Introduction
Lightwave Devices
- LED
- Lasers
- Modulators
- Photodetectors

Optoelectronics
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Optical

Semiconductors with strong interaction with light
Direct Bandgap
eg. GaAs, InP, III-V

Indirect Bandgap
eg. Si, Ge

\[ E_g \sim h\nu = \frac{hc}{\lambda} = \frac{1.24}{\lambda_{\text{in \, um}}} \text{ eV} \]

\[ 1 \text{ eV} = 1.6 \times 10^{-19} \text{ J} \]

eg. GaAs, \( E_g = 1.42 \text{ eV} \), \( h\nu \sim \frac{1.24}{1.42} = 0.87 \text{ um} \)
InGaAs, \( E_g = 0.74 \text{ eV} \), \( h\nu \sim \frac{1.24}{0.74} = 1.68 \text{ um} \)
Optoelectronics
- Classical electrostatics (Maxwell's eqs.)
- Solid state theory (electron wave, effective mass approx., energy bands, DOS)

Quantum Electronics
- Classical electromagnetics (Maxwell's eqs.)
- Light interaction with electronic states (Quantum Mechanics, <Phys 137 AB>
  Time-dependent perturbation, Fermi's Golden rule)