PHYS 5380 – Syllabus
Fall 2019

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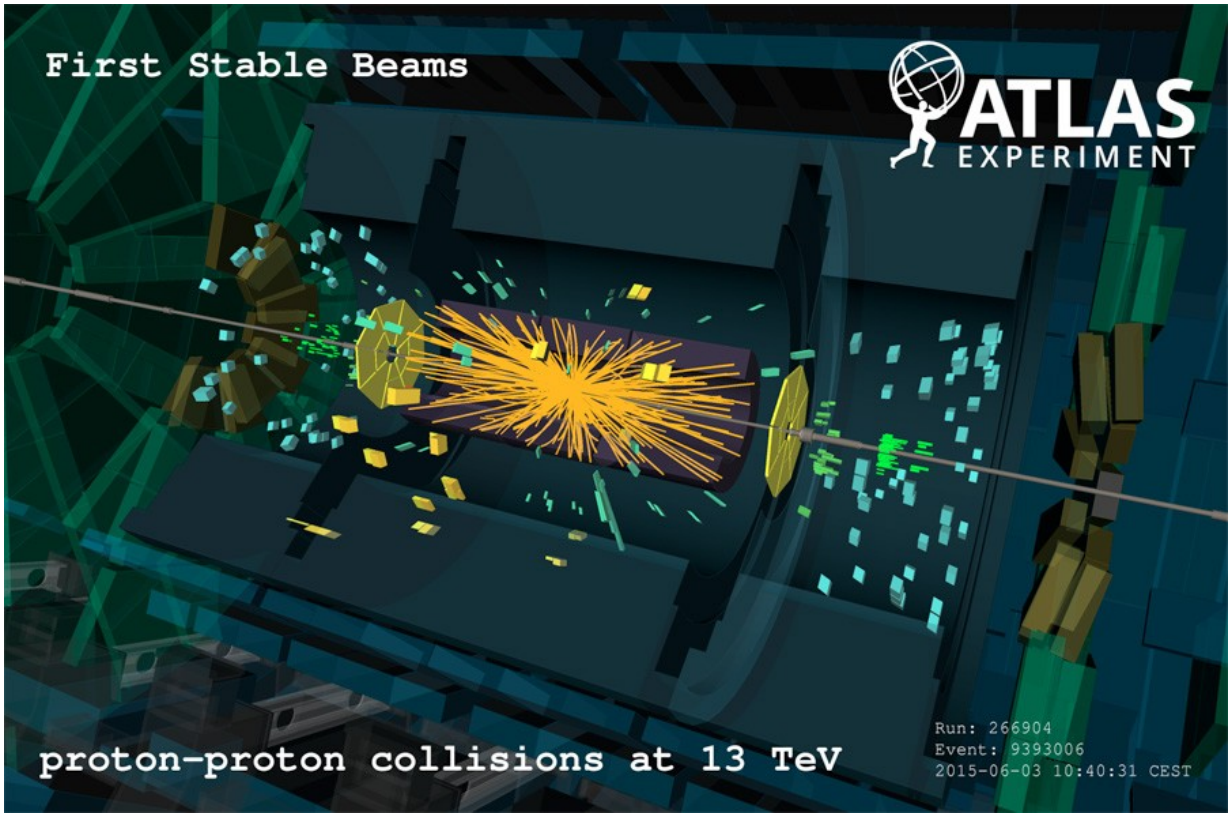
Course Objective:

Upon completion of this course the students will be able to describe the structure of matter, ranging from atoms and nuclei to quarks and leptons, and the type and strength of forces governing basic interactions among the elementary components of matter. The course will cover particle acceleration and detection techniques and their applications to technologies used in every-day life. There is no single textbook covering this material and the list of books available in the library is appended to this syllabus. Some homework exercises will be taken from Richard Fernow's "Introduction to experimental particle physics". Web based reviews and publications can be used as additional resource. Major components of the final grade will be based on the evaluation of a 30-40 minutes-long public oral presentation with power-point slides on one of the selected topics. The presentation should cover all elements of the course: explanation of the physical phenomena, observation and detection techniques, how the observations affect our understanding of the universe and the direction of future studies on this subject.



