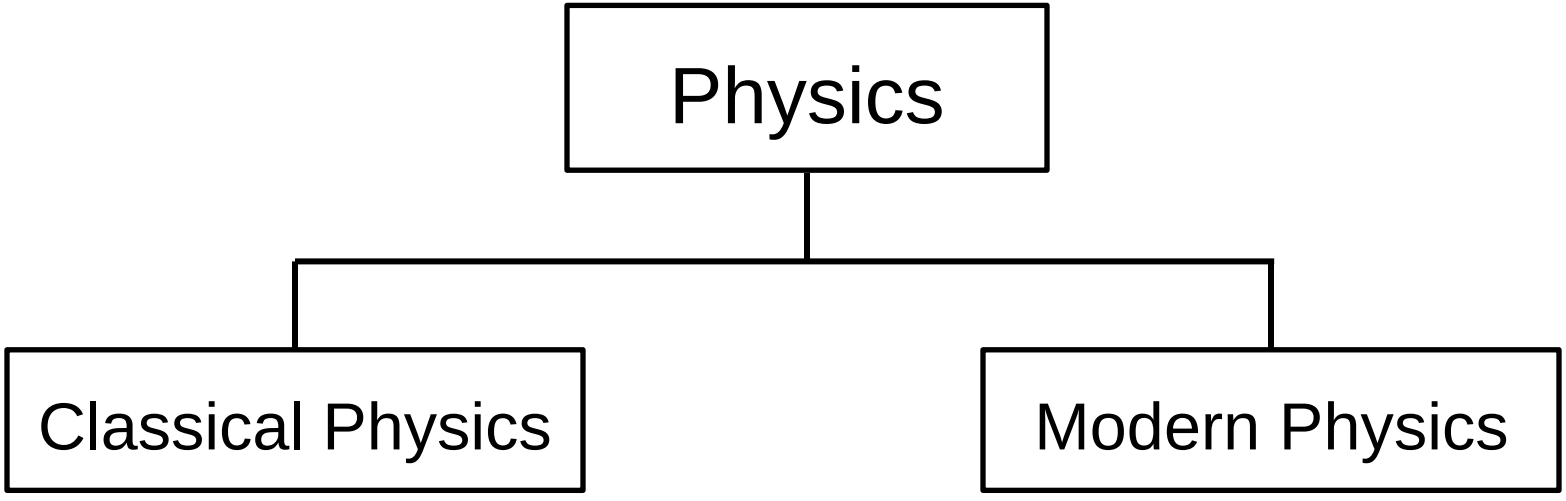
# Solid State Physics

## Lecture - 1

## Introduction

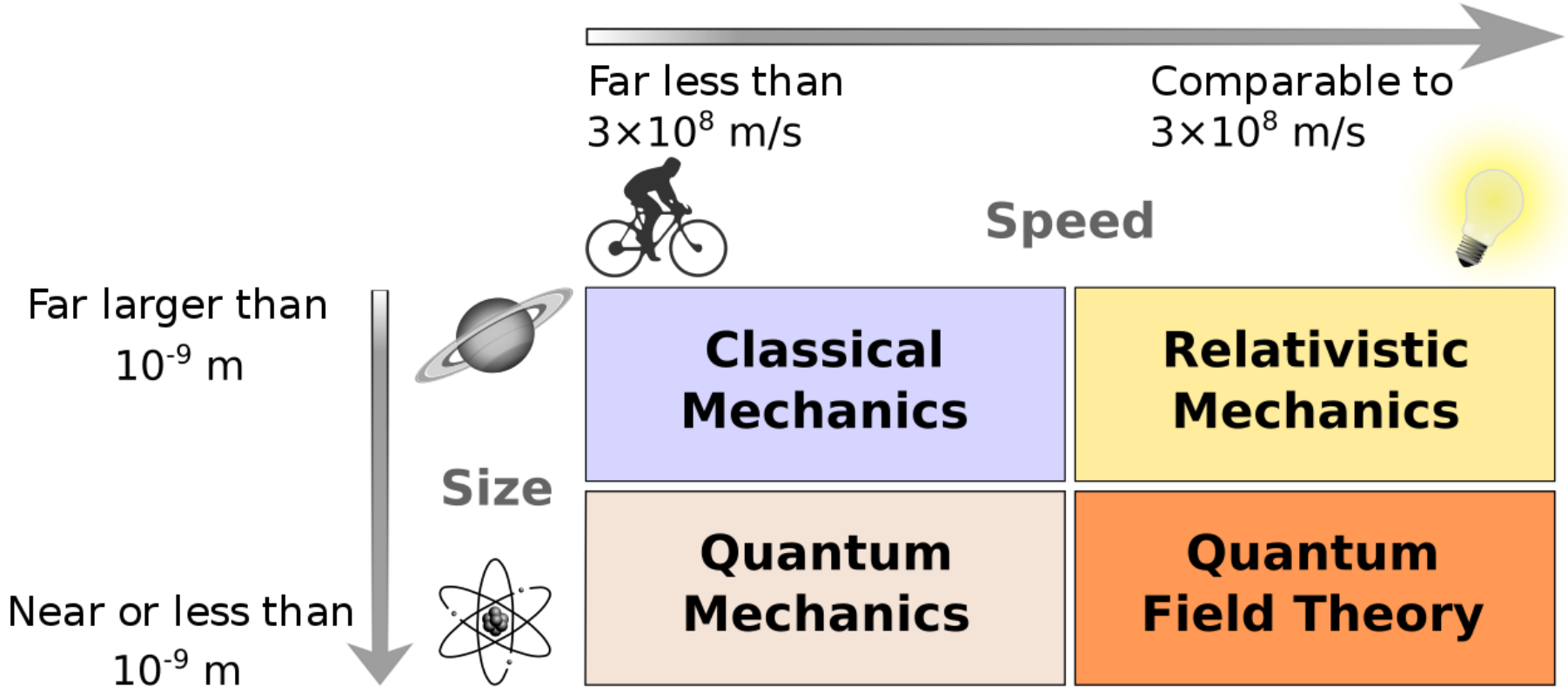



- Classical mechanics
- Acoustics
- Optics
- Thermodynamics
- Electromagnetism

- Atomic physics
- Nuclear physics
- Quantum mechanics

https://en.wikipedia.org/wiki/Branches_of_physics

# Basic Domains of Physics




https://en.wikipedia.org/wiki/Branches_of_physics#Classical_mechanics

# Major Fields of Physics

| Field | Subfields | Major theories | Concepts |
|---|---|---|---|
| Nuclear and particle physics | Nuclear physics, Nuclear astrophysics, Particle physics, Astroparticle physics, Particle physics phenomenology | Standard Model, Quantum field theory, Quantum electrodynamics, Quantum chromodynamics, Electroweak theory, Effective field theory, Lattice field theory, Lattice gauge theory, Gauge theory, Supersymmetry, Grand Unified Theory, Superstring theory, M-theory | Fundamental force (gravitational, electromagnetic, weak, strong), Elementary particle, Spin, Antimatter, Spontaneous symmetry breaking, Neutrino oscillation, Seesaw mechanism, Brane, String, Quantum gravity, Theory of everything, Vacuum energy |
| Atomic, molecular, and optical physics | Atomic physics, Molecular physics, Atomic and molecular astrophysics, Chemical physics, Optics, Photonics | Quantum optics, Quantum chemistry, Quantum information science | Photon, Atom, Molecule, Diffraction, Electromagnetic radiation, Laser, Polarization (waves), Spectral line, Casimir effect |
