Lecture: Particle Physics

Lecturers:	Prof. S. Degenkolb Prof. U. Uwer Prof. T. Plehn (Theory blocks)
Venue:	INF 227, HS2
Time:	Thursdays, 14:15 - 16:00, Fridays, 14:15 - 16:00
Web Page:	https://uebungen.physik.uni-heidelberg.de/vorlesung/20242/1950

The web-page contains a table with the week to week topics and the uploaded lecture material.

You can also find the links to the tutorial groups and the exercise sheets on the lecture page.

Tutorials: Thursdays 16:15-18:00 (1 group)
Fridays, 09:15-11:00 and 11:15-13:00 (4 groups)
Will start next week!

Exercise sheets: Appear on the web always on Tuesdays (1st next week)
Need to be handed in by Tuesday, 18:00 the week after:
Upload in the Übungsgruppenverwatlung

Will be discussed in the tutorials following the hand-in date.

The exercises will not be corrected in detail, but you will get 0 or 1 point depending if you did a decent attempt to solve the problem even if the solution is not 100% correct.

You can hand-in your exercises in groups of maximal three students. Please put always all names on the sheet. We expect every student of the group to be able to present and explain the solutions she/he has handed in.

60% of the points on the sheets are required to be admitted for the exam.
Admissions to exams from previous years are not valid this year.

Date of written exam will announced later (we foresee it in the week of Feb 10th)

Lecture concept and topics:

The lecture concept is slightly modified w/r to earlier years where the lecture followed closely the book from M. Thomson.

This term, we have included three blocks of “light theory”, each block w/ 3 lectures. Thomson’s book is still covering large fractions of the lecture material.

Theory blocks: given by T. Plehn.

- QED Lagrangian and Fenyman rules, calculation of ee→ff
- Electroweak interactions, Feynman graphs for W, Z
- QCD Lagrangian and Feynman rules

This term’s lecture will be followed next semester by a new lecture “Advance Particle Physics” which will also contain theory blocks.

Lecture program (preliminary):

Lecture	Date	Titel
1	Do, 17.10.	Introduction: Fermions, Interaction, Feynman Graphs
2	Fr, 18.10.	Concepst: Natural units, spez. Relativity, golden rule & Matrix element & LISP, cross section, lifetime
6	Do, 24.10.	Theory 1: QED Lagrangian, Spinors, feynman rules, Chirality, helicity, gamma5, ee-> ff , R_had
7	Fr, 25. 10.	
8	Do, 31.10.	
	Fr, 01.11.	Holiyday
3	Do, 7.11.	Particle detetction. Recap: Bethe-Bloch, Bremsstrahlung, Phtoton IA (p.e., compton, pair production), Chrenkov
4	Fr, 08.11.	Particle Detectors: Spectrometer, calorimeter, PID
5	Do, 14.11.	Accelerators
9	Fr, 15.11.	ee-Annihilation and discovery of tau, c, b quarks
10	Do, 21.11.	Weak interaction: Recap Wu & Partity violation, Goldhaber
11	Fr, 22.11.	Weak interaction: V-A Feynmanrules, effective Theory
12	Do, 28.11.	Weak interatcion: muon decay, pion decay.
13	Fr, 29.11.	Theory 2: "Electroweak Lagrangian" - Sigma model, gauge bosons, sin2thetaw, rho parameter
14	Do, 05.12.	
15	Fr, 06.12.	
16	Do, 12. 12.	Recap: Discovery of Z and W-boson Also: ppbar & stochastic cooling, UA1,2; Z-Pole Physics
17	Fr, 13. 12.	Physics at Z-pole: Z parameters, asymmetry and couplings, sin2thetaw,
		W-pair production and W measuements, Atomic parity violation
		Representations and Statis Quark Model
		Predictions of the Static Quark Model
		DIS: Proton radius and FF, structure functions, QPM, interpretation of SF, neutrino nucleon scattering, extraction of PDFs,snapshot: scaling violation,
22	Do, 16.01.	DIS: Proton radius and FF, structure functions, QPM, interpretation of SF, neutrino nucleon scattering, extraction of PDFs,snapshot: scaling violation,
23	Fr, 17.01.	Theory 3: "Introduction to QCD" - Lagrangian, Feynman rules, color factors, qqbar annihilation, running of alphas
24	Do, 23.01.	
25	Fr, 24.01.	
26	Do, 30.01.	QCD tests in ee-Annihinaltion
27	Fr, 31.01.	Neutrino Oscillation and Neutrino Masses