

Weak interaction

1. Historical review and basic concepts: 4 fermion coupling and the Fermi constant; parity violation; V-A current; universality and Cabibbo theory; neutral currents; W and Z bosons. (O 1- O 2, N 21.1-21.4)
2. Conserved quantum numbers and selection rules in weak interactions: the precise form of the current \times current Lagrangian (neutral currents!). (O 1- O 2, N 21.1-21.4)
3. Muon decay: amplitude; energy spectrum; polarized muon decay; V-A checks. (O 3.1- O 3.3)
4. Strangeness conserving semileptonic processes: general description; $\pi \rightarrow l\nu_l$ decay; the β decay of charged pions. (O 4- O 5)
5. β decay: formfactors and their properties; energy spectrum; angular correlations, polarized and nuclear β decays; g_A/g_V . (O 4- O 5)
6. Conserved isovector current: consequences and experimental verification; ($\pi^+ \rightarrow \pi^0 e^+ \nu_e$, β decay, $\Sigma \rightarrow \Lambda e \nu$). (O 4- O 5)
7. Axial formfactors: PCAC; Goldberger - Treiman relation. (O 5.5 CL 5.4)
8. Semileptonic decays of K mesons and hyperons (O 6.1- O 6.7)
9. Strangeness changing non leptonic decays (O 7.1- 7.2, 7.4)
10. Non leptonic decays of K mesons and the neutral K meson (O 10.1-10.3, N 26)
11. GIM mechanism: charmed particles and their weak decays. (O 11.1-11.3, CL 12.2)
12. τ lepton, b quark, flavour families (O 13.1-13.5, 14.1-14.3)
13. Kobayashi Maskawa model (O 15.1-15.3)
14. The limits of the current \times current theory: the problems of weak vector bosons. (O 18.1-18.6)
15. Spontaneous symmetry breaking: Goldstone theorem, Goldstone bosons. (O 20.1-20.3, IZ 11.2.2)
16. Higgs mechanism (O 20.4-20.5, CL 11.2)
17. The bosonic sector of Salam-Weinberg model: W and Z bosons, masses and couplings. (CL 11.1-2)
18. The fermionic sector of Salam-Weinberg model (CL 11.2-3)
19. The idea of grand unification (CL 14.1-14.3)
20. Neutrino oscillation

Suggested reading

O: L.B. Okun: Leptons and quarks (North Holland, 1984)

CL: T.P. Cheng and L.F. Li: Gauge theory of elementary particle physics (Oxford Univ. Press, 1988)

N: O. Nachtmann: Elementary particle physics (Springer, 1989)

IZ: C. Itzykson, J.B. Zuber: Quantum field theory (McGraw-Hill, 1980)

W. Greiner and B. Müller: Gauge theory of weak interactions (Springer, 1993)

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