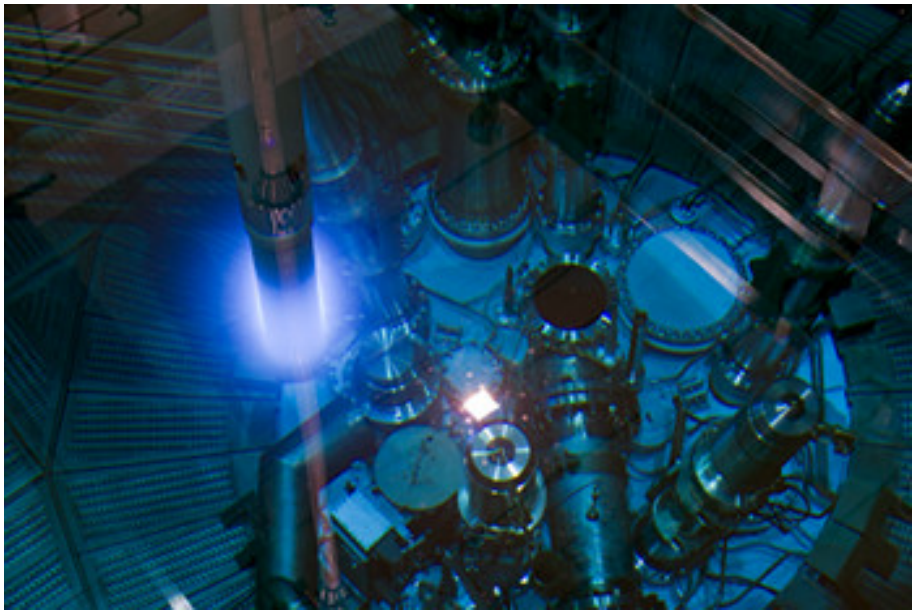
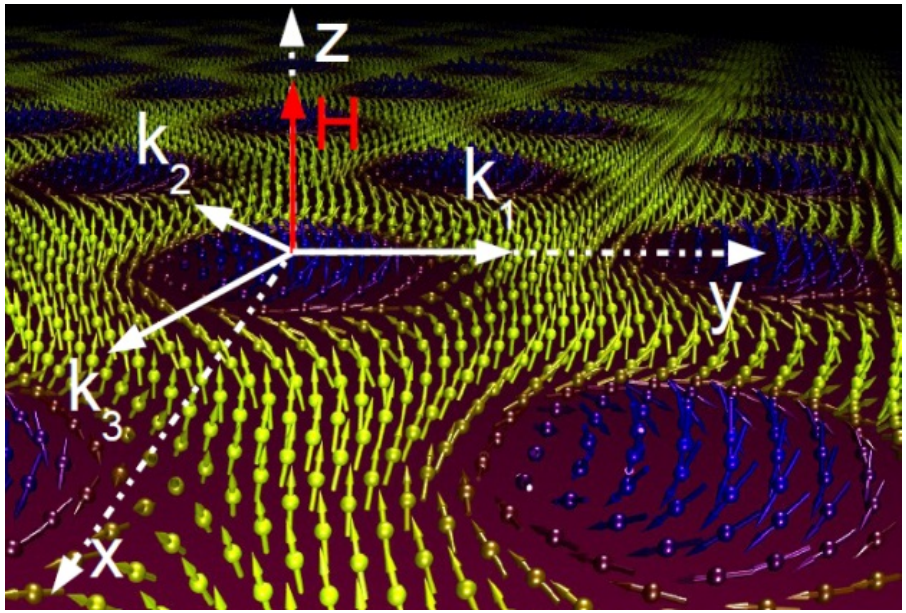
Physics with Neutrons I, WS 2015/2016





Lecture 9, 14.12.2015

Organization

Visit FRM II : 21.12.2015

10:15 – 13:00 (after the lecture)

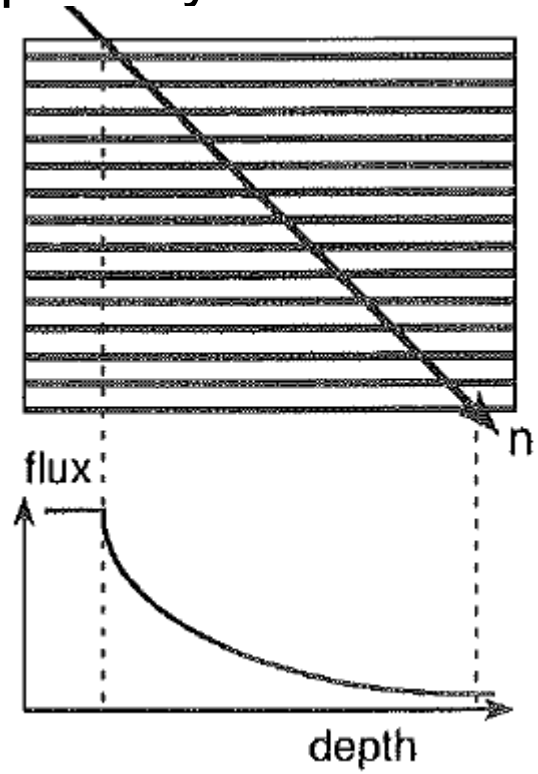
Valid ID necessary!!!

Exam (after winter term)

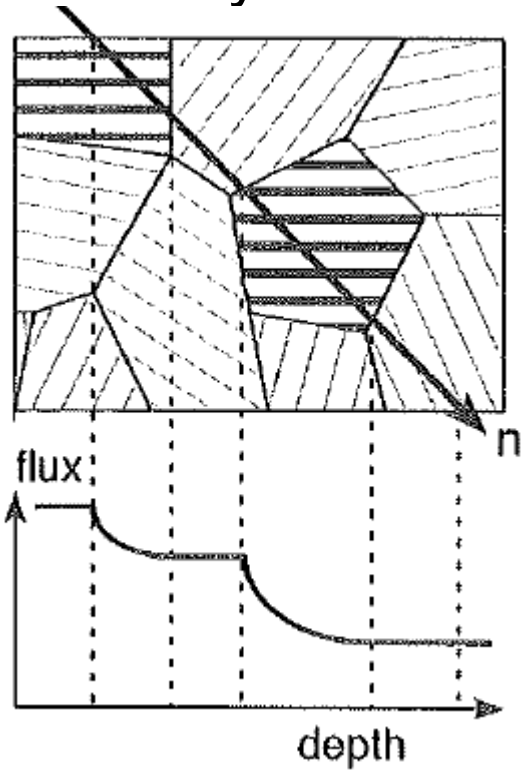
- Registration: via TUM-Online between 16.11.2015 – 15.1.2015
- Email: sebastian.muehlbauer@frm2.tum.de for date arrangement
- 30min oral exam