| Condensed matter physics | Solid-state physics, High-pressure physics, Low-temperature physics, Surface physics, Nanoscale and mesoscopic physics, Polymer physics | BCS theory, Bloch wave, Density functional theory, Fermi gas, Fermi liquid theory, Many-body theory, Statistical mechanics | Phases (gas, liquid, solid), Bose–Einstein condensate, Electrical conduction, Phonon, Magnetism, Self-organization, Semiconductor, superconductor, superfluidity, Spin, |
| Astrophysics | Astronomy, Astrometry, Cosmology, Gravitation physics, High-energy astrophysics, Planetary astrophysics, Plasma physics, Solar physics, Space physics, Stellar astrophysics | Big Bang, Cosmic inflation, General relativity, Newton's law of universal gravitation, Lambda-CDM model, Magnetohydrodynamics | Black hole, Cosmic background radiation, Cosmic string, Cosmos, Dark energy, Dark matter, Galaxy, Gravity, Gravitational radiation, Gravitational singularity, Planet, Solar System, Star, Supernova, Universe |
| Applied physics | Accelerator physics, Acoustics, Agrophysics, Atmospheric physics, Biophysics, Chemical physics, Communication physics, Econophysics, Engineering physics, Fluid dynamics, Geophysics, Laser physics, Materials physics, Medical physics, Nanotechnology, Optics, Optoelectronics, Photonics, Photovoltaics, Physical chemistry, Physical oceanography, Physics of computation, Plasma physics, Solid-state devices, Quantum chemistry, Quantum electronics, Quantum information science, Vehicle dynamics | | |