Grading

Homework 40%, Presentation – 40%, class and seminars participation – 20%
Presentation to be made in form of a lecture to the class.
Grading of seminar presentations will be done in collaboration with the audience.
Sample grading sheet:
Rate the following aspects in the range of 1 to 10 with 10 being best:

1) Introduction of the topic. Is the subject important to physics?
2) Organization and logic of the talk:
3) Transparencies: was the presentation clear? what was missing?
4) Questions: was the speaker able to answer questions?

What element of this presentation would you like to see expanded further

Syllabus

Aug 26 (Mon)	Introduction, discovery of atom's substructure, electron, neutron,
Aug 28 (Wed)	Quantum mechanics, relativity, units
Aug 30 (Fri)	History 1920-1940: angular momentum, spin, beta decays
Sep 2 (Mon)	**LABOR DAY – no class**
Sep 4 (Wed)	Muons, neutrinos, pions, interactions with matter
Sep 6 (Fri)	Forces and interactions, cross sections
Sep 9 (Mon)	Lifetime, resonances, particles ZOO
Sep 11 (Wed)	Particles as waves, e+e-, conservation laws
Sep 13 (Fri)	Symmetries P, C, CP
Sep 16 (Mon)	Isospin, quark model
Sep 18 (Wed)	Dynamic evidence for quarks, e-m interactions
Sep 20 (Fri)	Strong and weak interactions
Sep 23 (Mon)	Accelerators part 1
Sep 25 (Wed)	Accelerators part 2
Sep 27 (Fri)	Particle detectors
Sep 30 (Mon)	Tracking
Oct 2 (Wed)	Solid state trackers
Oct 4 (Fri)	Fibers + TOF
Oct 7 (Mon)	Cosmic rays
Oct 9 (Wed)	Calorimetry part 1
Oct 11 (Fri)	Calorimetry part 2
Oct 14 (Mon)	**FALL BREAK – no class**
Oct 16 (Wed)	Neutrinos part 1
Oct 18 (Fri)	Neutrinos part 2
Oct 21 (Mon)	ATLAS detector systems
Oct 23 (Wed)	Electronic readout
Oct 25 (Fri)	Trigger
Oct 28 (Mon)	Computing for particle physics
Oct 30 (Wed)	Monte Carlo techniques
Nov 1 (Fri)	Probability and statistics part 1

Nov 4 (Mon)	Probability and statistics part 2	
Nov 6 (Wed)	Cosmology part 1	
Nov 8 (Fri)	Cosmology part 2	
		Review
Nov 11 (Mon)	Student's presentations	Oct.30
Nov 13 (Wed)		Nov. 2
Nov 15 (Fri)		Nov. 4
Nov 18 (Mon)		Nov. 6
Nov 20 (Wed)		Nov. 9
Nov 22 (Fri)		Nov.11
Nov 25(Mon)		Nov 12
Nov 27 (Wed)	**Thanksgiving – no class**	
Nov 29 (Fri)	**Thanksgiving – no class**	
Dec 2 (Mon)	Applications	
Dec 4 (Wed)	Future of particle physics: Grand unification, superstrings	
Dec 6 (Fri)	Future machines: proton-proton - HL-LHC, Neutrino - Dune, electron-positron - NLC, CEPC	
Dec 9 (Mon)	Last class	

Subjects for seminar presentations

Particle physics:	magnetic monopole, neutrino oscillations, CP violation, Higgs boson. antimatter, ,supersymmetry, charge leptons, quark mixing +CKM, photodetectors,
Astroparticle physics:	dark matter, dark energy, gravitational waves, detection challenges
Machines and detectors:	application of particle beams in medicine application of photon beams in medicine
Design an experiment:	what do you want to measure, why, how

Textbooks

David Griffith, Introduction to Elementary Particles
F. Halzen and A. Martin, Quarks and Leptons
Gordon L. Kane: "Modern Elementary Particle Physics: Updated Edition"
Richard Fernow, Introduction to experimental particle physics

Disability Accommodations: Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit http://www.smu.edu/Provost/ALEC/DASS to begin the process. Once registered, students should then schedule an appointment with the professor as early in the semester as possible, present a DASS Accommodation Letter, and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

- **Religious Observance**: Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

- **Excused Absences for University Extracurricular Activities**: Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue). A student who is absent from class without valid reason for two consecutive weeks will be administratively dropped from the class by the instructor.