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

*PH512 Data Analysis Techniques in Astronomy and Planetary 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

*15*

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 Modules to be withdrawn on the introduction of this proposed module and consultation with other relevant Schools and Faculties regarding the withdrawal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

*I*

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

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

*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, and of those aspects upon which astronomy depends. (A2)*
   2. *Competent use of appropriate C&IT packages/systems for the analysis of data and the retrieval of appropriate information. (C1)*
   3. *An ability to present and interpret astronomical information graphically. (C2)*
   4. *An ability to communicate scientific information, in particular to produce clear and accurate scientific reports. (C3)*
   5. *An ability to make use of appropriate texts, research-based materials or other learning resources as part of managing their own learning. (C6)*

*Other more specific learning outcomes:*

* 1. *Students will become able to: use the web to access and process astronomical data available on the internet, enhance digital and astronomical images, learn how to use astronomical image processing packages, carry out searches of astronomical databases on the web, and develop familiarity with the topics covered in the course by use of computer exercises to illustrate them.*
  2. *Develop key skills for employment, learning to access data, the internet and data libraries, and development of practical skills in data collection and processing. The course is also aimed in part at promoting independent thinking when handling practical problems with astronomy data.*

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, databases, and the interaction with colleagues to extract important information. (D2)*
   3. *Communication skills in the area of dealing with surprising ideas and difficult concepts, including listening carefully, reading demanding texts and presenting complex information in a clear and concise manner. C&IT skills are an important element to this. (D3)*
   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. *Personal skills – the ability to work independently, to use initiative, to organise oneself to meet deadlines. (D5)*
2. A synopsis of the curriculum

*SYLLABUS:*

*This module focuses on the use of data processing and analysis techniques as applied to astronomical data from telescopes. Students will learn how telescopes and CCD cameras work, to process astronomical images and spectra and apply a range of data analysis techniques using multiple software packages. Students will also engage in the scientific interpretation of images and spectra of astronomical objects.*

*1. Use of Virtual Observatories for accessing astronomical databases and applying analysis tools to the data files retrieved (with particular emphasis on the Aladdin system); astronomical image formats.*

*2. Astrometry: Measuring coordinates of celestial objects from images   
3. Photometry: Determining magnitudes of variable stars and/or solar system bodies  
4. Spectroscopy: Determining spectral properties of variable stars and/or solar system bodies  
5. Image Analysis and Enhancement with AIP: Quantifying digital imagery in more detail than Aladdin, and applying a range of techniques (primarily through the use of image operators and convolution kernels)*

1. Indicative Reading List

*The Handbook of Astronomical Image Processing [with cd-rom] (2nd Edition); Berry, R. & Burnell, J. (2005)*

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

*36 contact hours including lecturer-led console sessions. This module is expected to occupy 150 total study hours, including the contact hours above.*

*The course is divided into 5 distinct topics (see syllabus above).*

*The module is comprised primarily of 12×3 hour sessions. Each student is assigned computer workstations (sometimes in pairs) (12.5) with the course software packages installed. Most sessions start off with a 3-60 minute presentation by the lecturer describing the use of a given technique in the context of professional-level astronomy along with relevant background knowledge, and taking the students through the key steps involved in using the relevant software package to complete the coursework assignment for that topic (11.1–11.7, 12.1–12.5). The students are then given a step-by-step guide so that they can complete the basic tasks for that assignment – as covered by the lecturer at the beginning (and with the assistance from the lecturer present). The assignments have an extra element built into them that requires the student to think creatively and independently (11.7). This involves a combination of applying the techniques and skills acquired to solve additional problems included in the assignments (11.7) (12.1), consulting the related literature to learn more about the area (11.5), and on occasion consulting the scientific literature to explore how a given technique has been applied to study various astrophysical phenomena (11.5) (12.2), along with some basic scientific interpretation of their processing and analysis (11.5) (12.2). For each of the 5 topics and associated assignments, the students will prepare a report detailing the method applied and results obtained, as well as reporting on other areas of the assignment related to background research (11.3–11.4, 12.1–12.5). Students are instructed in detail on how to prepare such reports, including the importance of formatting and citations (11.4, 12.3–12.4).*

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

*100% coursework including weekly console exercises and various assignments. There will be 5 assignments in total, each worth 20% of the total mark for the module. The assignments cover the 5 topic areas listed in the syllabus section above (one assignment for each topic). (11.1-7) (12.1, 12.2, 12.3, 12.4, 12.5)*

*The above assessments test students’ knowledge and understanding of laws and principles (11.1, 12.4) and application of techniques to model behaviour and solve problems (11.2, 11.3, 11.6, 11.7, 12.1). Students will need to manage their own revision using reference materials for the assignments and for producing reports (11.4, 11.5, 11.7, 12.2-12.5)*

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*