1. **Title of the module**

PHYS7090 (PH709) - Space Astronomy and Solar System Science

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**

None

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

MPhys/MPhys with Year Abroad Physics

MPhys/MPhys with Year Abroad Physics with Astrophysics

MPhys/MPhys with Year Abroad Astronomy Space Science and Astrophysics

MSc 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. An ability to identify relevant principles and laws when dealing with problems in Space Astronomy and Solar System Science, and to make approximations necessary to obtain solutions. (B1)
2. An ability to solve problems in astronomy, astrophysics and space science using appropriate mathematical tools. (B2)
3. An ability to use mathematical techniques and analysis to model physical behaviour in Space Astronomy and Solar System Science. (B4)
4. An ability to comment critically on how spacecraft and space telescopes (operating at various wavelengths) are designed, their principles of operation, and their use in solar system exploration and astronomy & astrophysics research. (B5)
5. An ability to solve advanced problems in astronomy, astrophysics and space science using appropriate mathematical tools. (B2)
6. An ability to interpret mathematical descriptions of physical phenomena in Space Astronomy and Solar System Science. (B7)
7. An ability to work within the space sciences area that is well matched to the frontiers of knowledge, the science drivers that underpin government funded research and the commercial activity that provides hardware or software solutions to challenging scientific problems in these fields. (B10)
8. An ability to present and interpret information graphically. (C2)
9. An ability to make use of appropriate texts, research-based materials, other primary sources or other learning resources as part of managing their own learning. (C6, 10)

Other more specific learning outcomes:

1. An ability to discuss coherently the origin and evolution of Solar Systems and be able to evaluate claims for evidence of Solar Systems other than our own.
2. Ability to identify relevant principles, make relevant approximations and solve problems using a mathematical approach.
3. Students should become fluent in current trends and methods as regards to space astronomy and Solar System exploration.
4. **The intended generic learning outcomes.
On successfully completing the module students will be able to:**

Have a knowledge and understanding of:

1. Problem-solving skills, in the context of both problems with well-defined solutions and open-ended problems; an ability to formulate problems in precise terms and to identify key issues, and the confidence to try different approaches in order to make progress on challenging problems. Numeracy is subsumed within this area. (D1)
2. Investigative skills in the context of independent investigation including the use of textbooks and other available literature and databases, to extract important information. (D2 partial)
3. Communication skills in the area of dealing with surprising ideas and difficult concepts, including listening carefully, reading demanding texts. (D3 partial)
4. Analytical skills – associated with the need to pay attention to detail and to develop an ability to manipulate precise and intricate ideas, to construct logical arguments and to use technical language correctly. (D4)
5. **A synopsis of the curriculum**

Space Astronomy:

Why use space telescopes; other platforms for non-ground-based astronomical observatories (sounding rockets, balloons, satellites); mission case study; what wavelengths benefit by being in space; measurements astronomers make in space using UV, x-ray and infra-red, and examples of some recent scientific missions.

Exploration of the Solar System:

Mission types from flybys to sample returns: scientific aims and instrumentation: design requirements for a spacecraft-exploration mission; how to study planetary atmospheres and surfaces: properties of and how to explore minor bodies (e.g. asteroids and comets): current and future missions: mission case study; how space agencies liaise with the scientific community; how to perform calculations related to the orbital transfer of spacecraft.

Solar System Formation and Evolution:

The composition of the Sun and planets will be placed in the context of the current understanding of the evolution of the Solar System. Topics include: Solar system formation and evolution; structure of the solar system; physical and orbital evolution of asteroids.

Extra Solar Planets:

The evidence for extra Solar planets will be presented and reviewed. The implications for the development and evolution of Solar Systems will be discussed.

Life in Space:

Introduction to the issue of what life is, where it may exist in the Solar System and how to look for it.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**
* Wertz and Larson, Space Mission Analysis and Design, 3rd Edition, 1992 [TL 790]
* Jones, Discovering the Solar System, 2nd Edition, 1999 [q QB501]
* Taylor, Solar System Evolution, 2nd Edition, 2001 [q QB501]
* Fortescue, Stark and Swinerd, Spacecraft Systems Engineering, 3rd ed, Wiley, 2003 [TL875]

*Other reading:*

* Davies; Astronomy from Space: The Design and Operation of Orbiting Observatories, Wiley,1997 [QB136]
* Encrenaz, Bibring and Blanc; The Solar System, Springer, 2010 [QB 501]
* Jakosky: The Search for Life on Other Planets, 1998 [QB 54]
* Gilmour & Sephton: Introduction to Astrobiology, 2004 [qQB 501]
* Carroll and Ostlie, Modern Astrophysics, 2nd Edition, 2007 (copies of the 1st edition are in the library at QB461)
1. **Learning and teaching methods**

Total contact hours (Lectures and workshop sessions – does not include office contact hours): 30

Private study hours: 120

Total study hours: 150

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

Two homework assignments (15% each) (10 hours each)

Examination (2 hours, 70%)

13.2 Reassessment methods

Like-for-like

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 8.9 | 8.10 | 8.11 | 8.12 | 9.1 | 9.2 | 9.3 | 9.4 |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Lectures and workshops | **x** | **x** | **x** | **x** | **x** | **x** | **x** |  | **x** | **x** | **x** | **x** | **x** |  | **x** | **x** |
| Private study | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **X** | **x** | **x** |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Assignments | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Examination | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |

1. **Inclusive module design**

The School/Collaborative Partner *(delete as applicable)* 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**

Space Astronomy and Solar System Science is an international subject with physical laws discovered and techniques developed and refined by scientists across the globe (the associated texts were drawn from this international expertise and knowledge base). Mastery of the subject-specific learning outcomes will equip students to apply the theories and techniques of this module to related problems. The module team is drawn from the School of Physical Sciences, which includes members of staff with experience of international collaborations in this area. The support SPS provides to its students is also internationally attuned given 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.**

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