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

*PH607 Stars, Galaxies and the Universe*

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

*36*

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 Modules to be withdrawn on the introduction of this proposed module and consultation with other relevant Schools and Faculties regarding the withdrawal

*None. Existing module.*

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

*H*

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

*None*

1. The programmes of study to which the module contributes

*Physics, Physics with Astrophysics, Astronomy Space Science and Astrophysics (BSc, BSc with Foundation Year, BSc with Year in Industry, MPhys, MPhys with Year Abroad).*

*This is not available as a wild module*

1. The intended subject specific learning outcomes

*11.1 Knowledge and understanding of physical laws and principles of astrophysics, and their application to diverse areas of physics. (A1)*

*11.2 An ability to identify relevant principles and laws when dealing with problems, and to make approximations necessary to obtain solutions. (B1)*

*11.3 An ability to solve problems in physics involving stars and galaxies using appropriate mathematical tools. (B2)*

*11.4 An ability to use mathematical techniques and analysis to model physical behaviour of stars and galaxies and the universe. (B4)*

*11.5 An ability to present and interpret information about stars and galaxies graphically. (C2)*

*11.6 An ability to make use of appropriate texts, research-based materials or other learning resources about astrophysics as part of managing their own learning.(C6)*

1. The intended generic learning outcomes

*12.1 Problem-solving skills, in the context of both problems with well-defined solutions and open-ended problems. Numeracy is subsumed within this area. (D1)*

*12.2 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

*Aims: To provide, in combination with PH507, a balanced and rigorous course in Astrophysics for B.Sc. Physics with Astrophysics students, while forming a basis of the more extensive M.Phys. modules.

SYLLABUS
Physics of Stars
Review of hydrostatic and thermal equilibrium, use to calculate stellar properties. Virial theorem and timescales. Radiative equilibrium, radiation and conduction, energy sources. Fission and fusion. Nucleosynthesis: PPI, PPII, PPIII chains; CNO cycle, Triple-alpha process; elemental abundances; Solar neutrino problem. Post main sequence evolution. Convection; conditions for convective instability. Convective vs radiative energy transport for stars of different mass. Stellar structure equations and description of techniques for solutions. Formation and properties of binary stars.
Galaxies
Our galaxy. Hubble classification of galaxies. Luminosity functions. Distribution of galaxies in space. Mass and dynamics of galaxies. Interpretation of spiral and elliptical galaxies. Dark Matter. Active galaxies, quasars; observational properties.
General Relativity and Cosmology
Inadequacy of Newton’s Laws of Gravitation, principle of Equivalence, non-Euclidian geometry. Curved surfaces. Schwarzschild solution; Gravitational redshift, the bending of light and gravitational lenses; black holes. Brief survey of the universe. Robertson-Walker metric, field equations for cosmological and critical density. Friedmann models. The early universe. Dark Energy.*

1. Indicative Reading List

*Carroll & Ostlie, Modern Astrophysics, Addison Wesley [QB461]*

*Bohm-Vitense, Volume 3; Stellar Structure and Evolution, Cambridge University Press [QB801]*

*Taylor, The stars: Their structure and Evolution, Cambridge University Press. [QB801].*

*Berry, Principles of Cosmology and Gravitation, Adam Hilger. [QB891]*

*Roos, Introduction to Cosmology, Wiley. [QB891]*

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

*26 lectures + 2 workshops - 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 12.1, 12.2.*

*This module is expected to occupy 150 total study hours, including the contact hours above*. *– 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 12.1, 12.2.*

1. Assessment methods and how these relate to testing achievement of the intended module learning outcomes

*Coursework assessment 30% including class tests Exam (Length 2 hours) 70%*

*The above assessments test students’ knowledge and understanding of laws and principles (11.1, 11.2, 12.2) and application of techniques to model behaviour and solve problems (11.3, 11.4, 11.5, 12.1, 12.2). In preparing for the assessments, students will need to manage their own revision using reference materials. (11.6, 12.2).*

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

*None. Existing module.*

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(es) where module will be delivered:

*Canterbury*