
Particle Physics - NPAC

June 12, 2014

1 Detailed introduction

1.1 Historical introduction

1.2 Standard Model

2 Kinematics

2.1 Relativity

2.2 Kinematics

3 Symmetries

3.1 Spin

3.2 Isospin

3.3 Discrete Symmetries

4 Collisions, decays

5 Feynman rules illustrated with a toy model

5.1 Generic rules for 1st order diagrams

5.2 Fast extension to higher orders

6 Quantum Electrodynamics

6.1 Photon

6.2 α_{QED} running

6.3 Radiative corrections

7 QCD

7.1 Historical and phenomenological introduction

7.2 QCD Feynman rules

7.3 Structure functions

7.4 Hadronic collisions

7.5 Spectroscopy

8 Weak interactions

8.1 Couplings

8.2 Muon decay

8.3 Pion decay

8.4 Quark coupling

8.5 Neutral currents

8.6 Electroweak unification

8.7 Neutrinos

9 Standard Model and beyond

9.1 Summary

9.2 Spontaneous symmetry breaking

9.3 Higgs boson de Higgs, searches and discovery

9.4 Standard Model tensions

9.5 Search for New Physics and future experiments in particle physics

References

- [1] D. H. Perkins, *Introduction to high energy physics*, Cambridge University Press.
- [2] A. Seiden, *Particle physics - a comprehensive introduction*, Addison-Wesley.
- [3] F. Halzen and A. D. Martin, *Quarks and leptons: an introductory course in modern particle physics*, John Wiley & Sons.
- [4] B. R. Martin and G. Shaw, *Particle physics*, John Wiley & Sons.
- [5] D. Griffiths, *Introduction to elementary particles*, Wiley-Vch.
- [6] Fayyazudin and Riazuddin, *A modern introduction to particle physics*, World Scientific.
- [7] C. Itzykson and J.-B. Zuber, *Quantum field theory*, Dover.
- [8] C. Cohen-Tannoudji, B. Diu and F. Laloe, *Quantum mechanics*, Wiley-Vch.
- [9] W. Rindler, *Introduction to special relativity*, Oxford University Press.
- [10] F. Scheck, *Electroweak and strong interactions - an introduction to theoretical particle physics*, Springer-Verlag.
- [11] Q. Ho-Kim and X.-Y. Pham, *Elementary particles and their interactions: concepts and phenomena*, Springer-Verlag.
- [12] H. Murayama, *Standard Model, Introductory lecture*, http://videlectures.net/site/normal_dl/tag=65671/cernstudentsummerschool09_murayama_sm_01.pdf.