

Temporary Outline of Study Groups

1. Quantum Mechanics
 - a. Dirac notation & a brief intro. to linear algebra & Operator (Matrix Representation), commutator and anticommutator (relation between commutator & Poisson bracket cf. Dirac : QM), Uncertainty Principle, Fourier Transformation, Delta Function
 - b. Heisenberg & Schrödinger Pictures & their E.O.M.s
 - c. Solving the 1-D Schrödinger Eq with a given time-indep potential (cf. Griffith Chapter 2)
 - d. S.H.O. in Q.M. in the sight of a and a^\dagger (cf. Sakurai chapter 2.3 or Griffith chapter 2.3.1)
 - e. General Angular Momentum & simultaneous eigenkets, Additional Angular Momentum, Schrödinger Eq in spherical coordinates, LRL vector & Accidental SU(2) symmetry (cf. Sergi Escane : LRL vector), Solution to the Hydrogen-like Atom
2. Electromagnetism
 - a. Homogeneous Maxwell Eqs & their derivations (potential and vector potential)
 - b. Calculating Potential through Laplace Eq, Uniqueness Theorems & Mirror Charge
 - c. EM waves
 - d. Inhomogeneous Maxwell Eqs & Poisson Eq & Green's Function (potential and vector potential)
 - e. Some Examples for Maxwell Eqs + B.C. (cf. Griffith 4th ed. 2.3.5)
3. Classical Mechanics
 - a. Lagrangian & Hamiltonian formalism for particles **and fields**, E.O.M.
 - b. Noether Theorem & Noether current & conserved charge
 - c. Passive & active transfs, global & local symmetries
 - d. Gauge symmetry & gauge fixing, constraint, **Dirac bracket, conserved charge**
 - e. Poisson bracket
 - f. Canonical transf, Hamilton-Jacobi Eq.
 - g. Rotation frame, Coriolis force
 - h. Differential & integration equations for central force field
 - i. Kepler Laws, LRL vector, **SO(4)** (cf. Sergi Escane : LRL vector)
 - j. Virial Theorem

PS: Topics with deeper color and a underline are for those who want to learn more.

- Recommended books for QM :
 - a. Steven Weinberg, "Lectures on Quantum Mechanics" 2nd ed.
 - b. J. J. Sakurai and Jim Napolitano, "Modern Quantum Mechanics" 3rd ed.
 - c. R. Shankar, "Principles of Quantum Mechanics" 2nd ed.
 - d. David J. Griffiths and Darrell F. Schroeter, "Introduction to Quantum Mechanics" 3rd ed.
 - e. Nouredine Zettili, "Quantum Mechanics- Concepts and Application" 2nd.
 - f. P. A. M. Dirac, "Principles of Quantum Mechanics"
- Recommended books for E&M :
 - a. David J. Griffiths, "Introduction to electrodynamics" 4th ed.
 - b. John David Jackson, "Classical Electrodynamics" 3rd ed.
 - c. Roald K. Wangsness, "Electromagnetic Fields" 2nd ed.
- Recommended books for Classical Mechanics:
 - a. Vladimir I. Arnold, "Mathematical Methods of Classical Mechanics"
 - b. "Classical Mechanics" by H. Goldstein, C.P. Poole, JR. J.L. Safko, 3rd edition
 - c. L.D. Landau and E.M.Lifshitz , "Mechanics"
 - d. L.D. Landau and E.M.Lifshitz, "The Classical Theory of Fields"
 - e. David Tong, "Lectures on Quantum Field Theory", section 1
 - f. Marc Henneaux and Claudio Teitelboim, "Quantization of Gauge Systems"