✓ **Chapter 10**: The Schrodinger Equation in Three dimension

- Central Potentuial
- Conditions and Normalization Condition
- Examples

  -Free particle

  - Infinite potential well

  -Finite potential well

  -Square well (bound states)

✓ **Chapter 7**: Scattering

- Lippmann-schwinger equation
  - Position basis
  - Momentum basis
  - Differential cross section
- Born approximation
  - First order born approximation
  - Example1: scattering by yukawa potential
  - Example2: scattering by coulomb potential
  - Born amplitude with spherically symmetric potential
  - Validity of the first order born approximation
  - The higher order born approximation
- Optical Theorem
- Eikonal approximation
- Method of partial waves
  - Unitarity and phase shifts
  - Connection with the Eikonal approximation
  - Determination of phase shifts
  - Example: Hard sphere scattering
  - Low and high energy limits of tan (δ_l)

- Low energy scattering and bound states
  - Zero energy scattering and bound states
  - Relation between scattering length and bound state energy
  - Bound states as poles of $\delta_l(k)$
- Resonance scattering
- Inelastic electron-atom scattering
  - Example: Interaction of incident electron with nucleus
  - Definition of the form factor
  - Stopping power
  - Nuclear form factor

✓ **Capter11**: Nuclear reaction

- Type of nuclear reaction
  - Mechanism of nuclear reaction
- Conservation laws
  - Conservation of total energy and liner momentum
  - Nuclear reaction in the laboratory
  - Threshold energy
  - Double valued region
  - Q-value as function of ϑ, T_a and T_b
  - Q_{ex}
  - Nuclear reaction in the center-of-mass system
  - Conservation of total angular momentum and parity and isospin
  - Isospin
- Cross section
  - Definition of the cross section
- Scattering
  - Coulomb scattering
  - Elastic coulomb scattering (Rutherford scattering)
  - Inelastic coulomb scattering

- Nuclear scattering
- Scattering and Reaction Cross Sections
- Optical Model
  - Optical potentials
- Reaction Mechanisms
  - Compound nucleus reactions
  - Direct Reactions

✓ **Capter13**: Nuclear Fission

- Why nuclei fission?
- Characteristics of fission
  - Mass Distribution of Fragments
  - Number of Emitted Neutrons
  - Radioactive Decay Processes
  - Fission Cross Section
- Energy in fission
- Fission and nuclear structure
- Controlled fission reactions
- Fission reactions
- Radioactive fission product

✓ **Capter14**: Nuclear fusion (Thermonuclear fusion)

- Basic fusion processes
- Characteristics of fusion
- Solar fusion
- Controlled fusion reactor

✓ **Capter9**: Fusion

- Introduction
- The compound nucleus
  - The compound nucleus and its decay
  - Stability in the mass
  - Stability in angular momentum
- Fusion above the barrier
  - The classical fusion cross section
  - Compound nucleus stability and the fusion cross section
  - The yrast-line limitation
  - The critical distance
  - Summary of the classical description of fusion
  - A classification of nuclear reactions
- Sub-barrier fusion
  - The transmission coefficient the WKB approximation
  - Tunnelling through a parabolic barrier
  - Semiclassical transmission in nuclear fusion
  - Quantal barrier penetration

Coupled Channels Fusion Reactions