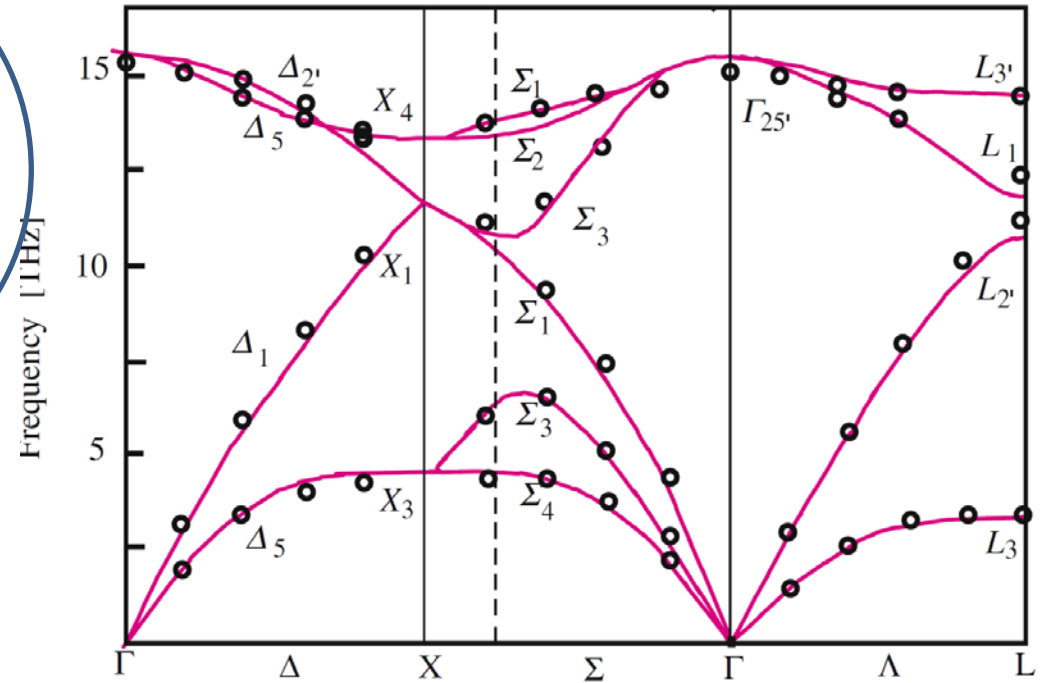
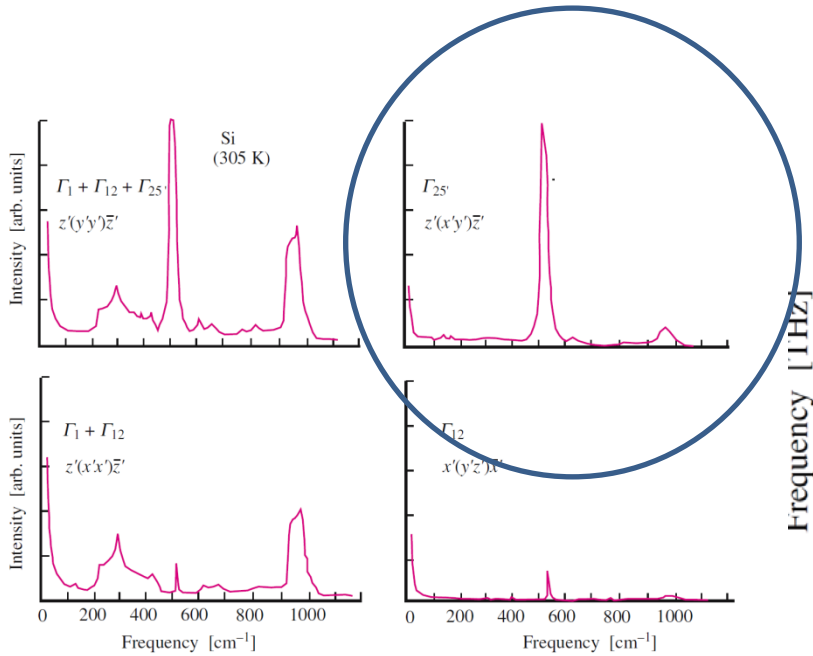
