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

*PH709 Space Astronomy and Solar System Science*

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

*31*

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 Modules to be withdrawn on the introduction of this proposed module and consultation with other relevant Schools and Faculties regarding the withdrawal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

1. Prerequisite and co-requisite modules

*None*

1. The programmes of study to which the module contributes

*Physics (MPhys, MPhys with Year Abroad)*

*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. *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.*
1. 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. *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)*
2. A synopsis of the curriculum

 *SYLLABUS:*

 *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. Indicative Reading List
* *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]*
* *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, 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

*30 contact hours, including: 26 lectures (26 hours), 2 workshops, and class tests. In addition, 120 hours of self self-study are required.*

*These methods target all learning outcomes (specific and generic).*

*Achievement of module learning outcomes:*

* *Lectures and workshop sessions (11.1-11.7, 11.9-11.11. 12.1, 12.4 )*
* *Self-study (11.8, 11.11, 12.2, 12.3)*
1. Assessment methods and how these relate to testing achievement of the intended module learning outcomes

*Final Examination (70% - written, unseen, length 2 hours), 2 class tests (15% each), and voluntary homework assignments may also be issued. The exam and class tests are to test overall breadth and depth of knowledge and understanding, and target all learning outcomes (specific and generic). Voluntary homeworks are to encourage learning and comprehension during the course.*

*The above assessments test students’ knowledge and understanding of laws and principles (11.1, 11.4, 11.9-11.11, 12.3, 12.4) and application of techniques to model behaviour and solve problems (11.2, 11.3, 11.5-11.7, 11.10, 12.1). In preparing for the assessments, students will need to manage their own revision using reference materials (11.8, 11.11, 12.2, 12.3)*

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*