4 Diffraction: Absorption and Extinction Correction

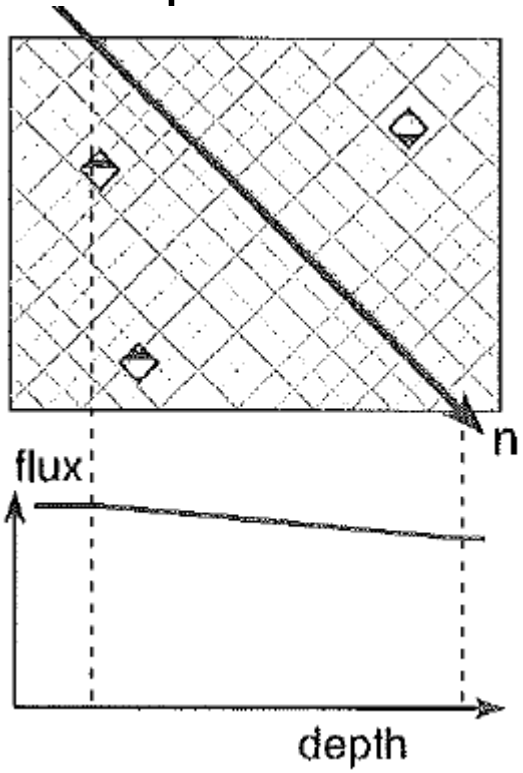
primary extinction



secondary extinction



powder

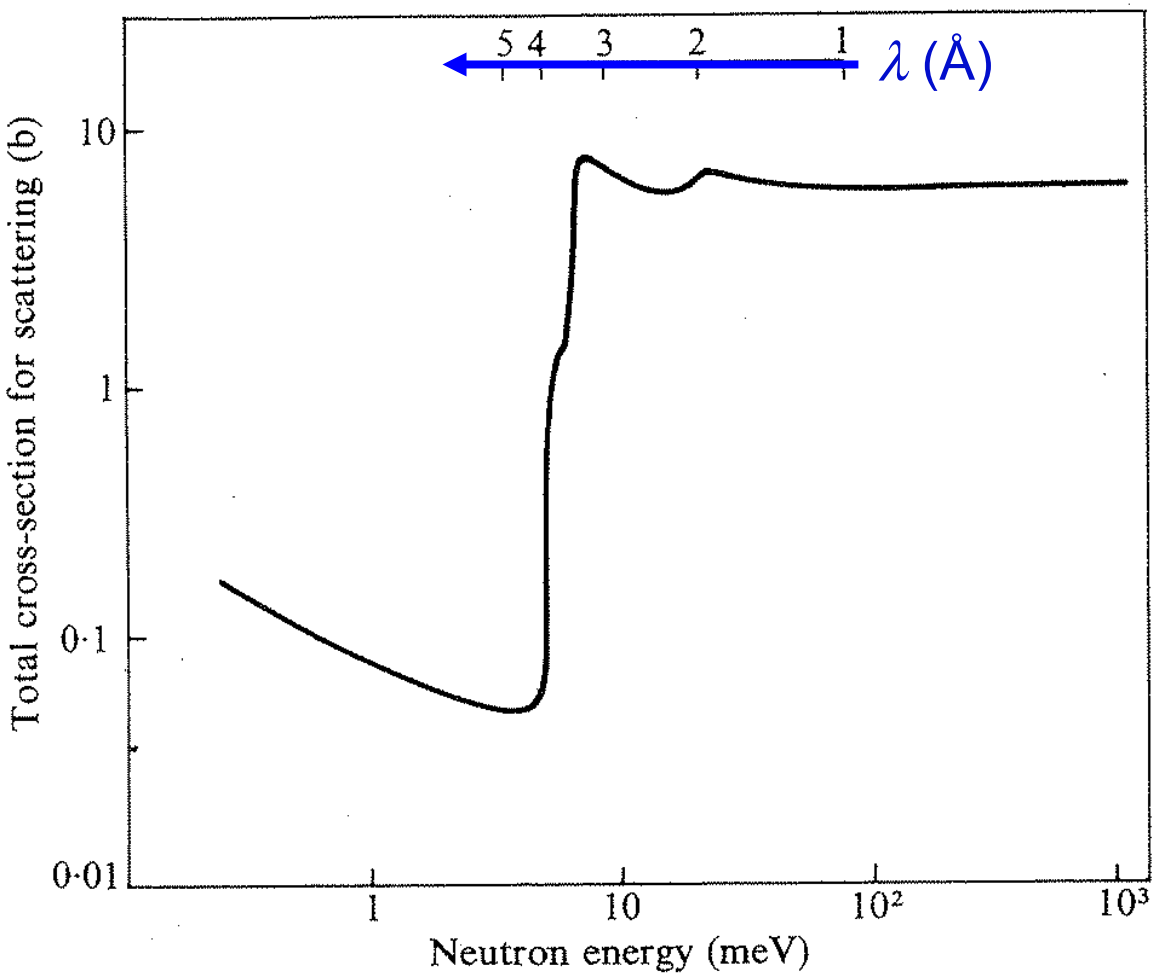


Attenuation:

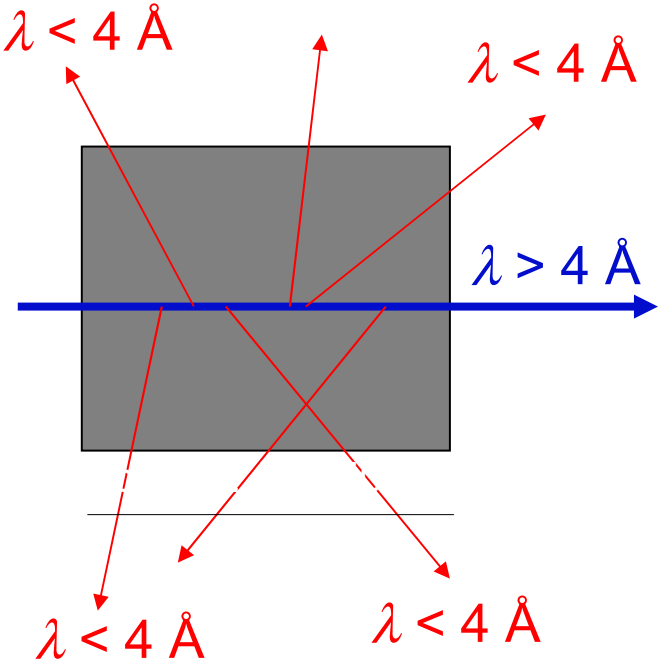
$$I_d = I_0 e^{-\mu d}$$

- Bragg scattering reduces intensity
- Primary extinction: strong in perfect crystals: neutrons mostly from surface region
- Secondary extinction: non-perfect crystals, scattering from grains
- Extinction usually unimportant in polycrystals or powders

