

PHYS-448

Introduction to particle accelerators

Seidel Mike

Cursus	Sem.	Type
Ing.-phys	MA1, MA3	Opt.
Nuclear engineering	MA1	Opt.
Physicien	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The course presents basic physics ideas underlying the workings of modern accelerators. We will examine key features and limitations of these machines as used in accelerator driven sciences like high energy physics, materials and life sciences.

Content

Overview, history and fundamentals
 Transverse particle dynamics (linear and nonlinear)
 Longitudinal particle dynamics
 Synchrotron radiation and related dynamics
 Linear and circular accelerators
 Acceleration and RF-technology
 Beam diagnostics
 Accelerator magnets
 Medical application of accelerators
 Future projects

Learning Outcomes

By the end of the course, the student must be able to:

- Design basic linear and non-linear charged particles optics
- Elaborate basic ideas of physics of accelerators
- Use a computer code for optics design
- Optimize accelerator design for a given application
- Estimate main beam parameters of a given accelerator

Transversal skills

- Communicate effectively with professionals from other disciplines.
- Use both general and domain specific IT resources and tools

Teaching methods

lecture based teaching using slides and blackboard,
 occasionally inquiry based learning,
 using Jupiter notebooks to simulate accelerator dynamics,

Application of knowledge through concrete exercises and provision of individual feedback in tutorials

Expected student activities

working on weekly problems, submitting the solutions and participation in the computer tutorials

Assessment methods

written exam

Resources

Moodle Link

- <https://go.epfl.ch/PHYS-448>