guess at 2D 2 atoms/cell → 2 acoustic + 2 optical
LA, TA
LO, TO

what do these bands look like?

TO x x x
LO x x

Wax = 1 i


Side note: effect of finite length
- 2 coupled eqns
- N x N matrix
- N frequencies

Important side note before CM in next page!

See Fig 8a pg 96

3D 2 atoms/cell (maximum)

TO & (unlike) dependent on

Lo

LA

TA

two degenerate branches

(see last chapter)

why GaAs optical

rip at · see next page

handout n | Si, Ge, As, \( n \)

Final task: Zone folding

1D, 1 atom/cell

10 atoms/cell vs another \( 2a \)

looks like fcc

They are not same!

Physical Insight:

For $U_0$, additional contribution to energy from Coulomb
Quantization of Elastic Waves

QM: not all energies are allowed. For spring

\[ \nu = \sqrt{\frac{4 (n + \frac{1}{2}) k}{n \omega}} \]

Appendix C: A bunch of modes, or springy act similarly

call these "phonon modes" or just "phonons" for short

\[ n = 0 \text{ phonons but are undeformed} \]
\[ n \text{ is site problem} \]

Cost analysis

\[ \nu_0 = \sqrt{\frac{4 (n + \frac{1}{2}) k}{n \omega}} \]

(\text{Can't get arbitrary amplitude!})

\[ p = n k \]

\text{"crystal momentum"}

Example on next pg

Remember: \[ F \text{ is only defined modulo } G \cdot \mathbf{F} \]

"crystal momentum + recoil momentum"