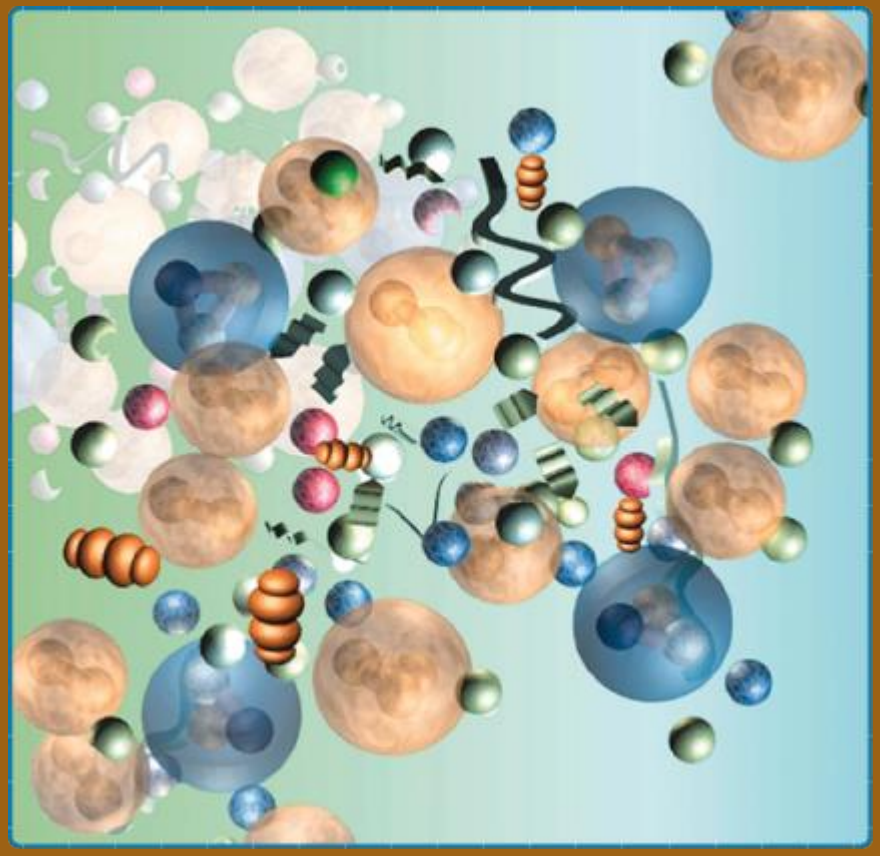
LUND UNIVERSITY

Modern Experimental Particle Physics

http://www.hep.lu.se/courses/fyst17-extp35/



Introductory notes, January 22, 2014

FYST17
EXTP35

Division of Particle Physics (www.hep.lu.se)

Teachers:
Oxana Smirnova
Vincent Hedberg

and invited lecturers

Introductory meeting, 22.01.2014

1. Learning outcomes
2. Required knowledge
3. Course plan
4. Lecture schedule
5. Assessment.
6. Projects (seminars)
7. Course literature
8. CERN summer student program

1. Learning outcomes

- Particle physics is the most fundamental of experimental natural sciences
- The purpose of this course is to give advanced knowledge on the current experimental particle physics aspects:
  - Current challenges
  - Experimental programs at world research centers, particularly at CERN
  - Future directions
- The student are also expected to learn how to:
  - Acquire scientific information, work with scientific publications in the area
  - Assess challenges in the area, solve problems
  - Communicate and discuss project results

2. Required knowledge

- Basic knowledge of four-vectors, relativistic kinematics, quantum mechanics
  - Check e.g. the “Notes on particle kinematics, cross-sections etc. ” at the course Web page
- Basic prior knowledge of particle physics is also beneficial

3. Course plan

- 16 lectures covering
  - Introduction to particle physics
  - Experimental methods
  - Modern-day challenges
- Home work: problems
  - hand in either at the respective lecture or leave in the teachers' mail box in the corridor B3xx
  - Problems are explained during 3 problem solving sessions
- Some invited presentations about current research activities will also be arranged
- Students' projects: mini-seminars

4. Lecture schedule

- Available from the course home page
- Course start: Friday, January **24**, 15:15 (H530)
- 3 times a week, in H530 (H322 on Feb 12, Feb 26 and Mar 5)
  - Start at 15:15
  - Including problem solving
- Student project presentations in March
- Written examination: March 21 (other dates can be arranged, too)

5. Assessment

- 7.5 ECTS credits, requires:
  - do homework (3 sets, 4-5 problems each)
  - present the project work on a selected topic, at a dedicated mini-seminar (ca 20 min)
  - pass written examination (4 hours)
- Scoring points for the final grade:
  - Exam: 6 complex questions, 50% of the final score.
    - To pass, at least half of the questions must be answered
  - Exercises: 10% of the final score. Exercises are evaluated by the teacher and points are awarded accordingly.
  - Project work: 40% of the final score. The contents of the work will be evaluated based on the given presentations.
  - ECTS grades A-E are assigned according to the standard recommended distribution
  - F is a failure to either pass the exam, do the project or submit exercises

6. Suggested project topics

- Students are asked to pick own subjects, some examples:
  - Discovery of the top quark
  - Discovery of neutrino oscillations
  - Discovery of CP violation
  - Pentaquarks
  - Search for the Higgs boson
  - Searches for supersymmetry
  - Dark matter
  - Dark energy
  - *Own (relevant) topics are most welcomed!*

7. Course literature

- B.R. Martin & G. Shaw, "Particle Physics" (3rd edition), 2008, publ. John Wiley & Sons Ltd
  - Certain chapters are extended with additional information
- Reviews and notes distributed/suggested by the lecturers
- Course homepage contains links to previous courses and (very old) video-recorded lectures, see http://www.hep.lu.se/courses/fyst17-extp35/
- Other related information at the Division's homepage: http://www.hep.lu.se/education.html

8. CERN Summer Student program

- A unique opportunity to enjoy a summer in Switzerland, learning bleeding-edge science and technology and meeting new friends from all over the world
- Google "CERN Summer Student Program"
- 2-3 months of training at CERN: work in a research group, lectures, student sessions, visits to experiments, workshops,…
- Possibility to make a diploma work

8. CERN Summer Student program

- Applications deadline in 2014: January 31
- Eligibility:
  - Undergraduate students of physics, engineering or computing
  - CERN member state nationality
    - Limited places for non-member states exist
  - At least 3 years of university studies
  - No previous work at CERN
  - Good knowledge of English
- Electronic application submission; 2 recommendation letters are required