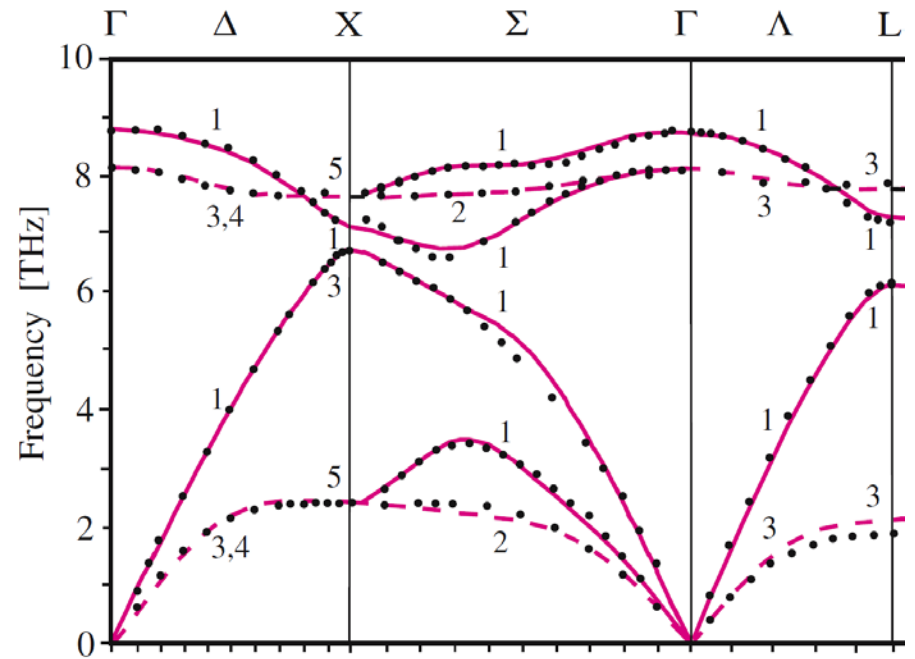
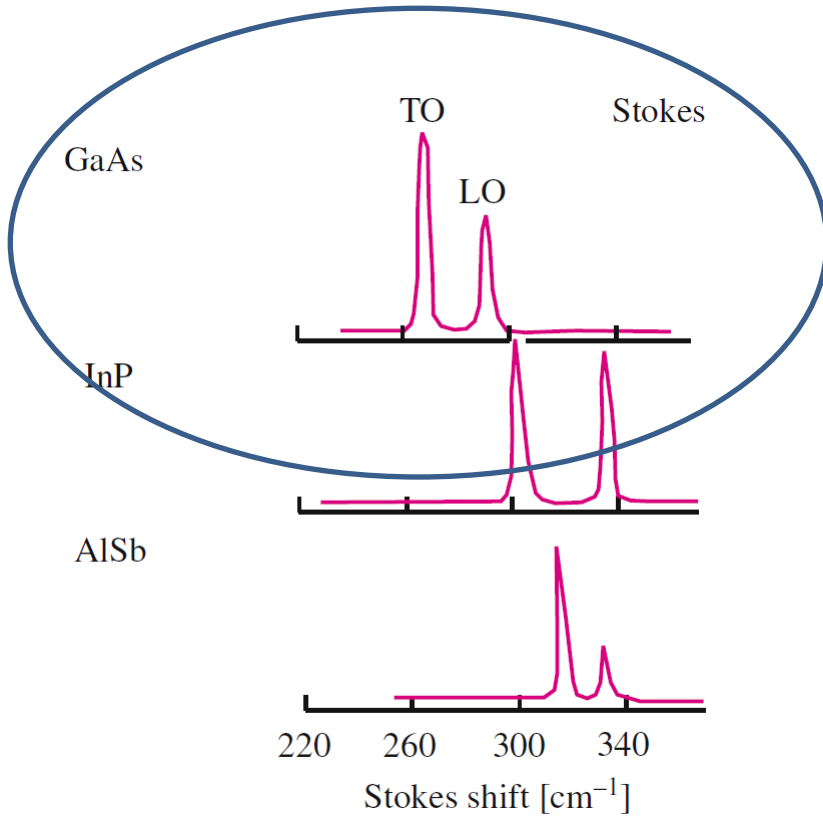


