ECE 30
Day 22 Notes

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Agenda

- Review of Midterm makeup
- Schrodinger Equation Thoughts
- Energy Bands
  - Insulators
  - Conductors
  - Semiconductors
- P and N Doped Silicon
  - MOSFET

Midterm Makeup Review

lol didn't need to take it

Schrodinger Thoughts

- No physical way to measure Bohr energy shells, due to Uncertainty principal (Heisenberg)
- Schrodinger applied Maxwell's equations to matter
  - Conservation of Energy
  - De Brogli Hypothesis
- Resultant Ψ^2 is the most detailed information we can actually measure.
- We say that Ψ^2 is physical reality, and Bohr orbits are an abstraction

$$K + U = E$$
$$K = \frac{-h^2}{2m}\frac{d^2\Psi(x)}{dx^2}$$
$$U = U(x)\Psi(x)$$
$$E = E\Psi(x)$$

Where Ψ is the disturbance in space due to the matter wave, and $\Psi^2 dx$ is the probability of finding the electron in a given length dx.

This is the Time independent Single Dimension Schrodinger Equation, since it only considers a single spatial dimension.

Energy Bands

In a regular lattice you get alternating bands of forbidden and allowed states for electrons.

For example, a Sodium Lattice:

- Energy Shells for one atom
- 1S, 2S, 2P, 3S are Bohr energy levels.

  Note: since energy levels are actually probability distributions over the energy levels, the distribution depends on temperature.

- Each S level accomodates two electrons, this comes from the spin of electrons, so electrons get two additional states $+\frac{1}{2}$ and $-\frac{1}{2}$.
- The P levels accomodate 6 electrons. This is because a P shell has multiple lobes which can allow for up to six electrons.

- Higher energy levels allow for more possible shapes and more possible electrons in the same energy level.
- This combined means a Sodium atom has 11 electrons to match the protons, That means each level has 2, 2, 6, 1 electrons respectively.

Sodium is a conductor because the shells are close enough to be jumped betwen in a lattice, allowing electrons to flow.