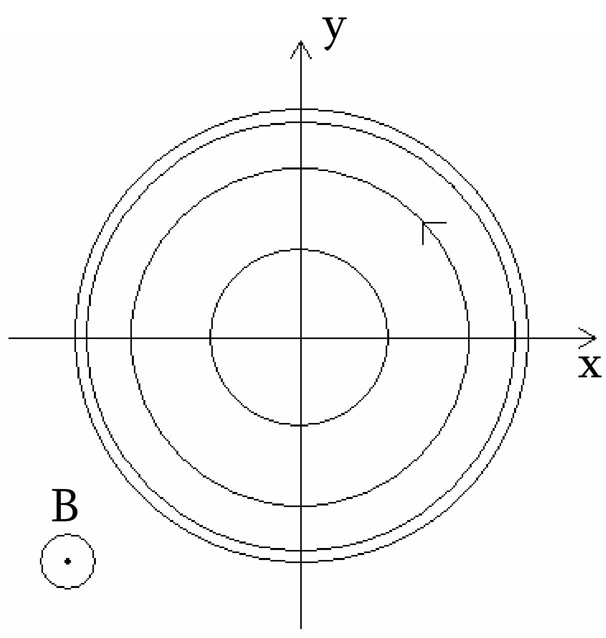
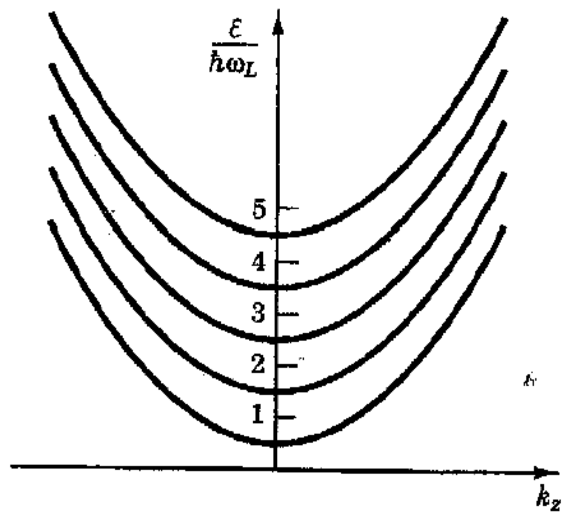
Electrons in a Magnetic Field

$$H = \frac{1}{2m^*}\left[-i\hbar\nabla + e\vec{A}(r)\right]^2 + \vec{V}(r)$$



$$H = \frac{-\hbar^2}{2m^*}\nabla^2 - i\hbar\omega_C\left(x\frac{\partial}{\partial y}\right) + \frac{1}{2}m^*\omega_C^2 x^2$$

$$\frac{-\hbar^2}{2m^*}\psi'' + \left[\frac{\hbar^2 k_y^2}{2m^*} + \hbar^2\omega_C k_y x + \frac{m^*\omega_C^2}{2}x^2\right]\psi + \frac{\hbar^2 k_Z^2}{2m^*} = \mathcal{E}\psi$$



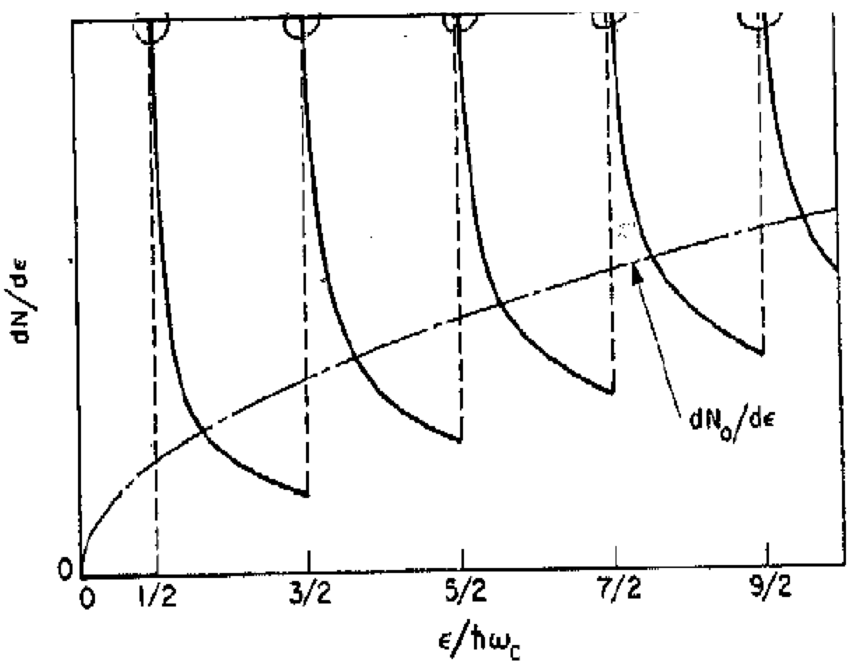
$$\mathcal{E} = \left(n + \frac{1}{2}\right)\hbar\omega_C + \frac{\hbar^2 k_Z^2}{2m^*}$$

“Quantum Mechanics”; H. Kroemer; Prentice Hall

Measurable Magnetic Field Effects

- deHaas-van Alphen Effect (magnetic susceptibility)
- Shubnikov-deHaas Effect (magnetoresistance)

3D DOS in presence of B-field



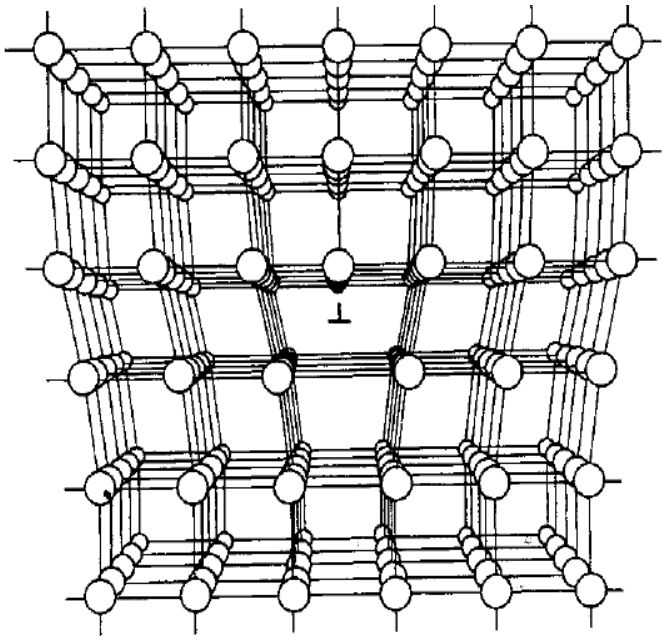
"Physics of III-V compounds"; R. Willardson, A. Beer; academic press

Our Approach

- Determine scattering potential for a lattice dislocation:

$$U_s = q\frac{\rho_l}{2\pi\kappa_s\varepsilon_0}\ \ln(r)$$

- Use *Fermi's Golden Rule:*
  - S(k, k')
  - τ_d



"Electronic Materials Science"; J. Mayer, S. Lau; Macmillan Pub. 1990