Hexagonal BN

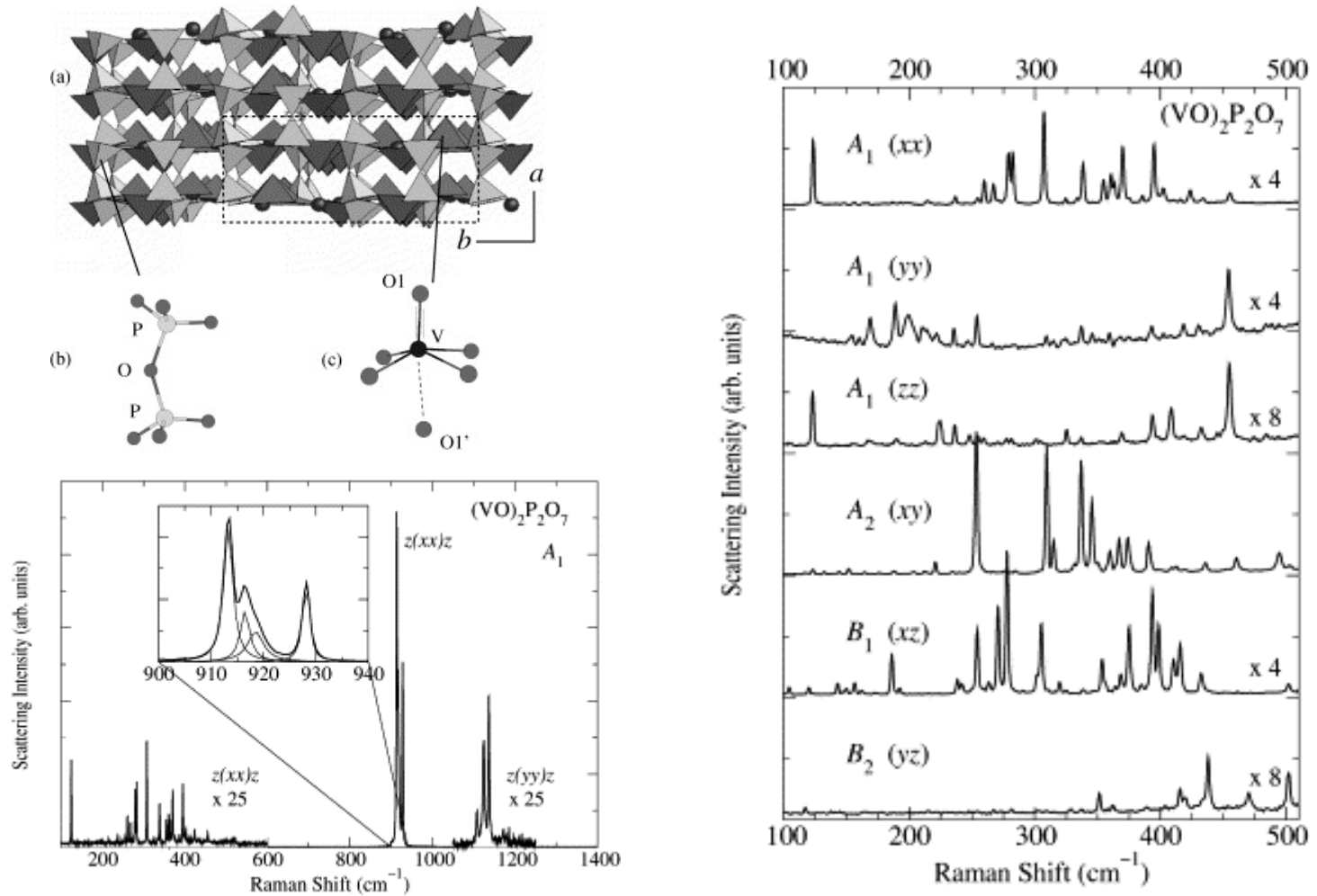
Phonon dispersion Si



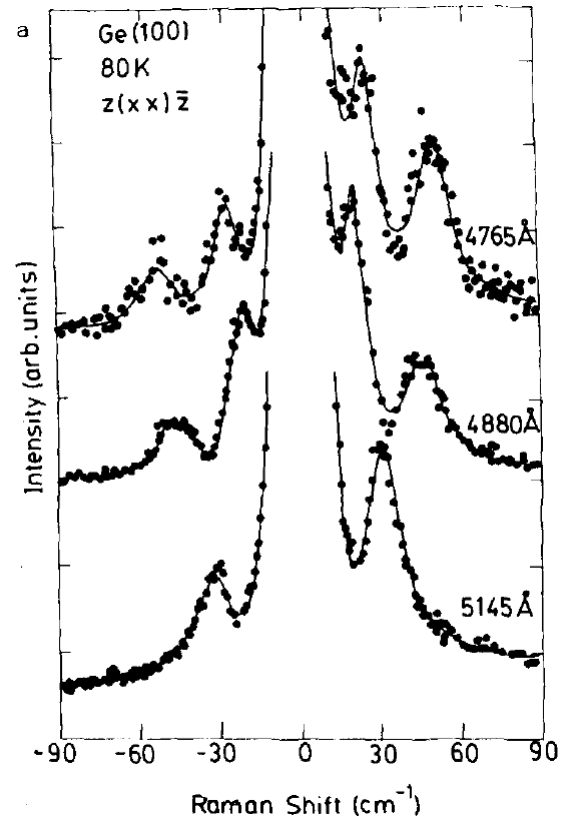
Phonon dispersion GaAs



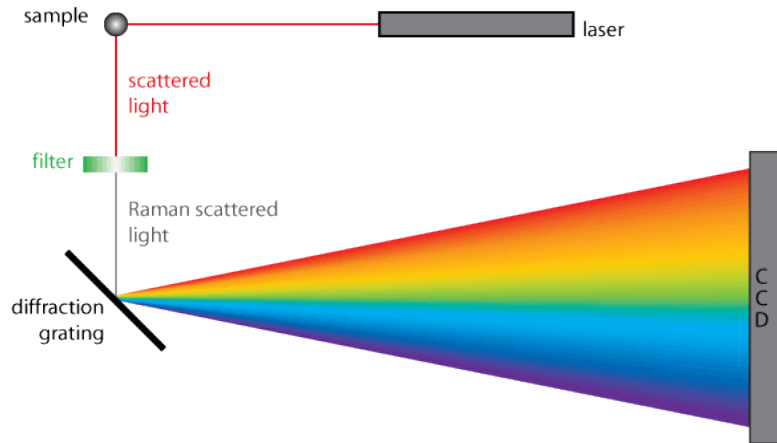