4 Diffraction: Absorption and Extinction: Be filters

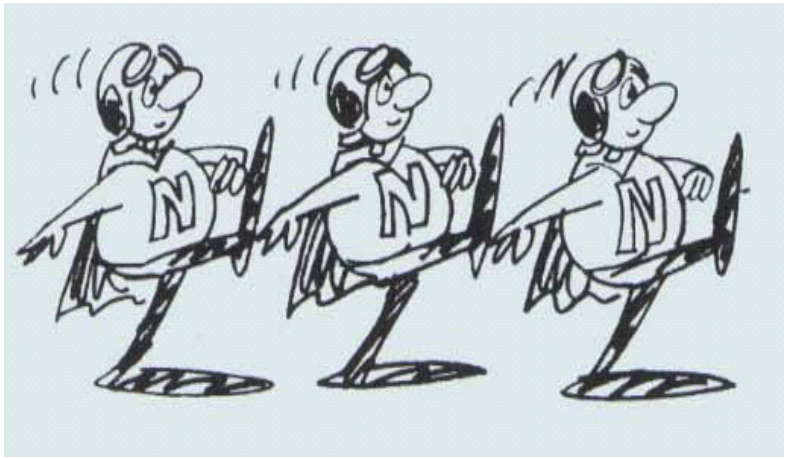


Total cross section of polycrystalline Be:
cut-off near E = 5.2 meV



3.3 Reminder: Coherent and incoherent scattering

Coherent



Spatial and temporal correlations between different atoms

- Interference effects:
- Given by average of b
  Bragg scattering

Incoherent

Spatial and temporal correlations between the same atom

- Constant in Q
- Given by variations in b due to spin, disorder, random atomic motion....

5 Inelastic scattering: Phonons – Linear chain with identical atoms

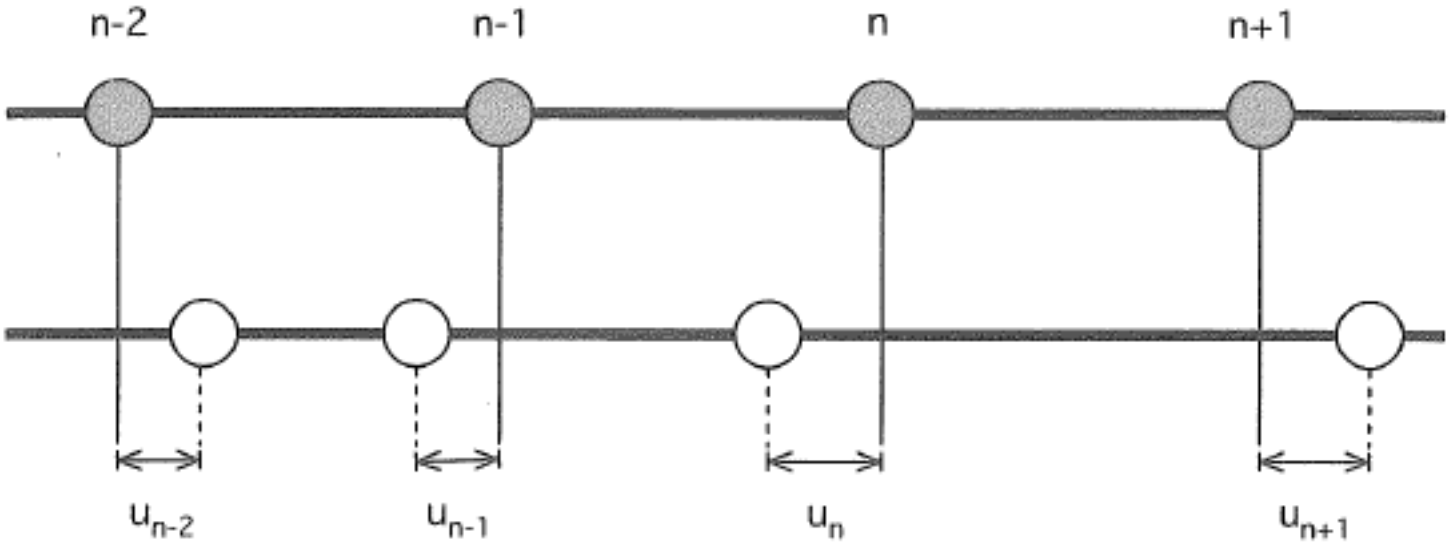
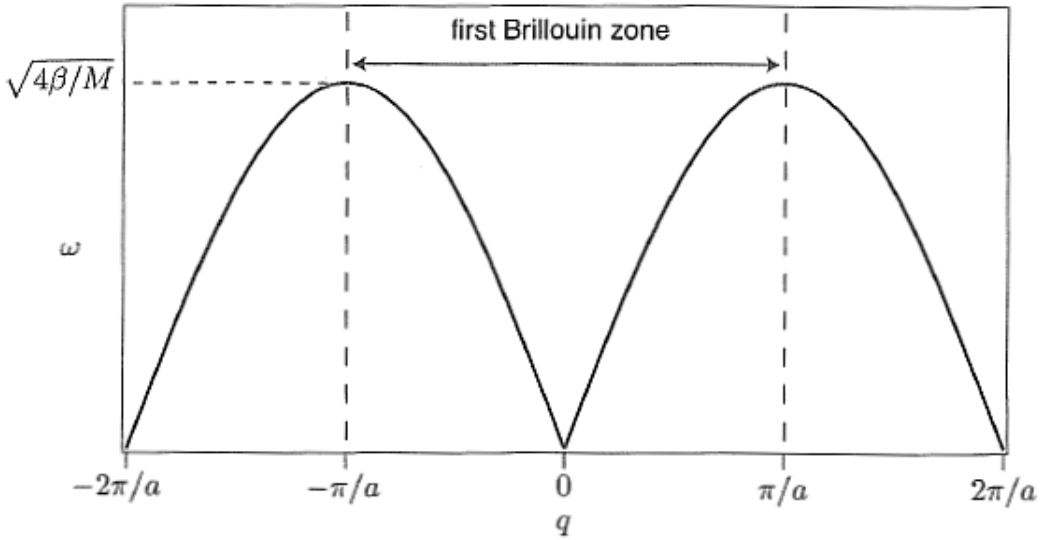
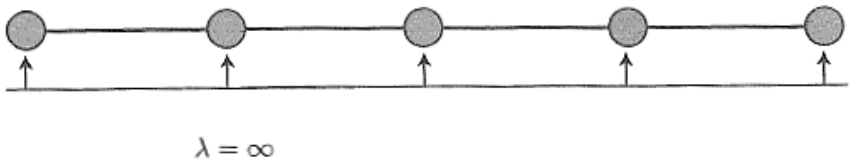
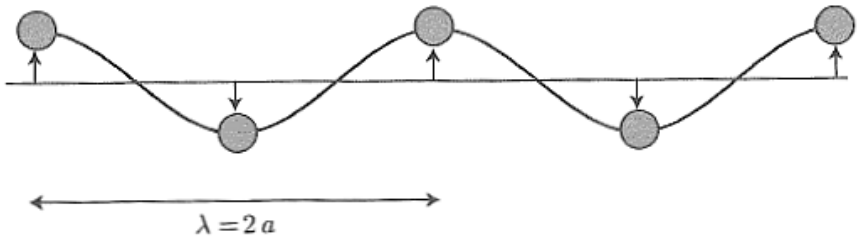


