Abstract for the Beam Dynamics Lectures of the ASP School
- Bernhard Holzer, CERN -

The lecture will cover in four main chapters

Introduction into the main accelerator types and their application following the historic development: the main accelerator types are explained as e.g. cyclotrons, betatrons, electrostatic machines and rf linacs. The synchrotron - the most commonly used accelerator for high energy physics will be treated in more detail.

The transverse dynamics of the particle beam will be explained, using the beta function and the beam emittance as general parameters to determine the beam size. The tools that have been developed to calculate the single particle trajectories in a storage ring as well as the description of the beam as a particle ensemble whose parameters depend on the properties of the external focusing fields will be covered.
A short introduction into the design and optimisation of a magnet lattice is given as well as examples of typical optical errors that have to be considered in a large machine.

The longitudinal beam dynamics describes the oscillations under the influence of the rf fields in the cavity resonators. A short introduction into the concepts is presented and the principle design features of accelerating structures in a synchrotron are explained.

A session about machine operation will complete these theoretical considerations. Based on the experience during the commissioning of the LHC storage ring, the main parameters that have to be controlled, the procedures that are used to bring a large accelerator into operation and examples of real measurements of the main parameters are presented.