

PHY 90 From Quarks to the Cosmos - Fall 2020

Instructor

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Office Hours: by appointment only (email me)

Course Information:

Time: MW 3:00pm-4:15 pm

Course Description

We have entered the era of large scale physics, from Black Hole mergers measured by 2.5 mile long LIGO experiment to the discovery of the Higgs Boson by 17 mile long Large Hadron Collider. The fields of astrophysics, particle physics and nuclear physics have started to blend together in order to understand events like the merger of two neutron stars. We will cover how measurements are made from subatomic world of the quark to the furthest reaches of the universe. We will cover what is known, what is likely to be true and venture into what has been merely been proposed. This class will be from the experimental standpoint, so some time will be spent on the physics of accelerators and detectors of modern physics experiments. The format of the course will be discussions of weekly reading assignments from the text and from scientific articles published within the last couple of years, and a final project (presentation + short paper).

Required Textbook

“Understanding the Universe: From Quarks to the Cosmos” by Don Lincoln

Course requirements and assessment criteria:

- Weekly reading assignments (quizzes) 10%
- In-class discussions 20%
- Homework 20%
- Final Project - 50%

Final Project The final project will be a combination of a presentation (10 minutes) and paper (5 - 10 pages with figures, not counting references) on a topic of your choice, related to issues discussed in class. Title and abstracts will be due October 12th. Final presentations

will be the last 2 weeks of the semester. The paper will be due by December 14th. More details will be presented in class.

Topics:

- History of Particle Physics
- Particle species
- How do forces work
- Higgs Boson
- Accelerators and Detectors
- Recent discoveries in nuclear, particle and astrophysics
- Exotic Physics (and unanswered questions)

Initial competences:

No specific initial competences required

Course objectives and final competences:

- Gain an appreciation for the major developments in particle, nuclear and astro-physics
- Learn the basic principles of the Standard Model of Particle Physics
- Understand the basics of how forces are treated in physics
- Gain an understanding of how detectors work in particle/nuclear/astro-physics
- Learn to perform literature searches and discuss scientific topics with a general audience

Zoom expectations

To meet the challenge of teaching and learning during the COVID-19 pandemic, Lehigh instructors and students will be adopting new forms of instruction and interaction; following new guidelines around classroom behaviors; enhancing communications; and doing our best to be patient, flexible, and accommodating with each other. In remote synchronous meetings, students are expected to attend just as they would any other Lehigh class. Zoom classes work best when all students come to class ready to participate and follow the instructor's guidelines. I will not require that anyone turn on their camera - however I do believe discussion is better when we can see each other. There will be no grading penalty for someone who does not turn on their camera. Students should respect the in-classroom

privacy of their instructors and fellow students by not taking screenshots or recording class sessions. I will record the portion of the class where I discuss the material and provide this to the students. I will not record the general classroom discussion. All recordings will be deleted at the end of the semester.

Accommodations for Students with Disabilities: Lehigh University is committed to maintaining an equitable and inclusive community and welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact Disability Support Services (DSS), provide documentation, and participate in an interactive review process. If the documentation supports a request for reasonable accommodations, DSS will provide students with a Letter of Accommodations. Students who are approved for accommodations at Lehigh should share this letter and discuss their accommodations and learning needs with instructors as early in the semester as possible. For more information or to request services, please contact Disability Support Services in person in:

Williams Hall, Suite 301
610-758-4152
indss@lehigh.edu
<https://studentaffairs.lehigh.edu/disabilities>

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

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.