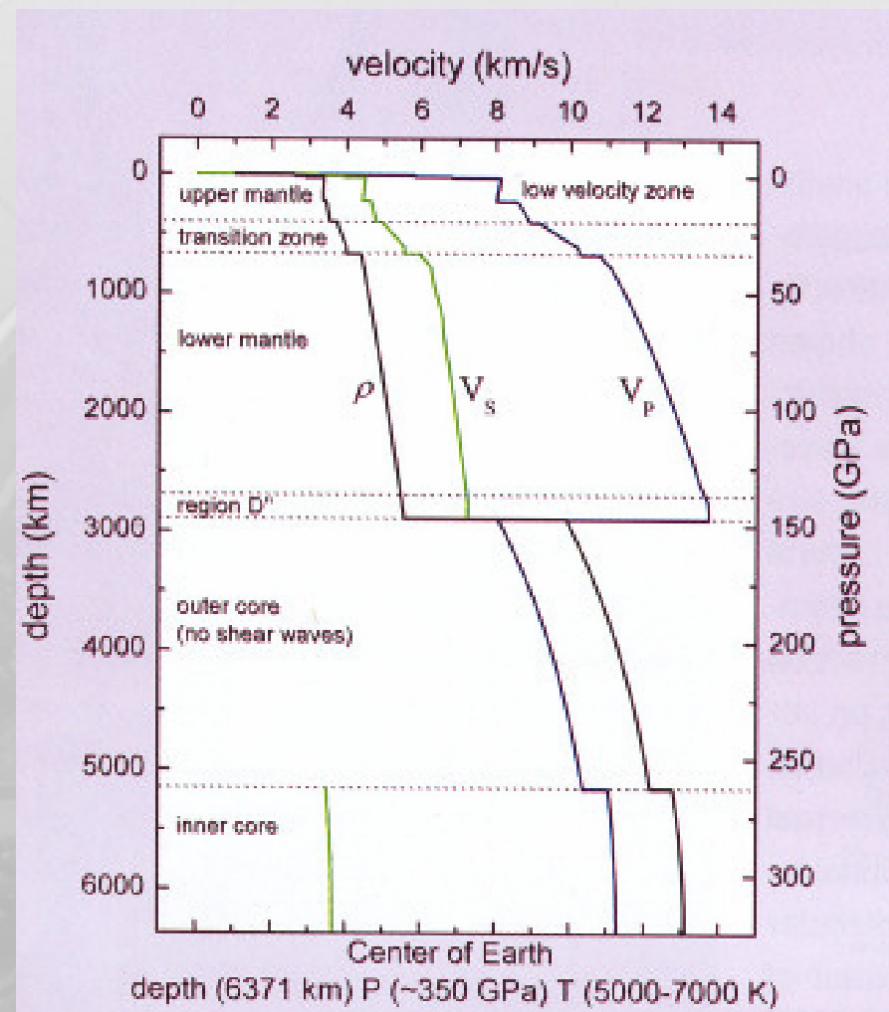
IXS in Earth science



- Seismology (+ mineral physics)
- Geochemistry (+ petrology)