VOPO - Vanadyl pyrophosphate



Acoustic phonons of Ge



Raman spectrometers



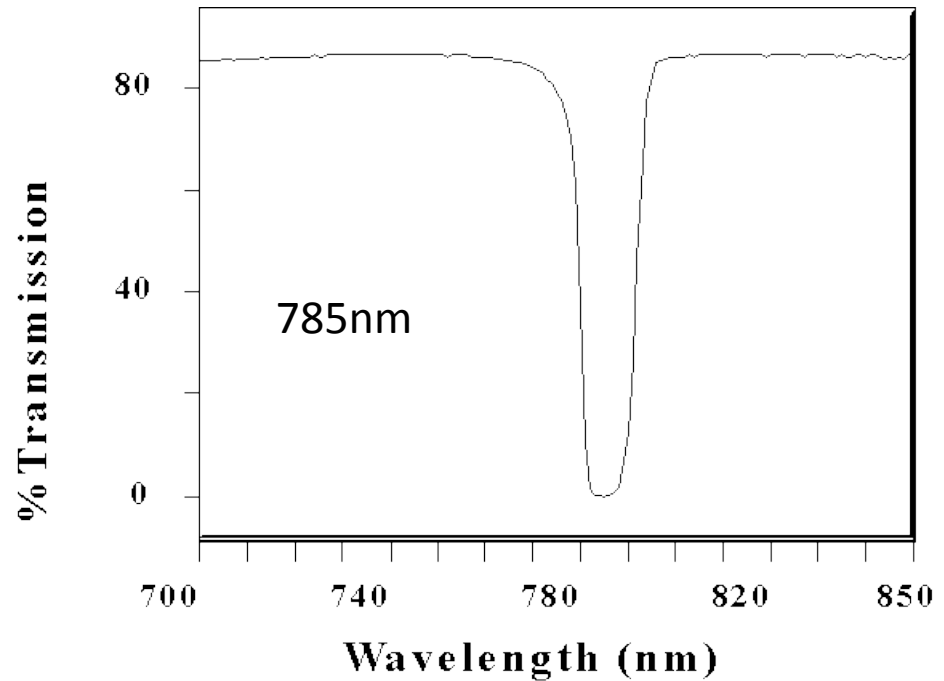
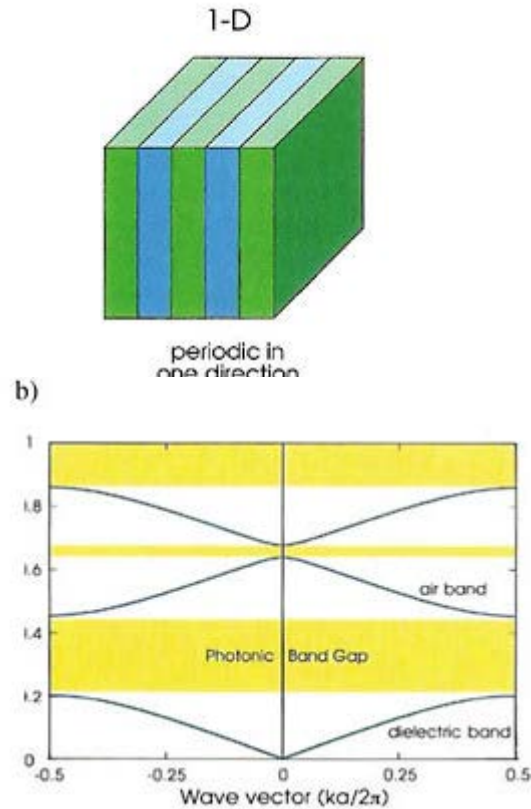
Laser
Sample

Filter?

