

Modules:

physics700 **Elective Advanced Lectures**
 physics710 **Experimental Physics**
 physics720 **Applied Physics**

Course:

Advanced Accelerator Physics

(E/A)

Course No.: physics714

Category	Type	Language	Teaching hours	CP	Semester
Elective	Lecture with exercises	English	3+1	6	ST/WT

Requirements:**Preparation:**

Accelerator Physics (physics612)

Form of Testing and Examination:

Requirements for the examination (written or oral): successful work with the exercises

Length of Course:

1 semester

Aims of the Course:

Understanding of the physics of synchrotron radiation and its influence on beam parameters
 Basic knowledge of collective phenomena in particle accelerators
 General knowledge of applications of particle accelerators (research, medicine, energy management)

Contents of the Course:

Synchrotron radiation:
 radiation power, spatial distribution, spectrum, damping, equilibrium beam emittance, beam lifetime
 Space-charge effects:
 self-field and wall effects, beam-beam effects, space charge dominated beam transport, neutralization of beams by ionization of the residual gas
 Collective phenomena:
 wake fields, wake functions and coupling impedances, spectra of a stationary and oscillating bunches, bunch interaction with an impedance, Robinson instability
 Applications of particle accelerators:
 medical accelerators, neutrino facilities, free electron lasers, nuclear waste transmutation, etc.

Recommended Literature:

F. Hinterberger; Physik der Teilchenbeschleuniger und Ionenoptik (Springer, Heidelberg 1997)
 H. Wiedemann; Particle Accelerator Physics (Springer, Heidelberg 2 Aufl. 1999)
 K. Wille; Physik der Teilchenbeschleuniger und Synchrotronstrahlungsquellen (Teubner, Wiesbaden 2. Aufl. 1996)
 D. A. Edwards, M.J. Syphers; An Introduction to the Physics of High Energy Accelerators (Wiley & Sons 1993)
 A. Chao; Physics of Collective Beam Instabilities in High Energy Accelerators (Wiley & Sons 1993)
 Script of the Lecture Particle Accelerators (physics612)
<http://www-elsa.physik.uni-bonn.de/~hillert/Beschleunigerphysik/>