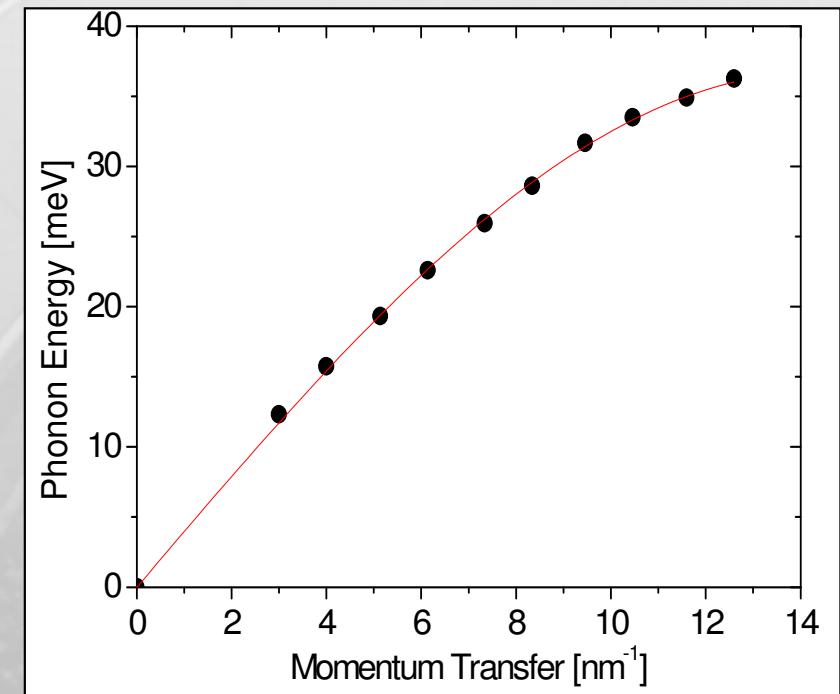
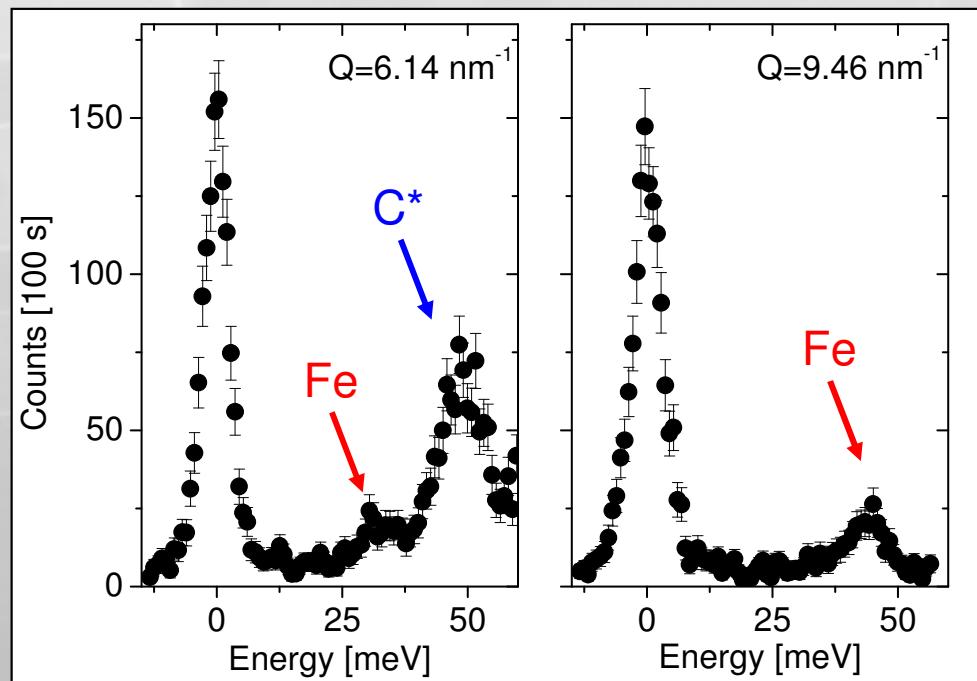
- density and elasticity
- partitioning and solubility

The preliminary reference Earth model (PREM)