Fig. 5.1 Schematic representation of a linear chain with identical atoms. The equilibrium and displaced atomic positions are indicated by full and open circles, respectively.

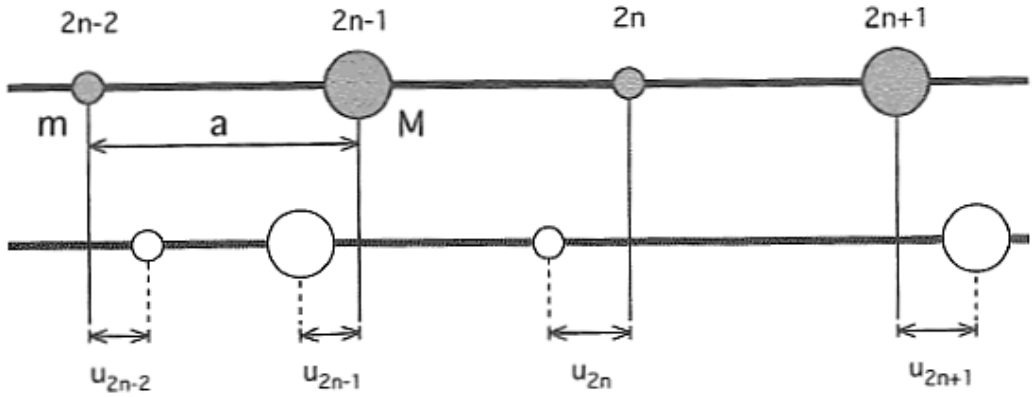
5 Inelastic scattering: Phonons – Linear chain with identical atoms

