PX3A5-15 The Standard Model

22/23

Department
Physics
Level
Undergraduate Level 3
Module leader
Steven Boyd
Credit value
15
Module duration
10 weeks
Assessment
100% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

The Standard Model (SM) of Particle Physics describes elementary particles (the quarks, leptons, and bosons) and their interactions. This module explores the symmetries on which the SM is based, outlines the defining properties of the three interactions and discusses the experimental evidence for the Standard Model. We will look at Noether's theorem (for any continuous symmetry there is a conserved quantity, eg conservation of charge and invariance under gauge transformations are the same thing), flavour symmetry, parity and others, as well as the reasons for quark confinement. We will also study the concept of a momentum-transfer dependent coupling, quark mixing and questions about unification.

Module web page

Module aims

To describe the main features of the Standard Model of particle physics and to identify major pieces of experimental evidence supporting the key theoretical ideas

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be

covered. Actual sessions held may differ.

Introduction and the language of Particle Physics

The structure of the Standard Model

Symmetries and Conservation Rules

Aspects of Quantum Electrodynamics, the Weak Interaction, the Strong Interaction

Triumphs and Limitations of the Standard Model

Learning outcomes

By the end of the module, students should be able to:

- Explain qualitatively how elementary particles and their interactions are described by local gauge theories
- Demonstrate quantitatively important aspects of the model and quote experimental evidence that supports it
- Discuss the limitations of the established theory

Indicative reading list

B.R. Martin, Nuclear and Particle Physics, Wiley (2016)
B.R. Martin and G. Shaw, Wiley-Blackwell (2017)
Introduction to High Energy Physics, Donald Perkins, Addison Wesley (2000)
D. Griffiths, Introduction to Elementary Particles, Wiley (2008)

View reading list on Talis Aspire

Subject specific skills

Knowledge of mathematics and physics. Skills in modelling, reasoning, thinking

Transferable skills

Analytical, communication, problem-solving, self-study

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Total	150 hours

Type	Required
Private study	120 hours (80%)
Total	150 hours

Private study description

Working through lecture notes, solving problems, wider reading, discussing with others taking the module, revising for exam, practising on past exam papers

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group B

Assessment component	Weighting	Study time	Eligible for self-certification
In-person Examination Answer 3 questions	100%		No

- Answerbook Pink (12 page)
- Students may use a calculator

Reassessment component is the same

Feedback on assessment

Personal tutor, group feedback

Past exam papers for PX3A5

Availability

Courses

This module is Option list A for:

- Year 3 of UPXA-F300 Undergraduate Physics (BSc)
- UPXA-F303 Undergraduate Physics (MPhys)
    - Year 3 of F300 Physics
    - Year 3 of F303 Physics (MPhys)
- Year 3 of UPXA-F3F5 Undergraduate Physics with Astrophysics (BSc)
- Year 3 of UPXA-F3FA Undergraduate Physics with Astrophysics (MPhys)

This module is Option list B for:

- Year 3 of UPXA-GF13 Undergraduate Mathematics and Physics (BSc)
- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
    - Year 3 of GF13 Mathematics and Physics
    - Year 3 of FG31 Mathematics and Physics (MMathPhys)