



Particle Physics (Course Handout)

PHY680A, Units: 3-0-0-0(9)

Prerequisite: Quantum Field Theory-I (PHY681)

Instructor: Sabyasachi Chakraborty

✉: sabyac@iitk.ac.in

1 Introduction to Particle Physics: (~ 3)

- Inventory of elementary particles, fundamental interactions, and discoveries.
- Relativistic Kinematics (Scattering and decays).

2 Spontaneous symmetry breaking: : (~ 6)

- Spontaneous breaking of global symmetries, Goldstone's theorem.
- Spontaneous breaking of local symmetries, Higgs mechanism, etc.

3 Weak Interaction and electroweak theory: (~ 14)

- Parity violation, $V - A$ theory.
- Charged and neutral current interactions, Cabibbo and Weak mixing angles, CP violation.
- Glashow-Weinberg-Salam model, Higgs phenomenology.

4 Strong Interactions: (~ 15)

- QCD Lagrangian, Renormalization Group Evolution, Asymptotic Freedom.
- Effective theories for QCD (Chiral perturbation, HOET), Spinor helicity formalism, Jet Physics.

5 Beyond Standard Model: (~ 1-2)

- Quick review of beyond Standard Model physics.

Evaluation (Tentative): Assignments-20%, Mid Sem-30%, End Sem-50%.

References

- [1] [Aitchison & Hey](#), *Gauge Theories in Particle Physics*.
- [2] [Halzen & Martin](#), *Quarks and Leptons*.
- [3] [Palash B. Pal](#), *An Introductory Course of Particle Physics*.
- [4] [Matthew D. Schwartz](#), *Quantum Field Theory & the Standard Model*.
- [5] [Böhm, Denner, Joos](#), *Gauge Theories of the Strong & Electroweak Interaction*.