Confirmation that this version of the module specification has been approved by the School Learning and Teaching Committee:

………11th March 2015………………………………………….

**MODULE SPECIFICATION**

1. Title of the module

*PH712 – Cosmology and Interstellar Medium*

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

*School of Physical Sciences*

1. Start date of the module

*Existing module, next running in 2015-16*

1. The number of students expected to take the module

*20.*

1. Modules to be withdrawn on the introduction of this proposed module and consultation with other relevant Schools and Faculties regarding the withdrawal

*None*

1. The level of the module (e.g. Certificate [C], Intermediate [I], Honours [H] or Postgraduate [M])

*M*

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

*15 (7.5 ECTS)*

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

*Term 2*

1. Prerequisite and co-requisite modules

*PH503, PH507, PH607*

1. The programmes of study to which the module contributes

*Physics with Astrophysics (MPhys, MPhys with Year Abroad)*

*Astronomy, Space Science and Astrophysics (MPhys, MPhys with Year Abroad)*

*Physics Euromasters (MSc)*

*This is not available as a wild module*

1. The intended subject specific learning outcomes
	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)*
2. The intended generic learning outcomes
	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)*
3. A synopsis of the curriculum

 *SYLLABUS:
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. Indicative Reading List

***None on library reading list. Module catalogue has as follows****:*

*‘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, including the nature and number of contact hours and the total study hours which will be expected of students, and how these relate to achievement of the intended module learning outcomes

*Contact hours: lectures and class tests (30 hours)*

*Total study time 150 hrs (including private study time)*

*Achievement of module learning outcomes:*

* *Lectures (11.1-11.11. 12.1, 12.2 )*
* *Self-study (11.12, 11.13, 12.2)*
1. Assessment methods and how these relate to testing achievement of the intended module learning outcomes

*Coursework 30% including class tests*

*Final (written, unseen, length 2 hours) exam 70%The above assessments test students’ knowledge and understanding of laws and principles (11.1-11.3, 11.6, 11.8-11.10, 12.2) and application of techniques to model behaviour and solve problems (11.3-11.5, 11.7, 11.10-11.11, 12.1). In preparing for the assessments, students will need to manage their own revision using reference materials (11.12, 11.13, 12.2)*

1. Implications for learning resources, including staff, library, IT and space

*None*

1. The School recognises and has embedded the expectations of current disability equality legislation, and supports students with a declared disability or special educational need in its teaching. Within this module we will make reasonable adjustments wherever necessary, including additional or substitute materials, teaching modes or assessment methods for students who have declared and discussed their learning support needs. Arrangements for students with declared disabilities will be made on an individual basis, in consultation with the University’s disability/dyslexia support service, and specialist support will be provided where needed.
2. Campus where module will be delivered:

*Canterbury*