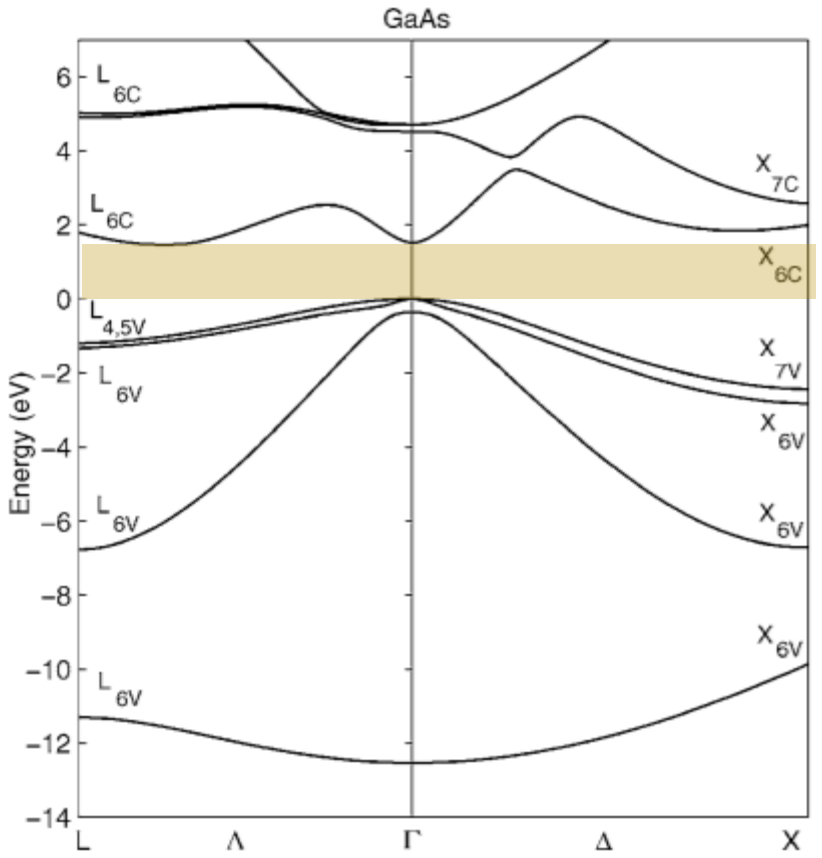
Class 03
Band Structures of real materials

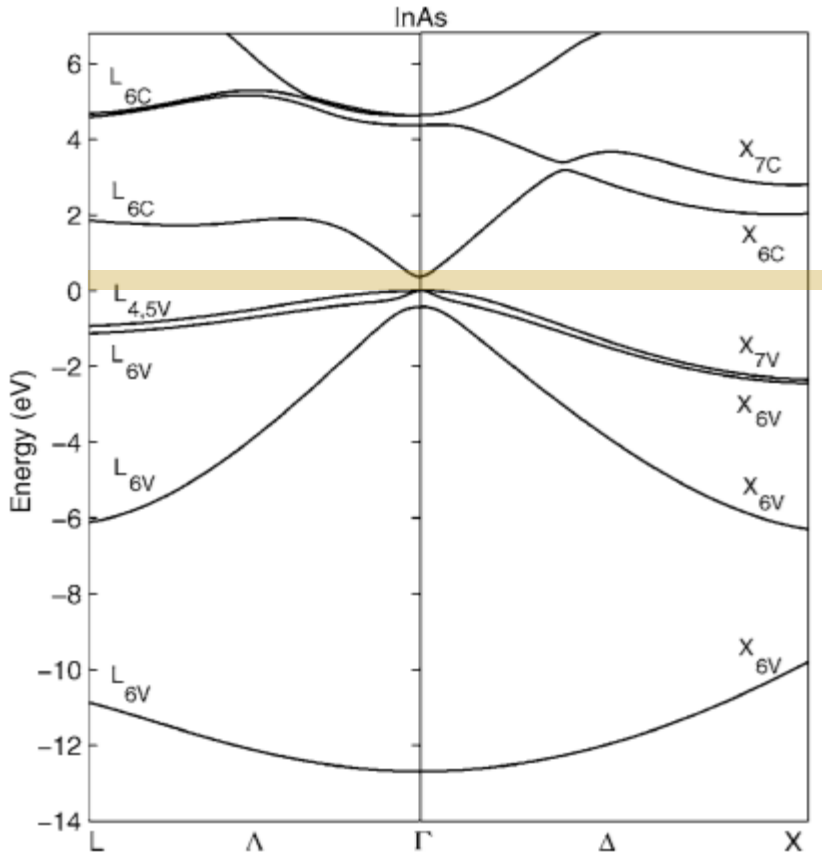
24.02.2025

- ❑ Crystal lattice and reciprocal space
  - Brillouin zone
  - Valence bands and split-off
- ❑ Exercise: Alloys
- ❑ Dispersion relationship in low-dimensional semiconductors
  - Particle in a box
  - Quantum well
- ❑ Band Structure and Density of States

