1. **Title of the module**

PHYS7120 (PH712) - Cosmology and Interstellar Medium

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)**

Spring

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

Prerequisites:

PHYS5030 Atomic Physics

PHYS5070 The Multiwavelength Universe and Exoplanets

PHYS6070 Stars, Galaxies and the Universe

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

MPhys/MPhys with Year Abroad Physics with Astrophysics

MPhys/MPhys with Year Abroad Astronomy, Space Science and Astrophysics

MPhys/MPhys with a Year in Industry Physics with Astrophysics

MPhys/MPhys with a Year in Industry 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. Knowledge and understanding of aspects of the theory and practice of astronomy, astrophysics and space science, and of those aspects upon which astronomy, astrophysics and space science depends. (A2)
	2. A systematic understanding of most fundamental laws and principles of physics and of astronomy, astrophysics and space science, along with their application – some of which are at (or are informed by) the forefront of the discipline. (A3)
	3. An ability to identify relevant principles and laws when dealing with problems, and to make approximations necessary to obtain solutions. (B1)
	4. An ability to solve problems in physics using appropriate mathematical tools. (B2)
	5. An ability to use mathematical techniques and analysis to model physical behaviour. (B4)
	6. An ability to comment critically on how spacecraft are designed, their principles of operation, and their use to access and explore space, and on how telescopes (operating at various wavelengths) are designed, their principles of operation, and their use in astronomy and astrophysics research. (B5)
	7. An ability to solve advanced problems in physics using appropriate mathematical tools, to translate problems into mathematical statements and apply their knowledge to obtain order of magnitude or more precise solutions as appropriate. (B6)
	8. An ability to interpret mathematical descriptions of physical phenomena. (B7)
	9. A working knowledge of a variety of experimental, mathematical and/or computational techniques applicable to current research within physics. (B9)
	10. An enhanced ability to work within in the astronomy, astrophysics and space science areas 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)
	11. An ability to present and interpret information graphically. (C2)
	12. An ability to make use of appropriate texts, research-based materials or other learning resources as part of managing their own learning. (C6)
	13. An ability to make use of research articles and other primary sources. (C10)
1. **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. 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)
1. **A synopsis of the curriculum**

Interstellar Medium:

The major properties of the Interstellar Medium (ISM) are described. The course will discuss the characteristics of the gaseous and dust components of the ISM, including their distributions throughout the Galaxy, physical and chemical properties, and their influence the star formation process. The excitation of this interstellar material will be examined for the various physical processes which occur in the ISM, including radiative, collisional and shock excitation. The way in which the interstellar material can collapse under the effects of self-gravity to form stars, and their subsequent interaction with the remaining material will be examined. Finally the end stages of stellar evolution will be studied to understand how planetary nebulae and supernova remnants interact with the surrounding ISM.

Extragalactic astrophysics:

Review of FRW metric; source counts; cosmological distance ladder; standard candles/rods.

High-z galaxies: fundamental plane; Tully-Fisher; low surface brightness galaxies; luminosity functions and high-z evolution; the Cosmic Star Formation History

Galaxy clusters: the Butcher-Oemler effect; the morphology-density relation; the SZ effect

AGN and black holes: Beaming and superluminal motion; Unified schemes; Black hole demographics; high-z galaxy and quasar absorption and emission lines.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**
* The Physics of the Interstellar Medium; Dyson, J.E. & Williams, D.A (1997)
* Cosmological Physics; Peacock, J.A (1999)
* Cosmology; Rowan-Robinson, M (1997)
* Astrophysics vol.2; Bowers, R.L. & Deeming, T (1994)
* Annual Reviews of Astronomy and Astrophysics, 30, 499-542; Carroll, Press & Turner (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

Coursework

Take-home Test 1 (10 hrs, 15%)

Take-home Test 2 (10 hrs, 15%)

Examination (70%, 2hrs)

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)**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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* | *8.13* | *9.1* | *9.2* |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Private Study | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Lectures | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |  |  | **x** | **x** |
| Assignments | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Take-Home Tests | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Exam | **x** | **x** | **x** | **x** | **x** | **x** | **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 physical laws discovered and techniques developed and refined by Physicists 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. 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 and a selection of texts has been identified to complement the delivery of the material. 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.**

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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) |
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Revised FSO Jan 2018