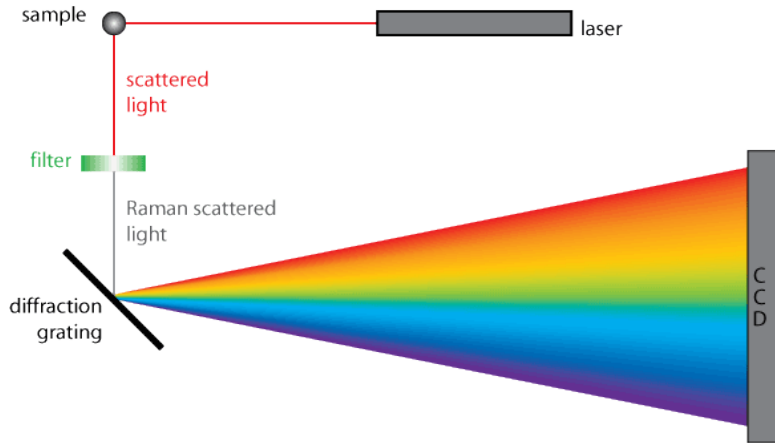
Spectrometer with CCD

Photonic crystal

- Band structure for photons from translational symmetry

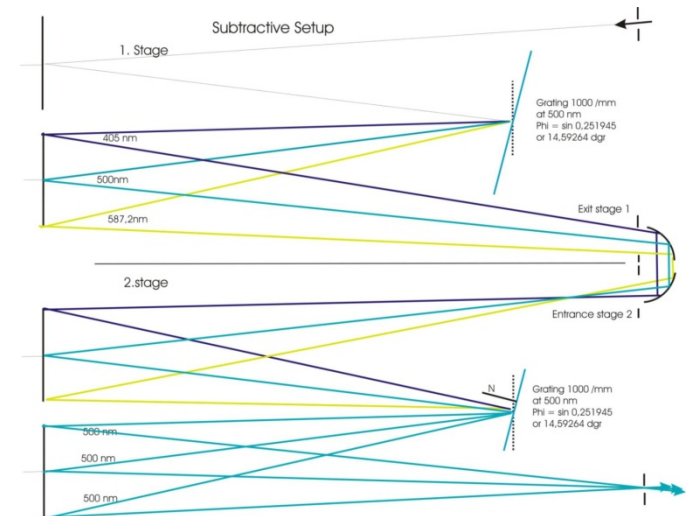


Raman spectrometers

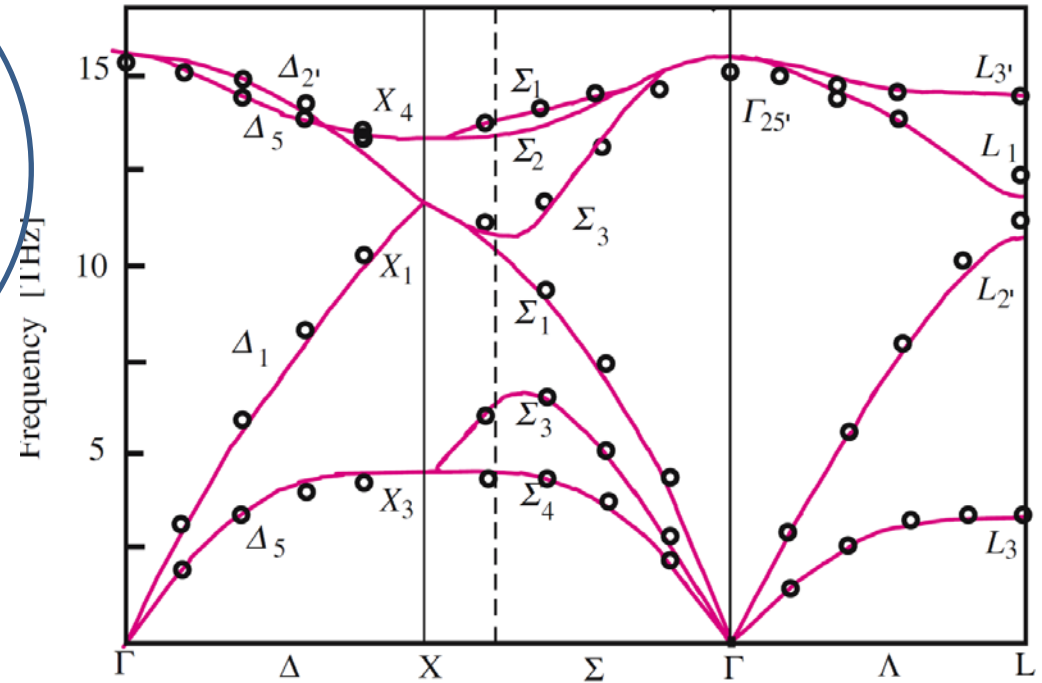
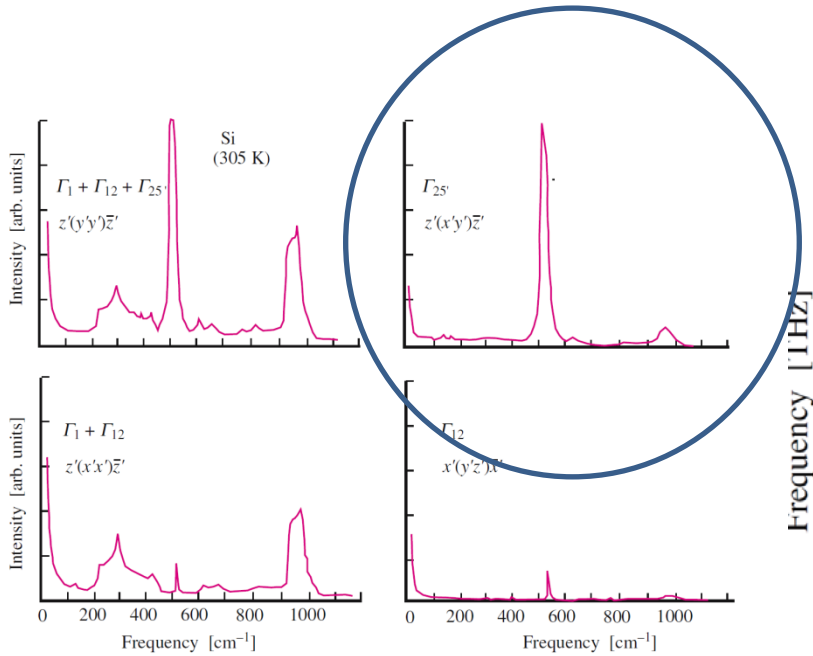


