

**Module: Specialization I**

Module No.: physics610

**Course:**  **Particle Physics**

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

**Requirements:****Preparation:**

Introductory particle physics and quantum mechanics courses

**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 fundamentals of particle physics: properties of quarks and leptons and their interactions (electromagnetic, weak, strong), experiments that have led to this understanding, the Standard Model of particle physics and measurements that test this model, the structure of hadrons

**Contents of the Course:**

Basics: leptons and quarks, antiparticles, hadrons, forces / interactions, Feynman graphs, relativistic kinematics, two-body decay, Mandelstam variables, cross-section, lifetime  
 Symmetries and Conservation Laws. Positronium, Quarkonium. Accelerators and Detectors  
 Electromagnetic interactions: (g-2) experiments, lepton-nucleon scattering  
 Strong interactions: colour, gauge principle, experimental tests of QCD. Electroweak interactions and the Standard Model of particle physics: spontaneous symmetry breaking, Higgs mechanism, experimental tests of the Standard Model. Neutrino physics, neutrino oscillations; CP violation

**Recommended Literature:**

F Halzen, A. Martin; Quarks and Leptons (J. Wiley, Weinheim 1. Aufl. 1984)  
 C. Berger; Elementarteilchenphysik (Springer, Heidelberg 2. überarb. Aufl. 2006)  
 Perkins; Introduction to High Energy Physics (Cambridge University Press 4. Aufl. 2000)  
 D. Griffith; Introduction to Elementary Particle Physics (J. Wiley, Weinheim 1. Aufl. 1987)  
 A. Seiden; Particle Physics : A Comprehensive Introduction (2005)  
 Martin & Shaw; Particle Physics, Wiley (2nd edition, 1997)