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

*PH503 Atomic and Nuclear Physics*

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 running for more than 10 years. Next running 2015-16.*

1. The number of students expected to take the module

*140.*

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 Modules to be withdrawn on the introduction of this proposed module and consultation with other relevant Schools and Faculties regarding the withdrawal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 running for more than 10 years.*

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 (ECTS 7.5).*

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

*Terms 1 & 2*

1. Prerequisite and co-requisite modules

*None*

1. The programmes of study to which the module contributes

*Physics (BSc, BSc with Foundation Year, MPhys, MPhys with Year Abroad)*

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

*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

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

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

*11.3 An ability to solve problems in Atomic and Nuclear Physics using appropriate mathematical tools. (B2)*

*11.4 An ability to use mathematical techniques and analysis to model physical behaviour in Atomic and Nuclear Physics. (B4)*

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

*11.6 An ability to make use of appropriate texts, research-based materials or other learning resources 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

*Atomic Physics*

 *Review of previous stages in the development of quantum theory with application to atomic physics; Atomic processes and the excitation of atoms; Electric dipole selection rules; atom in magnetic field; normal Zeeman effect; Stern Gerlach experiment; Spin hypothesis; Addition of orbital and spin angular moments; Lande factor; Anomalous Zeeman effect; Complex atoms; Periodic table; General Pauli principle and electron antisymmetry; Alkali atoms; ls and jj coupling; X-rays. Lamb-shift and hyperfinestructure (if time).*

 *Nuclear Physics*

 *Properties of nuclei: Rutherford scattering. Size, mass and binding energy, stability, spin and parity.*

 *Nuclear Forces: properties of the deuteron, magnetic dipole moment, spin-dependent forces.*

 *Nuclear Models: Semi-empirical mass formula M(A, Z), stability, binding energy B(A, Z)/A. Shell model, magic numbers, spin-orbit interaction, shell closure effects.*

 *Alpha and Beta decay: Energetics and stability, the positron, neutrino and anti-neutrino.*

 *Nuclear Reactions: Q-value. Fission and fusion reactions, chain reactions and nuclear reactors, nuclear weapons, solar energy and the helium cycle.*

1. Indicative Reading List

*Nuclear and particle physics - Martin, B. R. 2009*

*Introductory nuclear physics - Krane, Kenneth S., Halliday, David 1988*

*Introduction to the structure of matter - Brehm, John J., Mullin, William J. 1989*

*Nuclear physics: principles and applications - Lilley, J. S. 2001*

*Quantum mechanics: concepts and applications - Zettili, Nouredine 2009*

*Quantum mechanics - Bransden, B. H., Joachain, C. J. 2000*

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

*32hours of lectures– 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 12.1, 12.2.*

*2 hours of workshops/revision sessions - 11.1, 11.2, 11.3, 11.4, 11.5, 11.6, 12.1, 12.2.*

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

*Continuous assessment 30%: 2 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 running for more than 10 years.*

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.*