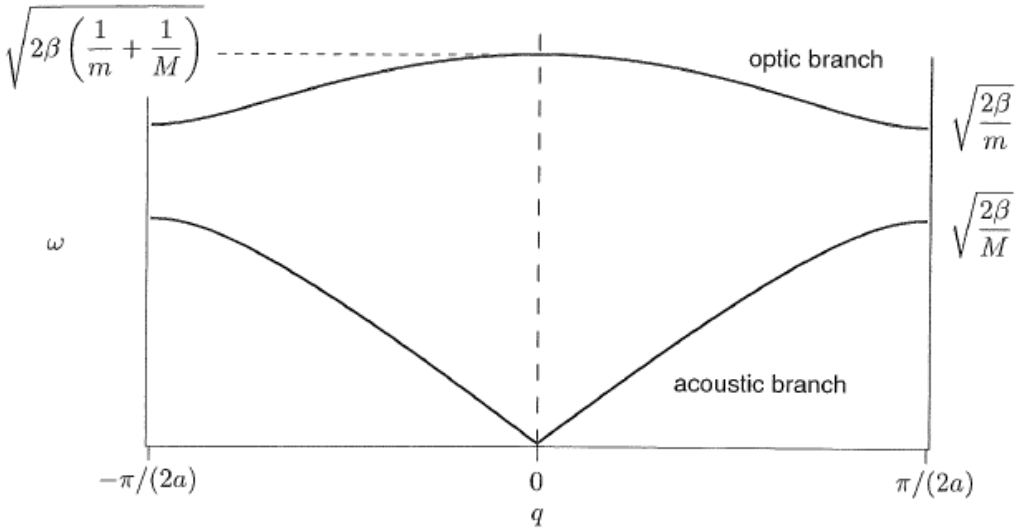


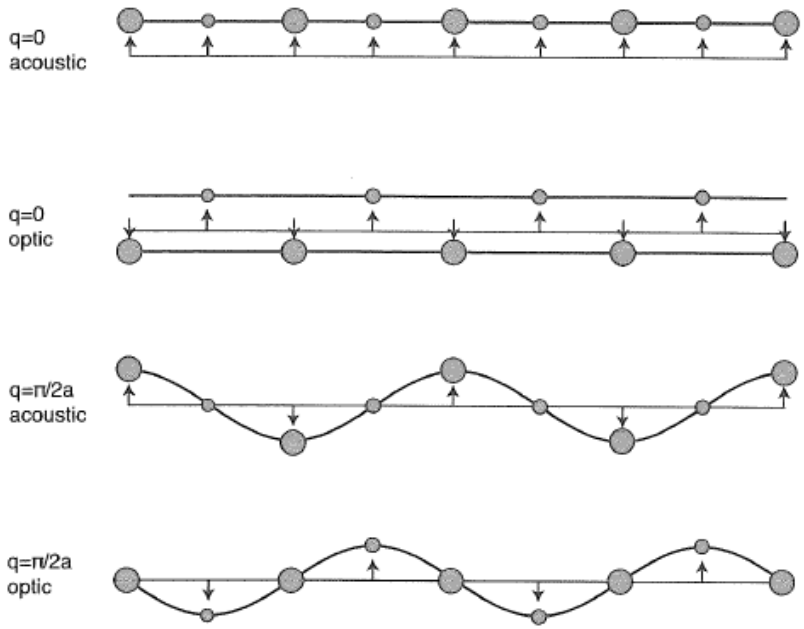




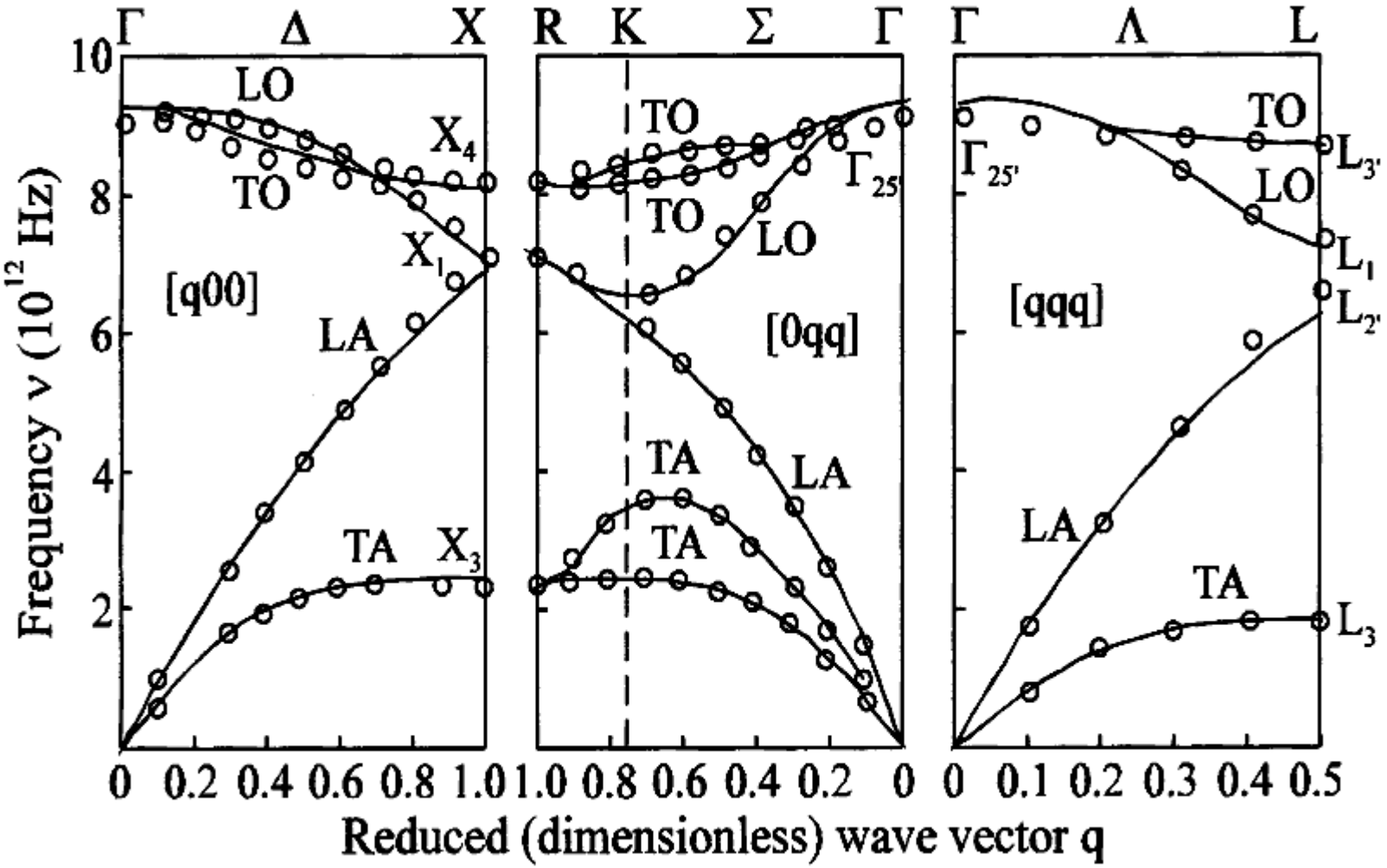
5 Inelastic scattering: Phonons – Linear chain with 2-atomic basis