Filter:
high-precision dielectric mirror
(notch filter) – single wavelength

double-grating spectrometer – fully
tunable filter (all wavelength)

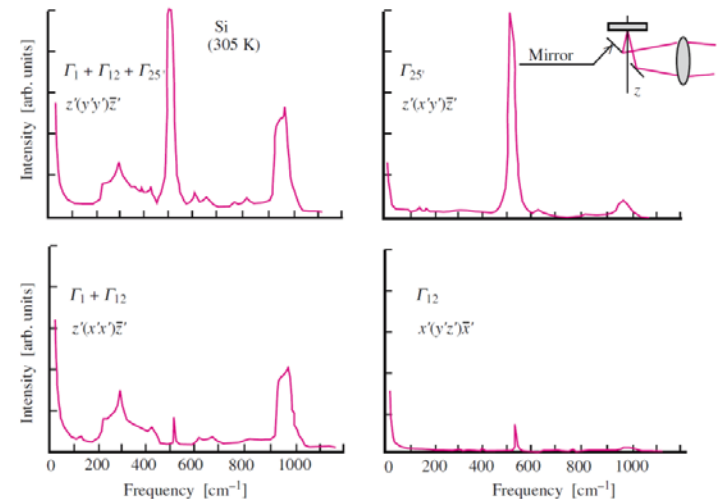


Phonon dispersion Si



Questions – Answers?

- You mentioned tunable lasers and spectrometers. Why does one need different laser wavelengths in Raman scattering?
- Why does the Si line change intensity under polarization?
- What are all the weak signals in the Si spectra besides the 520cm⁻¹ line?
- I have a different question.



Raman selection rules

Character table for point group O_h

O_h	E	$8C_3$	$6C_2$	$6C_4$	$3C_2=(C_4)^2$	i	$6S_4$	$8S_6$	$3\sigma_h$	$6\sigma_d$	linear functions, rotations	quadratic functions	cubic functions
A_{1g}	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	-	$x^2+y^2+z^2$	-
A_{2g}	+1	+1	-1	-1	+1	+1	-1	+1	+1	-1	-	-	-
E_g	+2	-1	0	0	+2	+2	0	-1	+2	0	-	$(2z^2-x^2-y^2, x^2-y^2)$	-
T_{1g}	+3	0	-1	+1	-1	+3	+1	0	-1	-1	(R_x, R_y, R_z)	-	-
T_{2g}	+3	0	+1	-1	-1	+3	-1	0	-1	+1	-	(xz, yz, xy)	-
A_{1u}	+1	+1	+1	+1	+1	-1	-1	-1	-1	-1	-	-	-
A_{2u}	+1	+1	-1	-1	+1	-1	+1	-1	-1	+1	-	-	xyz
E_u	+2	-1	0	0	+2	-2	0	+1	-2	0	-	-	-
T_{1u}	+3	0	-1	+1	-1	-3	-1	0	+1	+1	(x, y, z)	-	$(x^3, y^3, z^3) [x(z^2+y^2), y(z^2+x^2), z(x^2+y^2)]$
T_{2u}	+3	0	+1	-1	-1	-3	+1	0	+1	-1	-	-	$[x(z^2-y^2), y(z^2-x^2), z(x^2-y^2)]$