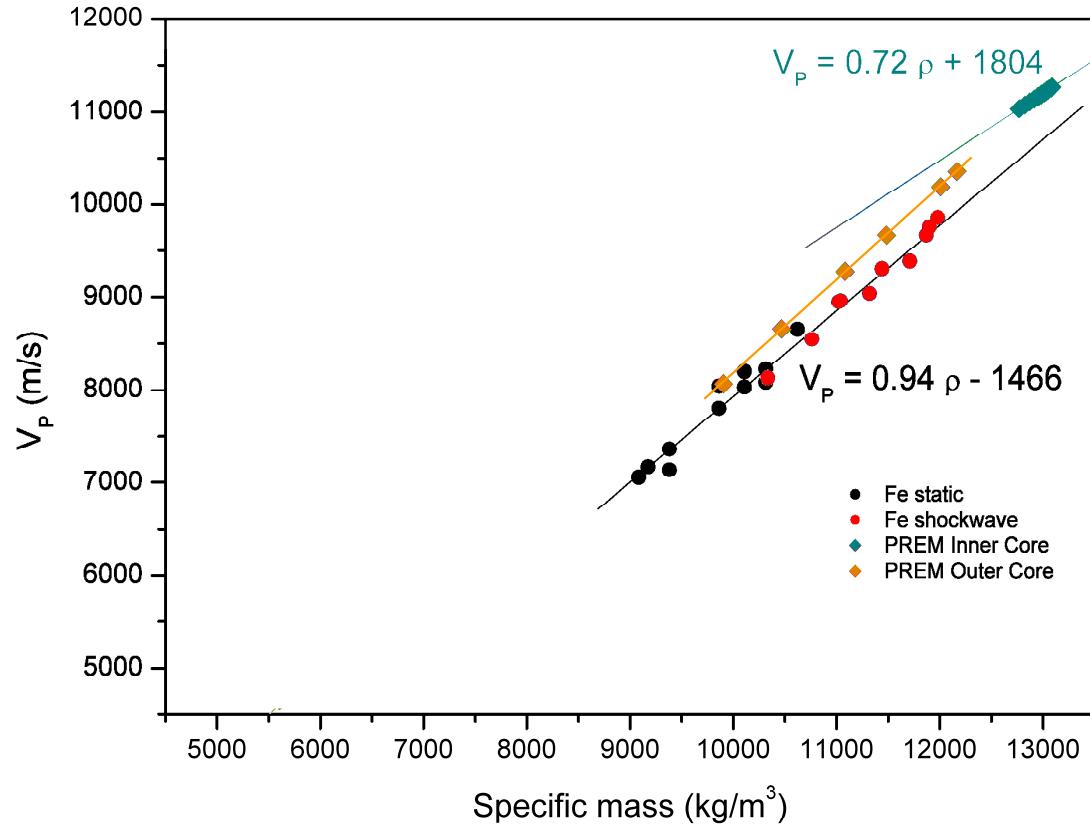
hcp iron: Raw spectra and phonon dispersion