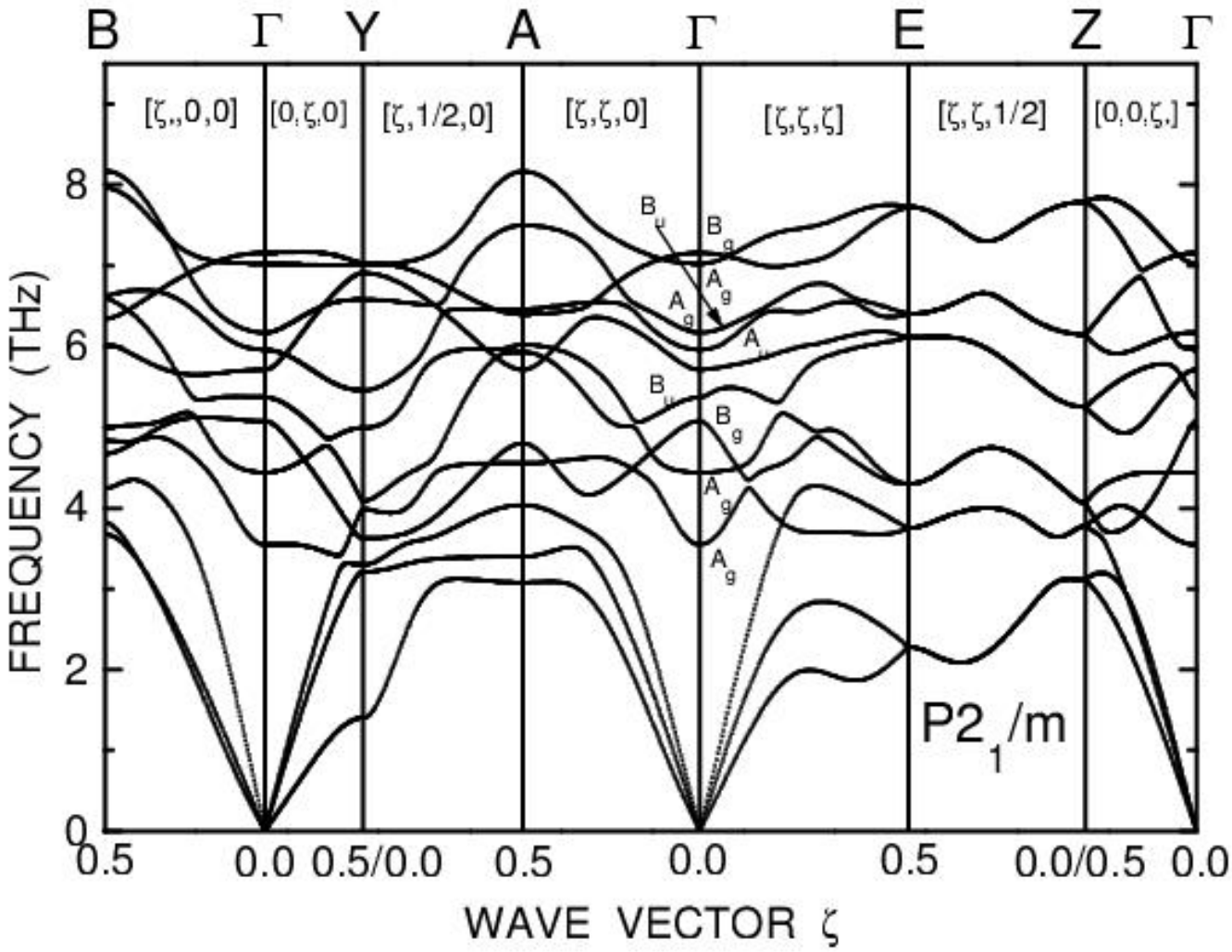




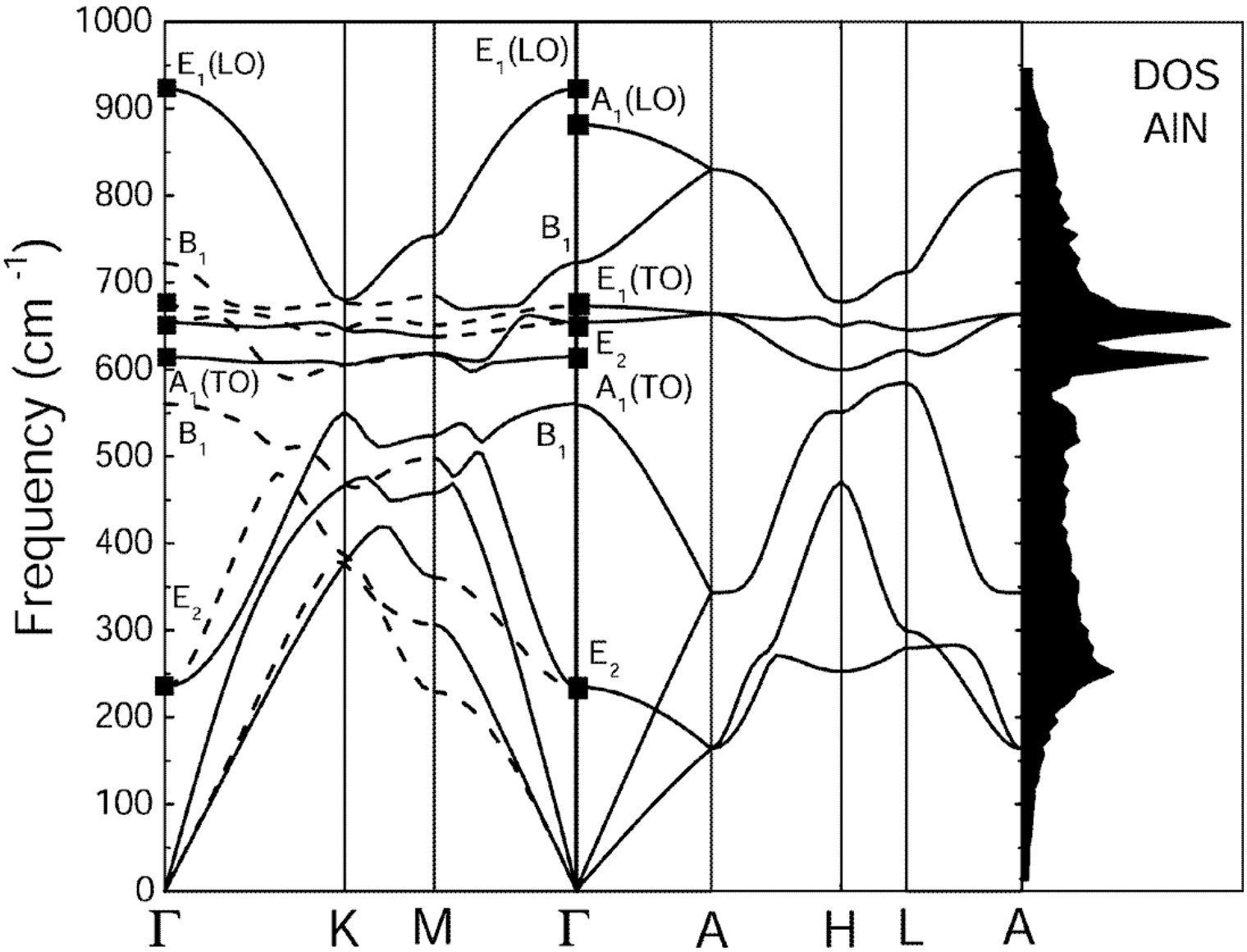
5 Inelastic scattering: Phonons (Germanium)



