

# Syllabus Advanced Particle Physics: Physics 372/472

## Lehigh University Department of Physics Fall 2017

Instructor: Professor Rosi Reed

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Text: *Modern Particle Physics 1st Edition*, by Mark Thompson, 2013

Class Times: MWF 9:10 in RM 511

Office Hours: Fridays, 10 am – 11 am, and by appointment

Course Requirements: General requirements include:

1. Attending all classes
2. Completing all assignments **on time**
3. Seeing me if you are having trouble!

Grading: Your numerical grade will be determined *approximately* as follows:

Homework	50%	You will be allowed to drop your two lowest
Final Project	20%	homework scores
Final Paper	30%	

### Primary Topics

Special Relativity	Standard Model
Symmetries and Conservation Laws	Quantum Electrodynamics
Quantum Mechanics	Quantum Chromodynamics
Fermi's Golden Rule	Feynman Diagrams
Interaction of particles and matter	Nuclear models

### Initial Competences:

1. Understand the connection between the wave-function and probability
2. Be able to perform basic calculations with special relativity
3. Understand the difference between full and partial derivatives

4. To determine whether a given reaction is possible.
5. To be able to accurately draw Feynman diagrams showing any possible reactions.
6. Have some familiarity with tree level QED calculations using Fermi's Golden rule.
7. Understand the connection between symmetries and conservation laws.
8. A basic understand of the Standard Model of particle physics

Final Competences:

1. A deeper understanding of the Standard Model of physics and its experimental verification.
2. Understand the limitations of the Standard Model and need for physics beyond it with both ideas on new physics and the experimental searches.
3. Be able to calculate tree level QED calculations
4. Understand the origin of the Feynman rules for calculations
5. Familiarity with the current state of experimental particle physics and the main detectors.
6. Use functional integrals and perturbation theory in quantum field theory.
7. Apply renormalization and regularization with quantum field theory.
8. Understand the connections of particle physics to astrophysics and cosmology.

Final Project – The final project will be a presentation on a modern topic in particle or nuclear physics. This will require a literature search and the ability to go beyond the material covered in class.

Final Paper – The final paper will be on the same topic as the final project in particle or nuclear physics. It will require Latex, so it is recommended that those who are not familiar with Latex download it and use it beforehand.

Note: As this is an advanced elective course, I will not have any exams as I expect every student will be engaged and interested in the material. However, this means the homework expectations will be consequently larger.

***Accommodations for Students with Disabilities:***

*If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, University Center C212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.*

***The Principles of Our Equitable Community:***

*Lehigh University endorses The Principles of Our Equitable Community [[http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity\\_Sheet\\_v2\\_032212.pdf](http://www.lehigh.edu/~inprv/initiatives/PrinciplesEquity_Sheet_v2_032212.pdf)]. We expect each member of this class to acknowledge and practice these Principles. Respect for each other and for differing viewpoints is a vital component of the learning environment inside and outside the classroom.*