P = 55 GPa



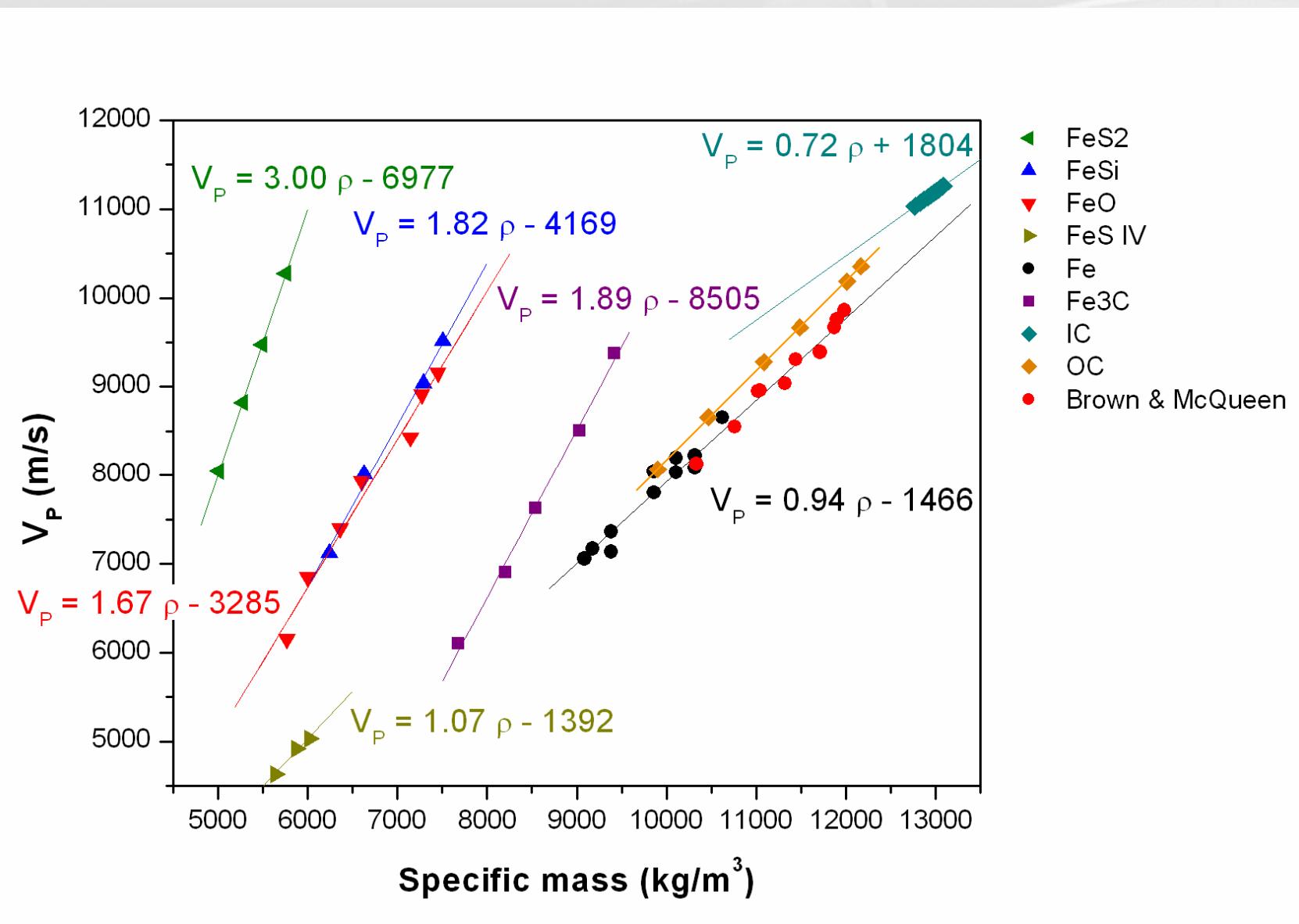
V_p from initial slope of dispersion curve via sine fit

Sound Velocities in the Core



- Linear dependence of V_p (ρ): Birch law
- Inclusion of light elements needed!

Sound Velocities in the Core



Simple composite model

$$\left\{ \begin{array}{l} \rho = (1-x)\rho_{Fe} + x\rho_{le} = \rho_{seismic} \\ \\ V = \frac{V_{Fe} \cdot V_{le}}{(1-x)V_{le} + xV_{Fe}} = V_{seismic} \end{array} \right.$$

Proposed composition of the core

Element	Fraction (wt%)	Compression (ρ/ρ_0)	Model Inner Core (wt%)	Model Outer Core (wt%)
Si	2.3	1.28	2.3	2.8
O	1.6	1.33	minor	5.3
S ²⁻	9.7	2.51	minor	minor
S ⁻	3.6	1.05	minor	minor
C	1.0	1.40	1.0	—