5 Inelastic scattering: Phonons NiTi (martensitic phase)



5 Inelastic scattering: Phonons AlN



5 Inelastic scattering: Phononic specific heat, Debye approximation

PHYSICAL REVIEW B VOLUME 7, NUMBER 6 15 MARCH 1973

Lattice Dynamics of Copper at 80 K

G. Nilsson and S. Rolandson
AB Atomenergi, Studsvik, Sweden
(Received 15 November 1971)

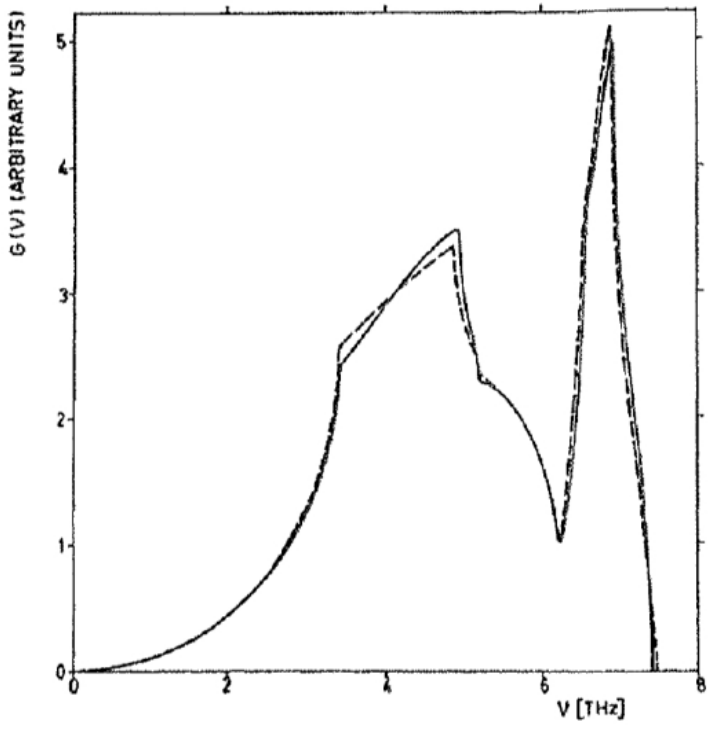
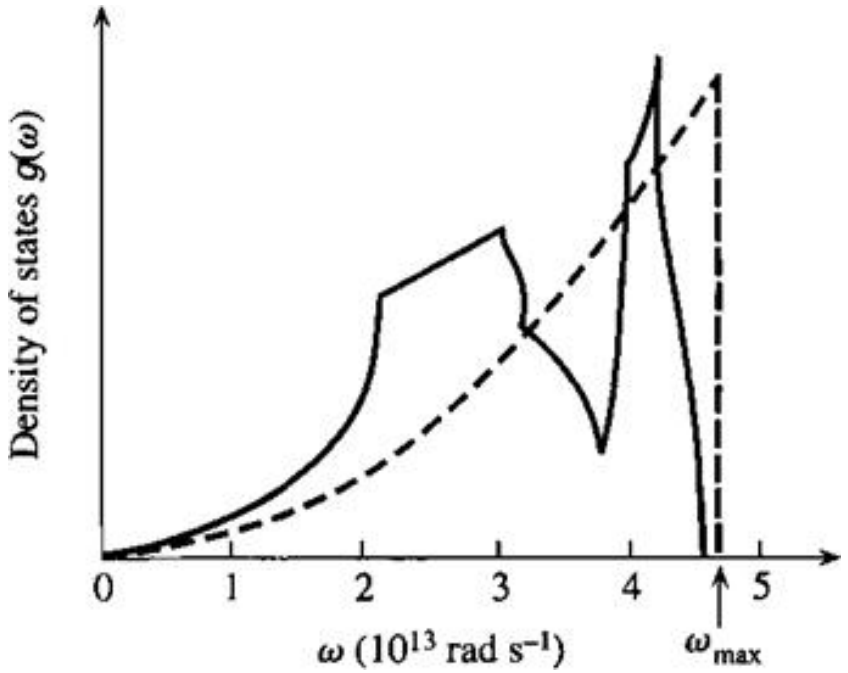
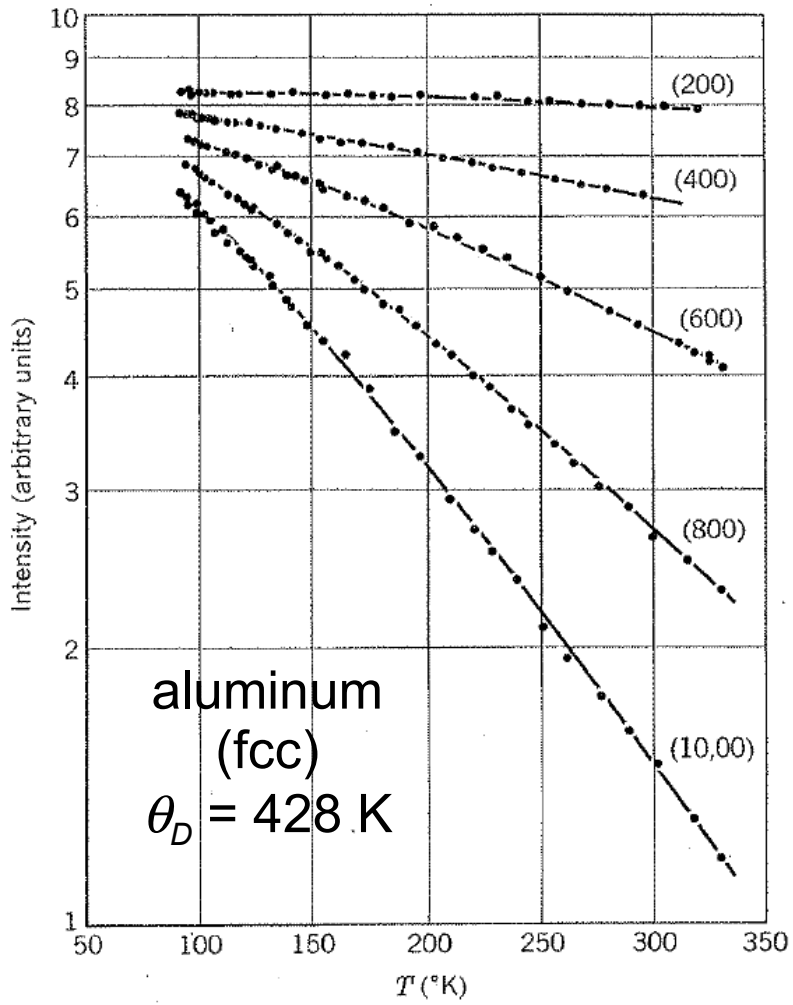


