

Syllabus for PY751: High-Energy Physics I

Instructor: Martin Schmaltz

Lectures: **Mo, We 2:30-4:15 pm**, SCI B58email: schmaltz@bu.edu

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Office hours: after class, drop by, or by appointment

Course page: <http://physics.bu.edu/~schmaltz/PY751>

This is an advanced graduate course on phenomenological aspects of modern particle physics. Principal topics are the Standard Model of strong and electro-weak interactions. I hope to convey that the Standard Model is a beautiful unified description of all of particle physics, but also that it has shortcomings which indicate that the Standard Model is incomplete. PY751 will include aspects of phenomenology of hadron colliders in order to establish a connection with the LHC experiments. The course is intended for experimental and theoretical graduate students interested in particle physics. PY752 may be offered in the Spring and covers special topics of the Standard Model and physics beyond.

Prerequisites: graduate Quantum Mechanics (PY511/PY512), Electricity & Magnetism (PY521) or equivalent. If you do not fulfill the prerequisites please see me to obtain permission to take this course. PY551 and PY713/714 are not prerequisites but are helpful.

Office hours: Mo, We after class, and in my office at any time. I am usually in or near my office and happy to answer questions. You may also email for an appointment.

Homework: There will be approximately 10 homework sets due on Wednesdays in class. They will be graded by me, and for your maximum benefit you are expected to solve all problems. I encourage you to collaborate on the homework. You may consult AI, but what you hand in should be your own work and you should indicate where you “collaborated” with AI or class mates. If you have difficulties please come see me for help. Late homework submissions will only be accepted in exceptional cases with prior permission.

Exams and course grade: There will be no in-class final exam. Your course grade is determined from the n homework sets. I will use the best $n - 1$ of your n homework scores. If you miss a homework set you lose your chance to drop one of the homework scores.

Academic conduct: You are expected to be familiar with and adhere to the BU Academic Conduct Code (posted at <https://www.bu.edu/academics/policies/academic-conduct-code/>). In particular, cheating on homework will not be tolerated, and suspected cases will be treated in accordance with BU Academic Conduct procedures.

Textbook: The course is based on a set of lectures given at CERN by Michael Peskin and a copy of his hand written notes is available for download from the PY751 course page. The notes subsequently morphed into the textbook

- *Concepts of Elementary Particle Physics* by Michael Peskin (Oxford University Press). This book contains most of the material covered in this class and is recommended.

If you would like to consult additional books, here is an incomplete list.

- Halzen and Martin, *Quarks and Leptons: An Introductory Course in Modern Particle Physics*, nice text.
- Barger and Phillips, *Collider Physics*, the classic in collider physics.
- Quigg, *Gauge Theories of the Strong, Weak, and Electromagnetic Interactions*.
- Peskin and Schroeder, *Quantum Field Theory*, contains a lot of the material we will cover with a lot more Quantum Field Theory.
- Ryder, *Quantum Field Theory*, more basic than Peskin & Schroeder.
- Perkins, *Introduction to High Energy Physics*, a classic PY551 textbook.
- Thomson, *Modern Particle Physics*, a PY551 textbook.
- Grossman and Nir, *The Standard Model*, <https://www.classe.cornell.edu/~yuvalg/GNB/> a new textbook, currently free of charge in draft version.

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