Physics 461

Elementary Particles
Spring Semester 2011

Room:	Seaver Hall 109
Time:	**MW 3:20 - 4:35 PM**
Instructor:	Dr. Gabriele Varieschi
Office:	Seaver Hall - 110
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Office hours:	T 10:00-11:30 am; F 11:00am-12:30 pm; and by appointment.
Required Text:	**David Griffiths – Introduction to Elementary Particles – Wiley – Second Edition – ISBN 978-3-527-40601-2**
Objectives and Topics:	We will cover several chapters of the book in the following order: Part I – Preliminaries: Historical introduction and discovery of the fundamental particles. Elementary particles dynamics and the four fundamental interactions. Relativistic kinematics. Applications to classical and relativistic collisions. Part II – Particle physics theory: Symmetries and conservation laws. Discrete symmetries and CPT theorem. Bound states and relativistic corrections. Feynman calculus and golden rules. Decay rates and cross sections. Introduction to quantum electrodynamics. Part III – Current status of particle physics and recent discoveries. Neutrino oscillations and masses. Higgs boson. Supersymmetry and string theory. Dark matter and dark energy. **Prerequisite or concurrent enrollment: PHYS 322.**
Learning Outcomes:	Understand the experimental foundations of particle physics and the basic principles of particle accelerators and detectors. Conceptually understand the theoretical framework of particle physics and the use of Feynman diagrams. Be able to solve problems of increasing complexity, dealing with the applications of particle physics. Understand the current status of the field and future challenges.
Tests:	There will be two tests during the semester. They will all count toward your final grade, so please try not to miss any of them.
Test Dates:	TBA
Final Exam:	The final exam is cumulative, equivalent to 2 tests, and will probably be a take-home exam, during the final week of the semester.
Homework:	Homework assignments will be given, typically one for each chapter of the book. Problem sets will be collected, graded, and will count toward the final grade. Solutions to the problems will be reviewed in class, with student participation.

Grading:	Class Attendance & Participation	10 %
	Homework	18 %
	Test 1	18 %
	Test 2	18 %
	Final Exam	36 %

Test Grading (approx.): <50%=F; 50-54%=D; 55-69%=C range; 70-84=B range; >84=A range.

Academic Honesty: Academic dishonesty will be treated as an extremely serious matter, with serious consequences that can range from receiving no credit for assignments/tests to expulsion. It is never permissible to turn in any work that has been copied from another student or copied from a source without properly acknowledging the source. It is your responsibility to make sure that your work meets the standard of academic honesty set forth in the "LMU Honor Code and Process" in the Undergraduate Bulletin 2008-2010.

Syllabus changes: If necessary, this syllabus and its contents are subject to revision; students are responsible for any changes or modifications announced in class.

Have a good semester. Good luck !

Physics 461 – Bibliography

Introductory Books (at the level of Scientific American)

- Close, Marten, and Sutton – The Particle Explosion – Oxford University Press (*)
  The best-illustrated book of particle physics.
- Carrigan and Trower – Particles and Forces at the Hearth of Matter – Scientific American (*)
  A classical collection of readings from Scientific American.
- Solomey – The Elusive Neutrino – Scientific American Library (*)
  The illustrated story of the (still) most puzzling particle of all.

History of Particle Physics

- Weinberg – The discovery of Subatomic Particles – Freeman (*)
  A classic history, written by a Nobel Laureate.
- Cahn and Goldhaber – The Experimental Foundations of Particle Physics – Cambridge
  Reprints of all the fundamental papers of particle physics with extensive annotations. Mostly on the experimental side.
- Ezhela, et al – Particle Physics One Hundred Years of Discovery – AIP Press
  Year-by-year history, through the abstracts of the fundamental papers. A key reference book.

Experimental Particle Physics

- Perkins – Introduction to High Energy Physics – Addison Wesley (*)
  The most "classical" introduction to particle physics from the experimental, phenomenological side.
- Sundaresan – Handbook of Particle Physics – CRC Press
  A new reference book with an extended overview of particle accelerators and detectors.

Undergraduate level books

- Griffiths – Introduction to Elementary Particles – Wiley (*)
  Our textbook, already a classic one.
- Halzen and Martin – Quarks and Leptons – Wiley (*)
  Another good introduction written by two experts of the field.
- Kane – Modern Elementary Particle Physics – Addison Wesley (*)
  Another introduction centered more on the theory rather than the experiments.

More advanced – Graduate level books

- Mandl and Shaw – Particle Physics – Wiley
- Cottingham and Greenwood – An Introduction to the Standard Model of Particle Physics (*)
- Cheng and Lee – Gauge theory of elementary particle physics

Quantum Field Theory

- Mandl and Shaw – Quantum Field Theory – Wiley
- Peskin and Schroeder – An Introduction to Quantum Field Theory (*)
- Weinberg - The Quantum Theory of Fields – Vol. I-II-III – Cambridge (*)

(*) Available at the LMU Library.

Websites

- http://pdg.lbl.gov/
  The Particle Data Group web page, where you can order for free *The Review of Particle Physics* (both in booklet and full review forms), which is the "Bible" of the particle physicist. You should get a copy of this. Many other interesting links.
- http://particleadventure.org/
  The Particle Adventure. A leading educational site.
- http://www.aps.org/
  The American Physical Society. See the many interesting links.
- http://public.web.cern.ch/public/
  CERN European Laboratory for Particle Physics.
- http://www.slac.stanford.edu/
  Stanford Linear Accelerator Center.
- http://www.fnal.gov/
  Fermi National Accelerator Laboratory.
- http://www.bnl.gov/
  Brookhaven National Laboratory.
- http://www.lngs.infn.it/
  Gran Sasso Italian Laboratory.
- http://xxx.lanl.gov/
  The archive (arXiv) of physics papers in free preprint form
- http://www.slac.stanford.edu/spires/hep/
  The leading search engine for hep papers.
- and many others…