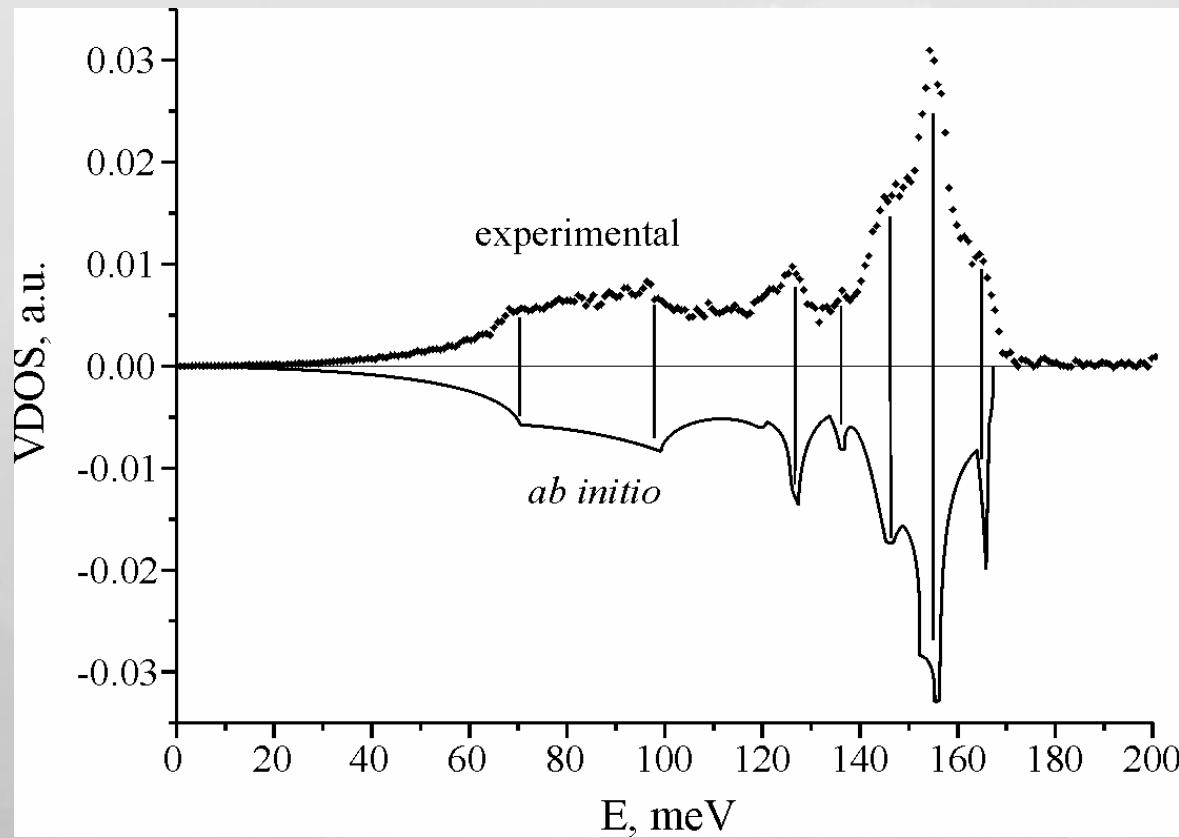
Determination of the phonon density of states

- Incoherent inelastic neutron scattering
 - sample volume: 10^{-4} mm^3
 - $f(Q)$ versus b
- Nuclear inelastic scattering
 - no need of Mössbauer isotope

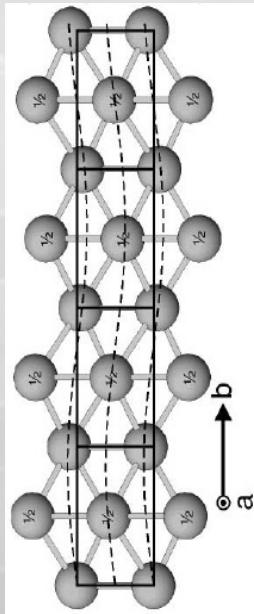
Prerequisites

- Uniform sampling of the Brillouin zone
- Mutual annihilation of “selection rule”-terms

Test case: polycrystalline diamond



- $\Delta E = 3 \text{ meV}$
- Sum of 10 IXS spectra ($45 \text{ nm}^{-1} < Q < 60 \text{ nm}^{-1}$)



... and first applications

