

Collider Particle Physics

Introduction to the course



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Chapter Summary

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How to contact the teacher

- ❑ Professor: Claudio Luci; claudio.luci@roma1.infn.it
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- ❑ Assistant Professors: Massimo Corradi; massimo.corradi@roma1.infn.it
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- ❑ Web site: http://www.roma1.infn.it/people/luci/corso_cpp.html (try this [link](#))
- ❑ **reception time:**
 - Monday: 11-12 (in my office) ; or 15-19 (in the LabSS)
 - Tuesday: 12-13 (in my office); or 16-18 (in my office)
 - Wednesday: 11 – 12 (in my office)
 - or send me an email to choose a date

Class Schedule

Course of 6 CFU: 3 CFU lectures + 3 CFU exercises
→ $3 \times 8 + 3 \times 12 = 60$ hours in the classroom

❑ Class times:

➤ Tuesday: 14-16; Wednesday: 8-11 Careri Classroom, Marconi Building

❑ First Lecture: Tuesday September 30th; Last Lecture: Wednesday December 17th

➤ → 24 days (12 weeks) = 60 hour lectures

❑ In principle we have a few more hours in January, that we could use as backup, just in case, or to do something else (I have a few ideas).

Lesson Program

- ☐ Accelerators and Colliders
- ☐ The first hadron collider: the ISR at CERN
- ☐ A reminder of the Standard Model Principles
- ☐ Discovery of the W and Z at the SppS
- ☐ LEP Physics (Lep1 and Lep2)
- ☐ Tevatron and the discovery of the quark top
- ☐ Hera Physics (deep inelastic scattering and more)
- ☐ LHC Collider
- ☐ Discovery of the Higgs boson at LHC
- ☐ Precision Physics at LHC
- ☐ New Physics searches at LHC
- ☐ CP violation in the B_0 system at B factories (if we will run out of time, it will be excluded from the program)

Bibliography

- ☐ Nuclear and Particle Physics; Burcham and Jobes; Pearson Prentice Hall
 - ☐ Elementary Particle Physics Yorikiyo Nagashima – Wiley VCH – 3 vol
 - ☐ Mark Thomson; Modern Particle Physics (2013) Cambridge University Press
 - ☐ Introduction to Particle Physics; A.Bettini
 - ☐ Martin – Shaw; Particle Physics
 - ☐ Perkins; Introduction to high energy physics
 - ☐ Particles and Nuclei; Povh, Rith, Scholz, Zetsche;
 - ☐ Griffiths; Introduction to high energy physics
 - ☐ Halzen-Martin; Quark & Leptons
 - ☐ Cahn-Goldhaber; experimental foundations of particle physics
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- ☐ Slides presented during the lectures that you can find on my web page
 - ☐ Other material that I have and/or I will put on my web page

<http://pdg.lbl.gov/>

Exams

❑ It is oral only.

1. you can choose the first topic among the ones presented during the lectures.
2. Then we will ask two more questions.

***Pay attention:** I am used to give also a “historical” introduction of the different subjects in order to better understand why some choices were made instead of others, or to understand what were the people feelings and/or the technical challenges at that time, but the “history” is not part of the exam, so don’t focus on these parts.*

During the lectures we will see a lot of materials, sometimes with complicated formulae and/or difficult analysis techniques. The aim of the exam is not a matter of determining whether you are capable of remembering everything by heart, but rather whether you have assimilated the basic facts of each topic, which will become part of your background as elementary particle physicists.

What you should expect from this course

- ❑ The first experiments of particle physics, once also called *High Energy Physics*, were *fixed target experiments* with different particle beams: electrons, protons, pions, muons, kaons and cosmic rays. Then, the need for higher energies, shifted the focus toward *Collider Experiments*, using only electrons and protons and their antiparticles.
- ❑ I will tell you about the basic facts of the Colliders, the Detector requirements, the new analysis methodologies that were developed in the early Colliders and I will remind you the main properties of the Standard Model that were established in the Collider Experiments; I will also remind you the basic principles of Particle Physics that you studied in other mandatory courses, like Particle Physics.
- ❑ My goal (or at least, my hope) is that you will consolidate, by the end of this course, the knowledge of the fundamental laws of Particle Physics and you will get the basic facts of a Collider Experiment, so that you will be able to move forward on your own during your thesis work and be able to understand, for instance, the jargon used in a Collider Experiment meeting.
- ❑ Some topics (accelerators, detectors, Standard Models, ...) have been covered in more details in other courses that are not mandatory, therefore not followed by everyone, so I will assume that nobody followed those courses ... apologies but ... repetita iuvant.



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