

PX455-15 Frontiers of Particle Physics

24/25

Department

Physics

Level

Undergraduate Level 4

Module leader

John Marshall

Credit value

15

Module duration

10 weeks

Assessment

100% exam

Study location

University of Warwick main campus, Coventry

Description

Introductory description

The Standard Model of Particle Physics (SM) describes well the nature of, and interactions between, fundamental particles. In this module we will look at the challenges the SM still faces. These include the origin of the baryon asymmetry of the Universe (the observation that the universe is dominated by matter over antimatter), the nature of neutrino mass and possible new particles at high energy. We will look at the theoretical and experimental aspects of these questions, placing emphasis on the future research planned in the field.

[Module web page](#)

Module aims

To investigate areas of current research in the field of particle physics. The module should explain the theoretical background to these questions, and develop an appreciation for the experimental techniques required to study them. It should cover some of the plans for future research in particle physics.

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.

1. Introduction to the general research landscape of particle physics
2. The baryon asymmetry of the Universe and CP violation
3. Quark flavour mixing and CP violation in the quark sector
4. Lepton flavour mixing and CP violation in the lepton sector
5. The puzzle of neutrino mass
6. Investigating the high energy frontier of particle physics

Learning outcomes

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

- Describe the basic theoretical ideas, and experimental approaches to the solution of three of the puzzles challenging the Standard Model
- Discuss the plans and direction of research in particle physics in the future

Indicative reading list

M. Thomson, Modern Particle Physics

[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%)
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

	Weighting	Study time
Frontiers of Particle Physics Answer 3 questions	100%	

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

Feedback on assessment

Personal tutor, group feedback

[Past exam papers for PX455](#)

Availability

Courses

This module is Optional for:

- Year 4 of UPXA-F303 Undergraduate Physics (MPhys)

This module is Option list B for:

- UPXA-FG31 Undergraduate Mathematics and Physics (MMathPhys)
 - Year 4 of FG31 Mathematics and Physics (MMathPhys)
 - Year 4 of FG31 Mathematics and Physics (MMathPhys)
- Year 4 of UPXA-F3FA Undergraduate Physics with Astrophysics (MPhys)