Physics of Semiconductor Devices

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Oct. 7, 2020

Physics of Semiconductor Devices

- Diodes, solid state lasers, transistors
- Computing, communications
- Controllers: vacuum cleaners, coffee makers, etc.
- Transportation, autonomous driving, electric cars
- Efficient lighting, solar cells, displays
- Lasers

TU Graz

PHT.301 Physics of Semiconductor Devices

Outline

- **Introduction**
  - Semiconductors, transistors, and the electronics industry
- **Semiconductor crystals**
  - Energy bands W
    - Crystal structure W
    - Bravais lattice W
    - Miller indices W
    - Examples of crystal structures W
      - silicon, GaN (wurzite), SiC 4H, ZnO (wurzite), diamond
      - simple cubic, fcc, bcc, hcp, zincblende
    - Wave and particle nature of electrons
    - k-space
    - Density of states W Some examples: Al fcc, Au fcc, Cu fcc, Pt fcc, W bcc, Si diamond, Grap
    - Pauli exclusion principle W
    - Fermi function W
    - Fermi energy W
    - Metals, semiconductors, and insulators
    - Metal band structure
    - Semiconductor band structure
  - Absorption and emission of photons
  - Direct and indirect band gaps W
- **Intrinsic semiconductors**
  - Conduction band
  - Valence band
  - Effective mass W
  - Holes W
  - Boltzmann approximation
  - Law of mass action W
  - Fermi energy of an intrinsic semiconductor ▶ EN 2:36
  - Intrinsic semiconductors with a split-off band

Winter Semester 2020

Recorded Lectures 'Physics of Semiconductor Devices'

Question and Answer sessions on BBB

Examination

1 hour written exam

One page of handwritten notes

1 Contribution to improve the course

Chapter summaries

Solutions to exam questions

Simulations

Videos

Oral exam