PHYS435: Introduction to the Physics of Particle Accelerators

Instructor Information

Instructor: Dr. T. Junginger

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Office Hours: Office hours will be posted on the course Brightspace site.

Course Schedule

Lectures: Tuesdays and Fridays, 10:00 AM

Prerequisite: 321A Classical Mechanics I and 326 Electricity and Magnetism

Course Description

An introduction to particle accelerators. The course will start with a survey of different accelerator concepts and some important concepts of electromagnetism and special relativity. The main topics are beam optics and RF systems for acceleration. The course is of interest for students interested in entering the field of particle accelerators and students mainly interested in particle or medical physics who would like to learn the fundamentals of accelerator science. Throughout the course, I will use CERN's LHC as an example in problems and worked exercises.

Learning Outcomes

Upon successful completion of this course, students will be able to:

- Explain different accelerator concepts and their applications.
- Solve simple linear beam dynamics problems using Hill's equation.
- Calculate beam steering and focusing for normal and superconducting dipole and quadrupole magnets.
- Evaluate radiofrequency fields and figures of merit for cavities and waveguides.

Course Organization

Students are expected to complete assigned readings and quizzes before lectures. Lectures will include a review of key concepts and collaborative problem-solving.

Assessment Methods

- 15% for quizzes based on readings. This assessment is mainly to test if reading was done thoroughly
- 40% homework

- 45% Final exam (oral)

Course Materials

Required textbook: Wille – The physics of particle accelerators

All other materials will be provided via Brightspace, including book chapters, slides, and lecture notes. The textbook 'The Science and Technology of Particle Accelerators' by Rob Appleby et al. is available as a free ebook through the UVic library.

Grading and Policies

Grades will be assigned in accordance with the University of Victoria's undergraduate calendar. Students are expected to adhere to academic integrity policies.

The skills you must demonstrate in this course include

- Explain different accelerator concepts and their application

- Solve simple linear beam dynamics problems using Hill's equation

- Calculate beam steering and focusing for normal and superconducting dipole and quadrupole magnets

- Calculate radiofrequency fields and figures of merit for cavities and waveguides

Examinable material includes everything discussed in class, in the assigned readings, and topics I think you should be able to deduce from those. Grades will be assigned in accordance with the narrative descriptions in the undergraduate calendar.