https://en.wikipedia.org/wiki/Physics#Research_fields

# Solid State Physcis?

- Solid State Physics is the study of rigid matter, or solids, through quantum mechanics, crystallography, and electromagnetism.

# Why Solid State Physcis?

- Solid is one of the four fundamental states (solid, liquid, gas, and plasma) of matter and also most of the elements in periodic table are in the form of solid at standard temperature and pressure.
- Solid state physics is the largest branch of condensed matter physics and also a theoretical basis of materials science.

# Structure of the Course

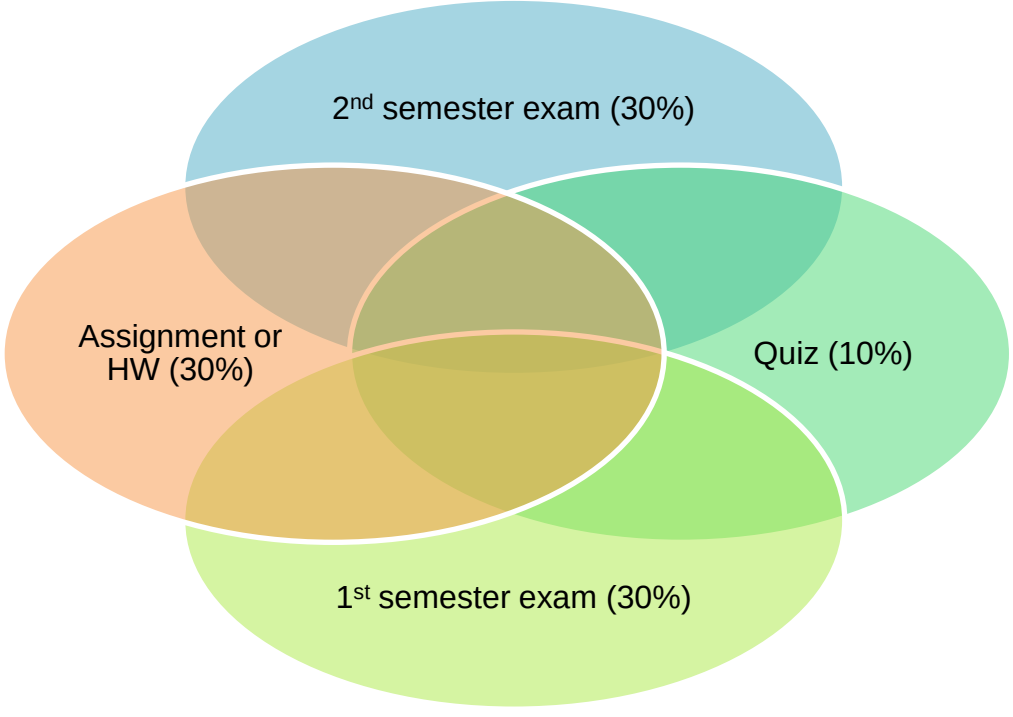
For the first semester

- Introduction to solid state physics
- Atomic and electronic structure
- Atomic bonding
- Crystal structure
- X-rays diffraction
- Crystal imperfection
- Atomic diffusion
- Atomic vibration
- Thermal properties of materials

For the second semester

- Free electrons in crystals
- Band theory
- Semiconducting properties of materials
- Dielectric properties of materials
- Optical properties of materials
- Magnetic properties of materials
- Superconductivity
- Modern researches of solid materials

# Study Guide of the Course



# Main Reference Books


1. Wahab MA. Solid State Physics: Structure Materials: Alpha Science International, Limited; 2017.
2. Simon SH. The Oxford Solid State Basics: OUP Oxford; 2013. and Properties of