In-Class Exercise



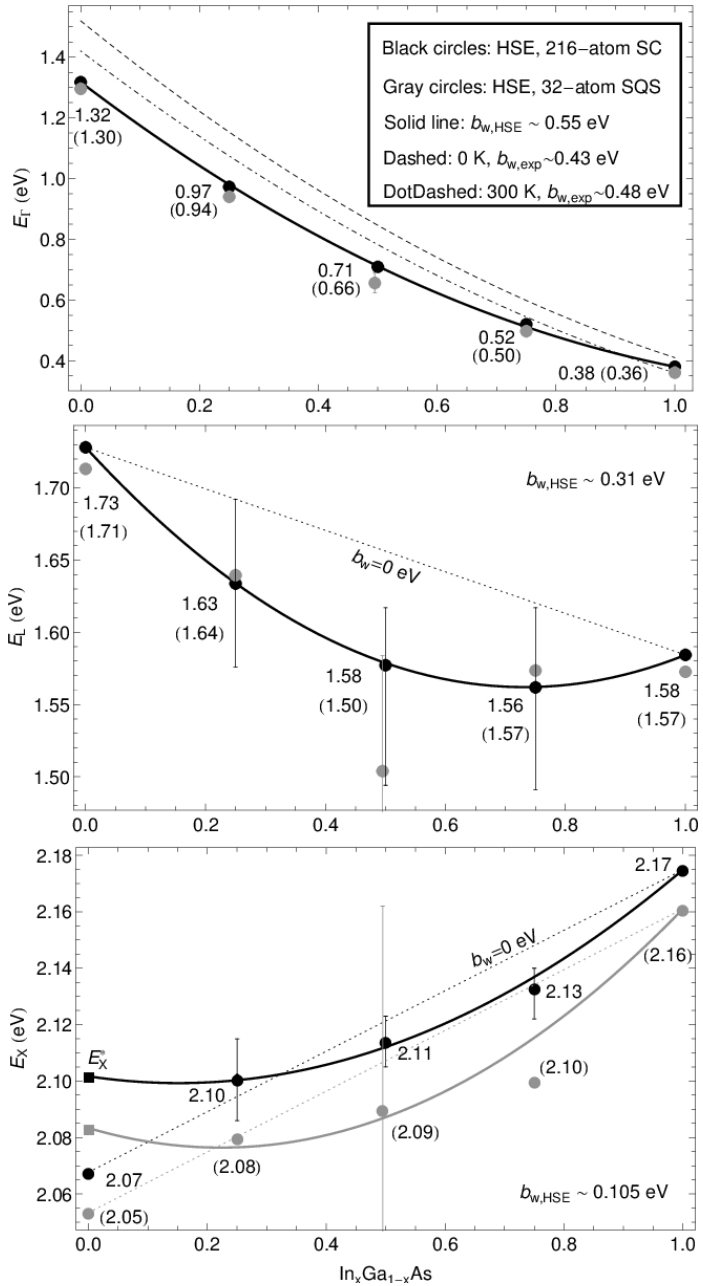
1.424 eV



0.354 eV

Could you write the function to calculate the band gap of the ternary alloy $In_{(1-x)}Ga_{(x)}As$?

10 minutes



Linear function $In_{(1-x)}Ga_{(x)}As$

$E_g^{InGaAs} = 0.354 + (1.424 - 0.354)*x$ x = [0;1]

Non-linear function $In_{(1-x)}Ga_{(x)}As$ (bowing parameters)

$E_g^{InGaAs} = y = 0.426*x^2 + 0.644*x + 0.354$ x = [0;1]

x	Linear (eV)	Non-linear (eV)	Error (meV)
0 (InAs)	0.354	0.354	0
0.2	0.568	0.500	68
0.4	0.782	0.680	102
0.5	0.889	0.782	107
0.6	0.996	0.894	102
0.8	1.210	1.141	69
1	1.424	1.424	0