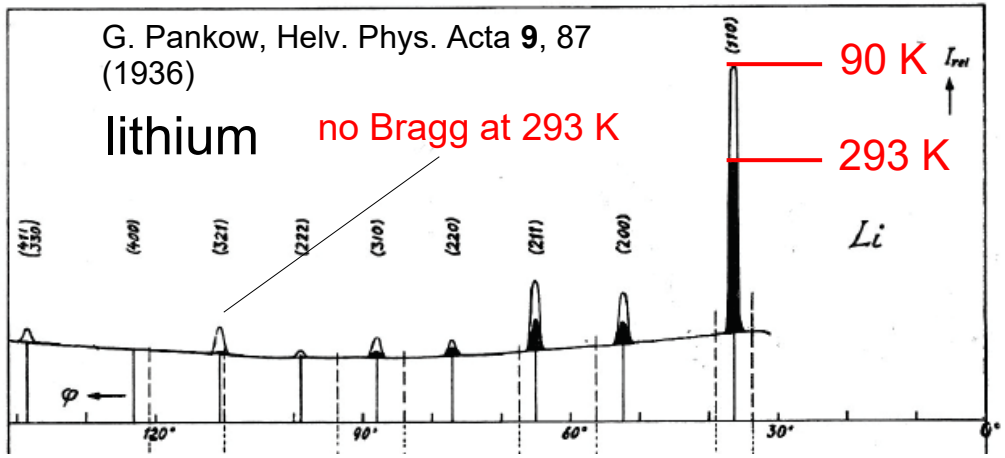
Fig.1

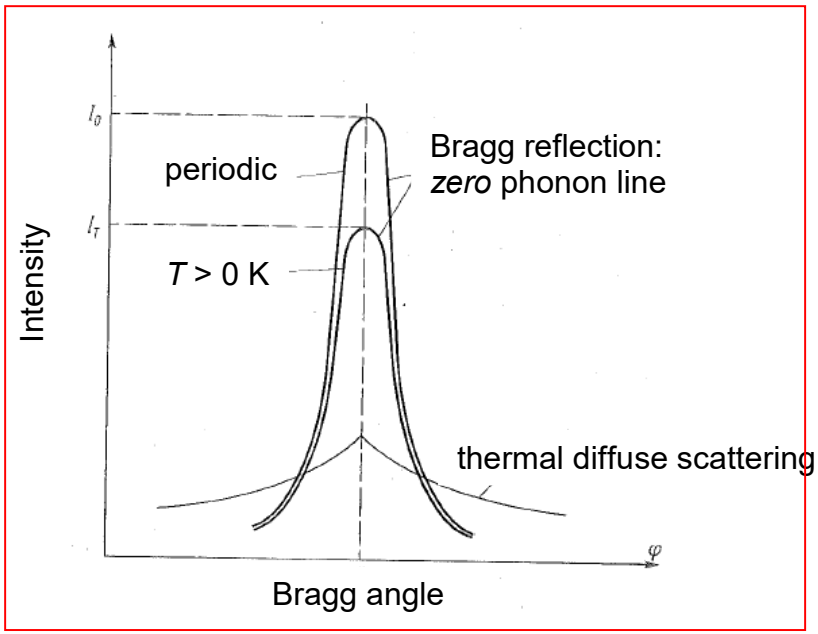
$\omega = 2\pi\nu$



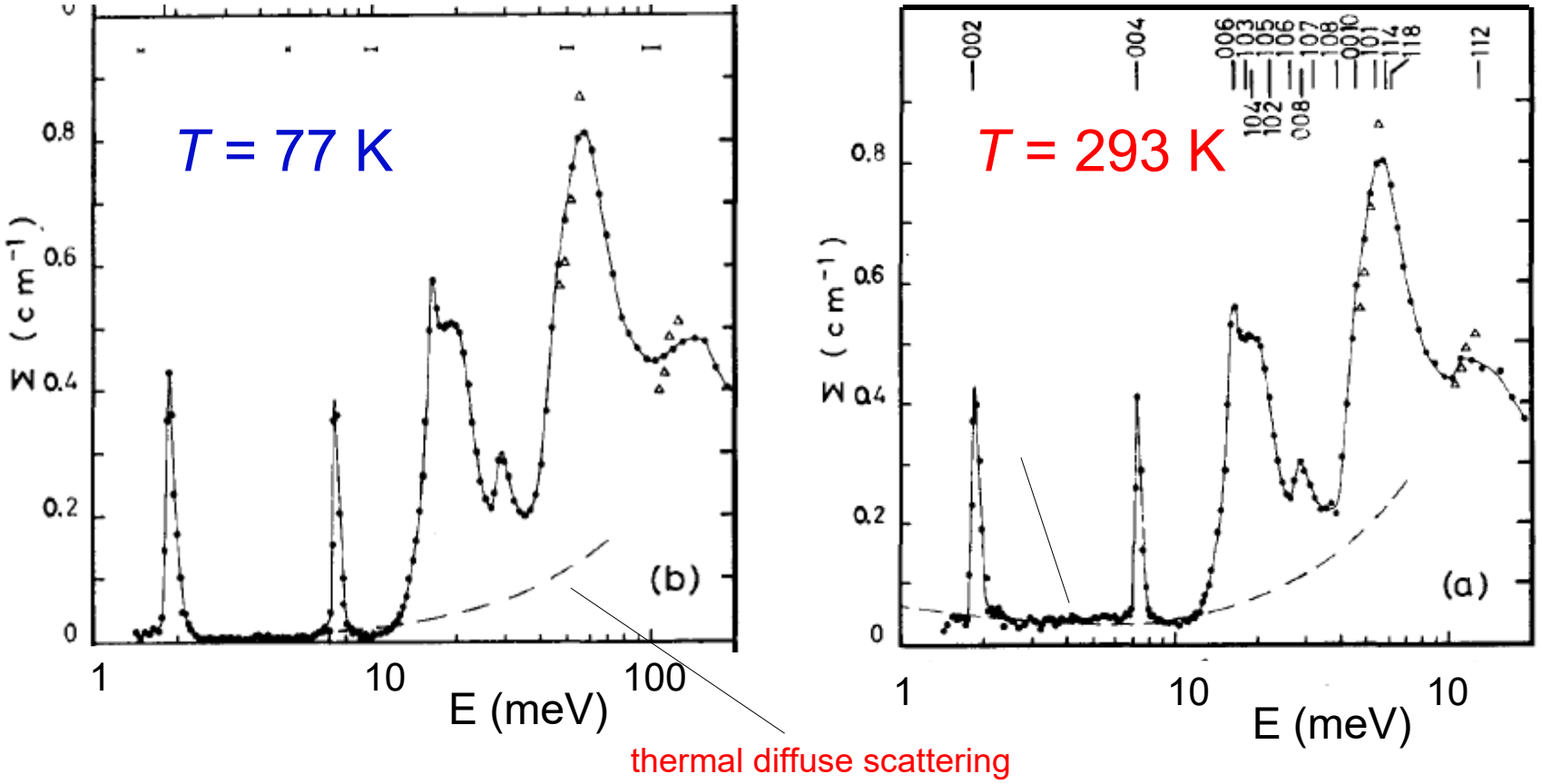
5 Inelastic scattering: Debye Waller factor: Aluminium/Lithium







5 Inelastic scattering: Thermal diffuse scattering of pyrolytic graphite



J. Bergsma and C. Van Dijk, Nucl. Instrum. Methods **51**, 121 (1967).