PHYC 561 Elementary Particles

Course Description

Investigates the nature and behavior of elementary particles through the study of the symmetries and dynamics responsible for their production, reactions, and decays. (3 Credit Hours)

Prerequisite: PHYC 464 or PHYC 564

Not open to those with credit in PHYC 461

Course Objectives

The course goal will be to investigate the field of elementary particle physics through the study of fundamental interactions, symmetries, and dynamics responsible for the production, reactions, and decays of particles. A good working knowledge of quantum mechanics and electrodynamics is needed for the course. Topics such as symmetries, conservation laws, Feynman diagrams, accelerators, particle detectors, and the Standard Model in the context of the fundamental interactions will be discussed.

Course Rationale

This course is designed primarily for physics majors and minors in understanding concepts in physics at the most basic level, such as the structure of matter, energy/mass, forces, and motion.

Course Content, Format, and Bibliography

Content

- The course emphasizes three major components: data analysis, experiments, and communication.
- Historical development of particle physics; Standard Model
- Particle production, decay dynamic, and conservation laws
- Accelerators and particle detectors
- Relativistic kinematics
- Kinematical and flavor symmetries
- Bound states of quarks
- Quantum Electrodynamics
- Deep inelastic scattering
- Quantum Chromodynamics and the strong interaction

- Weak interactions
- Unification and beyond the Standard Model

Format

Lectures, peer instruction, examinations, and homework problems

This course is taught as a dual undergraduate/graduate course. Students will be required to complete activities appropriate for the level of the course in which they are enrolled. Student performance on homework, exams and/or labs will be evaluated using different standards for undergraduate and graduate students.

Bibliography

Introduction to Elementary Particles, 2nd Rev. Ed., D. J. Griffiths, Wiley-VCH, 2008, ISBN 978-3-527-40601-2.

Introduction to Elementary Particle Physics, A. Bettini, Cambridge, 2008, ISBN 978-0-521-88021-3.

Quarks and Leptons, F. Halzen and A. D. Martin, Wiley, 1984.

Introduction to High Energy Physics, 4th Ed., D. Perkins, Cambridge, 2000.