



Contribution ID: 7

Type: **not specified**

Transverse Beam Dynamics I

Tuesday 10 May 2022 08:45 (1 hour)

This lecture gives an introduction to the dynamics of the transverse motion of the particles in an accelerator or storage ring. Following the general tenor of the school, special focus is put on a basic level of the explanations and so

tedious mathematical deductions are avoided and replaced by logical arguments and equivalent descriptions in other fields of physics.

As a consequence the lectures give a simplified but consistent introduction to the basic concepts:

The equation of motion, the matrix description of focusing and defocusing magnets, and single-particle trajectories are explained. Referring to the beam as an ensemble of many particles the concept of beta function and emittance is introduced as a quality parameter for the particle ensemble and transverse size of the beam. Dispersion and Chromaticity are explained to describe the effect of the finite energy spread of the beam and the luminosity of a particle collider is shown based on the example of the LHC.

Whenever possible the emphasis is put on the physics behind the equations and the understanding of the fundamental design principles.

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