Physics 441: Introduction to Particle Physics & Particle Astrophysics

Spring 2020
TuTh 2:00-3:15 pm, Chemistry Building 1228

Professor: Greg Sullivan

Prof. Greg Sullivan
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Office hours: drop-in anytime or e-mail for appointment

TA - Grader

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Course Description: A review of the field of Particle Physics & Astrophysics

Specific objectives are:

This course aims to learn about:

1. The role of relativity and quantum mechanics in modern day theories;
2. The Standard Model of Particle Physics;
3. The history of Particle Physics
4. The interactions of particles with matter and how these are used to build instruments;
5. The principles of particle accelerators;
6. The emergence of High Energy particle Astrophysics;
7. Topical subjects in contemporary particle physics and astrophysics;
8. Topical discussion on some open questions and future prospects in the field of particle physics, cosmology and astrophysics.

Prerequisites

Prerequisite: Phys401 /Co-requisite: PHYS402, or permission of instructor.

Text - Not required, but for those interested you can look at my copies to decide:

Introduction to Elementary Particles; second, revised edition, David Griffiths, Wiley-VCH ISBN: 978-3-527-40601-2

Introduction to Nuclear and Particle Physics, second edition – A. Das and T. Ferbel, World Scientific, ISBN: 978-981-238-744-8 (paperback)

Course Website

http://elms.umd.edu

We will use ELMS to communicate with the class. All homework assignments will be assigned and submitted through the ELMS course page. You may also contact us directly through our email address listed above.

Assignments:

During the semester you will be given several (3-4) homework assignments.

Class Participation:

During the semester you will be expected to miss no more than 5 of the 29 total lectures without an official documented excuse. Unexcused absences above 5 will reduce your ***participation*** score by 2 points for each additional absence.

Final Exam/Final Project:

Please be aware that I am not yet 100% decided on a final exam versus a final project. Make sure to leave availability for the scheduled time of the final exam until further notice at the early part of the semester.

Grades

Homework:	25 points
Class Participation:	50 points
Final Exam/Project:	25 points

Disabilities: If you have a documented disability and wish to discuss accommodations, please contact the professor as soon as possible.

Important Dates:

First Class:	Jan. 28, 2020
Spring Break:	March 15-20, 2020
Last Class:	May 12, 2020
Final Exam:	Monday May 18, 2020 10:30am-12:30pm

Academic Integrity: The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit **http://www.studenthonorcouncil.umd.edu/whatis.html**

Tentative Schedule: (Note this may Change and will be updated on ELMS)

Week	Day	Tu Date	Topic
1	Tu/Th	28-Jan	Intro to Particle Physics (The Big Picture - History, Unification, SR, QM, Standard Model, QFT, Cosmology, Open Questions etc…)
2	Tu/Th	4-Feb	Early 20th Century - Special Relativity
3	Tu/Th	11-Feb	Early 20th Century - Quantum Mechanics and Bound States
4	Tu/Th	18-Feb	Relativistic QM - Dirac Equation
5	Tu/Th	25-Feb	Relativity + QM --> Antiparticles, Feynman diagrams
6	Tu/Th	3-Mar	Experimental History of Particle Physics
7	Tu/Th	10-Mar	Particle detectors (Scintillators, Calorimeters, PMTs, etc…), Particle Accelerators
8	Tu/Th	17-Mar	SPRING BREAK
9	Tu/Th	24-Mar	The Standard Model of Particle Physics, QED, Electroweak unification
10	Tu/Th	31-Mar	The Standard Model of Particle Physics, QED, Electroweak unification
11	Tu/Th	7-Apr	Recent Experimental Particle PhysicsP (W,Z, # of neutrinos, Top quark, Higgs particle, Neutrino Oscillations, etc…) Confirmation of the Standard Model
12	Tu/Th	14-Apr	Recent Experimental Particle PhysicsP (W,Z, # of neutrinos, Top quark, Higgs particle, Neutrino Oscillations, etc…) Confirmation of the Standard Model
13	Tu/Th	21-Apr	The Emergence of High Energy Particle Astrophysics, The High Energy Universe (gamma-ray astronomy, neutrino astronomy, Cosmic Rays)
14	Tu/Th	28-Apr	Neutrono mass, oscillations, CP violation, HE Neutrino Astronomy
15	Tu/Th	5-May	Topical subjects on open Questions (Dark Matter, Dark Energy, Cosmology, Grand Unification and proton decay, inflation, Matter/antimatter assymetry, fine tuning problems, Origin of HE cosmic rays, space based experiments, future accelerators, future experiments, ...)

16	Tu	12-May	Topical subjects on open Questions (Dark Matter, Dark Energy, Cosmology, Grand Unification and proton decay, inflation, Matter/antimatter assymetry, fine tuning problems, Origin of HE cosmic rays, space based experiments, future accelerators, future experiments, ...)
17	M	18-May	FINAL EXAM (10:30am - 12:30pm)