1. **Title of the module**

PHYS7220 (PH722) - Particle and Quantum Physics

1. **School or partner institution which will be responsible for management of the module**

Physical Sciences

1. **The level of the module (Level 4, Level 5, Level 6 or Level 7)**

Level 7

1. **The number of credits and the ECTS value which the module represents**

15 credits (7.5 ECTS)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

Autumn

1. **Prerequisite and co-requisite modules**

Prerequisites:

PHYS5020 Quantum Physics

PHYS5030 Atomic Physics

1. **The programmes of study to which the module contributes**

MPhys Physics/Physics with Astrophysics/Astronomy, Space Science and Astrophysics

MSc in Physics (Euromasters)

This is not available as a wild module.

1. **The intended subject specific learning outcomes.  
   On successfully completing the module students will be able to:**

Have:

1. Ability to identify relevant physical principles, make mathematical descriptions or approximations and solve problems using a mathematical approach. (B1, B2, B4, B6. B7, D1, D4)
2. Familiarity with how particle physics experiments work. (A3)
3. Ability to discuss particle physics in the language of particles and fields. (A3)
4. An understanding of the formalism of quantum mechanics and the ability to cast physical problems into it and solve them. (A3, B7)
5. **The intended generic learning outcomes.  
   On successfully completing the module students will be able to:**

Have the knowledge and understanding of:

1. Enhancement of problem solving abilities, particularly mathematical approaches to problem solving. (B1, B2, B4, B5, B6, C7, D1, D4)
2. To use appropriate sources as part of directed self-learning. (C6, C10)
3. Enhancement of the ability to interpret theory. (C2, C6, C7)
4. An improved ability to manipulate precise and complex ideas and to construct logical arguments. (C6,C8,D4)
5. **A synopsis of the curriculum**

* Approximation Methods, perturbation theory, variational methods.
* Classical/Quantum Mechanics, measurement and the correspondence principle.
* Uncertainty Principle and Spin precession.
* Key Experiments in Modern Quantum Mechanics (Aharonov-Bohm, neutron diffraction in a gravitational field, EPR paradox).
* Experimental methods in Particle Physics (Accelerators, targets and colliders, particle interactions with matter, detectors, the LHC).
* Feynman Diagrams, particle exchange, leptons, hadrons and quarks.
* Symmetries and Conservation Laws.
* Hadron flavours, isospin, strangeness and the quark model.
* Weak Interactions, W and Z bosons.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**

* B. R. Martin, Nuclear and Particle Physics, Wiley (2006)
* Bettini, Introduction to Elementary Particle Physics (QC794.6.575)
* S. McMurry, Quantum Mechanics, Prentice-Hall (1993)
* M. Thomson, Modern Particle Physics (2013)
* F. Mandl, Quantum Mechanics, Wiley (1992)

1. **Learning and teaching methods**

Total contact hours: 30

Private study hours: 120

Total study hours: 150

1. **Assessment methods**
   1. Main assessment methods

Assignment 1 (10hour, 15%)

Assignment 2 (10hour, 15%)

Examination (70%)

13.2 Reassessment methods

Like-for-like

1. **Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section12) and methods of assessment (section 13)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | *8.1* | *8.2* | *8.3* | *8.4* | *9.1* | *9.2* | *9.3* | *9.4* |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |
| **Private Study** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| *Lecture* | **X** | **X** | **X** | **X** | **X** |  | **X** | **X** |
| **Assessment method** |  |  |  |  |  |  |  |  |
| *Assignments* | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| *Exam* | **X** | **X** | **X** | **X** | **X** |  | **X** | **X** |

1. **Inclusive module design**

The School recognises and has embedded the expectations of current equality legislation, by ensuring that the module is as accessible as possible by design. Additional alternative arrangements for students with Inclusive Learning Plans (ILPs)/declared disabilities will be made on an individual basis, in consultation with the relevant policies and support services.

The inclusive practices in the guidance (see Annex B Appendix A) have been considered in order to support all students in the following areas:

a) Accessible resources and curriculum

b) Learning, teaching and assessment methods

1. **Campus(es) or centre(s) where module will be delivered**

Canterbury

1. **Internationalisation**

Physics is an international subject with laws of physical sciences discovered and techniques developed and refined by physical scientists across the globe. Mastery of the subject-specific learning outcomes, will equip students to apply the theories and techniques of this module in a wide range of international contexts. In fact, Physics is Universal and so restricting this section to the international context is unnecessarily limiting. The module team is drawn from the School of Physical Sciences, which includes many members of staff with international experience of teaching and research collaboration. In compiling the reading list, consideration has been given to the range of texts that are available internationally. The support SPS provides to its students is also attuned to our international student body.

**FACULTIES SUPPORT OFFICE USE ONLY**

**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

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| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| 10/07/2019 | Minor | September 2019 | 6, 12, 13, 14 |  |
|  |  |  |  |  |