

## Programme Specification Mphys (Hons) Physics with Astronomy

1 Awarding Institution	University of Southampton
2 Teaching Institution	University of Southampton
3 Programme Accredited by	The Institute of Physics
4 Final Award	Master of Physics – Honours
5 Programme title	M.Phys. Single Honours, Astrophysics-with-a year abroad
6 UCAS Code	
7 QAA Subject Benchmark	Physics, astronomy and astrophysics
8 Programme Coordinator	Dr. M. J. Coe
9 Specification prepared by	Prof. D. A. Ross, December 4, 2003

## 10 Educational Aims of the Programme

Physics and Astronomy are dynamic subjects which are continually being developed by new discoveries and innovations. In choosing to study astrophysics at Southampton you will benefit from being taught by research active physicists who enjoy an outstanding international reputation in all research areas carried out within the School. The School assigns a high priority to the continual development and improvement of its teaching methods and curriculum design in order to guarantee students a highly stimulating as well as enjoyable and fruitful learning experience.

Astronomy is one of the strong research features of Southampton and students greatly benefit from extensive contact with staff involved in cutting-edge research. This is particularly true for final year projects which often involve working with the latest results from international observatories. In addition Southampton has pioneered the award-winning field trip to the Izana Observatory in Tenerife. This provides Astrophysics students with an opportunity to carry out observational work at an international professional observatory.

In the fourth year the students spend 30 weeks working in a research laboratory abroad. This will take place in the Harvard-Smithsonian Center for Astrophysics, Boston, USA starting 1 September. During this period of time they will be under the immediate supervision of a local member of staff who will guide them in their work on a previously agreed programme of study. A member of staff from Southampton will visit them during their first 3 months to ensure satisfactory progress. In addition, at all stages it will be possible for the student to exchange email communications with both their personal tutor, and the Southampton Course Coordinator.

This programme aims to:

1. introduce you to the main branches of physics and astronomy;
2. help you to understand the principles of physics;
3. provide you with a solid foundation for a successful career as a physicist, and opportunities to develop skills transferable to a wide range of other careers, and to prepare you for further studies in physics leading to a graduate degree such as a Ph.D.;
4. offer you the opportunity to study some of the advanced concepts and techniques of contemporary physics
5. enable you to develop skills in problem solving and critical and quantitative analysis in physics;
6. enable you to develop advanced knowledge and laboratory skills through undertaking laboratory work using a range of physical techniques.
7. provide you with the opportunity for a broader education by studying other subjects in addition to physics;
8. provide you with a friendly and supportive environment and enrich your learning experience through interaction with staff engaged in internationally respected research;
9. provide you with some of the basic IT and numeracy skills necessary for further study and employment, including word-processing, data analysis and use of the internet. You will also have the opportunity to learn specific programming languages;
10. help you develop key skills: personal organisation and teamwork;
11. develop your ability to seek out, organise, critically analyse and communicate technical information and concepts through writing a dissertation and giving seminars;
12. enhance your capacity for self-study;
13. help you to develop a deeper insight into the theoretical framework underlying the principles of physics;
14. enable you to prepare and present seminars on advanced physics topics;
15. explain to you the challenges involved in carrying out ground-based and space-based observations of the fundamental parameters of the universe.
16. give you the opportunity to study some advanced concepts in contemporary astrophysics;



## 11 Learning Outcomes

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### 11.1 Knowledge and Understanding

Having successfully completed this programme you will be able to demonstrate good knowledge and understanding of:

1. mathematics required for the description of the physical world;
2. the breakdown of classical (19th century) physics and the revolution in physics at the beginning of the 20th century;
3. special relativity and its application in nuclear physics and high-energy particle scattering;
4. the quantitative description of oscillating systems and wave-motion;
5. Newtonian mechanics and its application to physical systems;
6. quantum theory, both from qualitative and quantitative (quantum mechanics) viewpoints;
7. application of quantum theory to describe the structure of atoms and nuclei;
8. the laws of thermodynamics and their consequences for the behaviour of physical systems;
9. statistical mechanics as a basis for the microscopic description of thermodynamic systems;
10. electricity, magnetism and their unification through the laws of electromagnetism;
11. the application of electromagnetism to the description of electromagnetic waves and optics;
12. advanced classical and quantum mechanics and electromagnetism;
13. specific topics selected for a dissertation and seminar;
15. a wide range of physics experimental techniques;
16. planetary, galactic, and extra-galactic astronomy, and cosmology;
17. the design and operation of astronomical detectors across the electromagnetic spectrum;
18. the motion of stars and solar system objects across the night sky throughout the year;

#### *Learning and Teaching Methods*

Core knowledge and understanding is acquired substantially via lectures, supported by tutor-led tutorials, laboratory practical classes, problem classes as well as guided independent study and research.

Students are strongly encouraged to attend all the lectures for the courses on which they are registered and are required to attend all the supporting sessions.

For the M.Phys. Programme, these learning outcomes are achieved partly through a dissertation and the presentation of seminars.

#### *Assessment Methods*

Assessment in the first, second and third year is a mixture of unseen written examinations, marked problem sheets and laboratory work. In their 3<sup>rd</sup> year in Southampton, the students take all the core material from the 3<sup>rd</sup> and 4<sup>th</sup> years of the normal MPhys programme. In the fourth year the students carry out a research project abroad. The aim of this year abroad is to permit first class students to engage in a real research programme which will challenge their skills and knowledge in astrophysics. This year abroad replaces several components in the normal MPhys course. In particular, students do not carry out the following: a dissertation or the 3<sup>rd</sup> year laboratory. It is expected that the learning outcomes from these missed components will be achieved from their work in Harvard Assessment for this year will be by two reports (one half way through and one at the end), a viva and a seminar presentation.

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## 11.2 Subject Specific Intellectual Skills

Having successfully completed this programme you will be able to :

1. apply knowledge of physics to the solution of theoretical and practical physical problems;
2. apply mathematical techniques in algebra, vectors, calculus and differential equations to the solution of physical problems;
3. use computers to assist in the solution of physical problems;
4. carry out a literature search for relevant material for the preparation of dissertations;
5. assimilate new material independently;
6. prepare and deliver seminars on specific subjects;
7. interpret data and make decisions taking into account experimental errors.

### *Learning and Teaching Methods*

Problem solving is at the heart of physics, and so it is emphasized throughout the learning and teaching experience, in lectures and problem classes. A teamwork exercise in mathematical problem solving related to physics ensures that you are equipped with the minimum set of mathematical tools from the start.

### *Assessment Methods*

Problem solving and mathematical skills are assessed in both the written examinations and in weekly problem sheets which contribute to the assessment of most core material.

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## 11.3 Subject Specific Practical Skills

Having successfully completed this programme you will be able to:

1. use standard laboratory and observatory apparatus for physical measurements;
2. design and set up advanced experiments using apparatus similar to that found in research laboratories;
3. carry out a critical analysis of experimental data;
4. use computers for the acquisition, storage, and analysis of data.

### *Learning and Teaching Methods*

Practical work using up to date equipment is a central part of both the first and second year core material. Computing and Data Handling are taught as self-paced exercises.

### *Assessment Methods*

Laboratory skills are assessed from laboratory notebooks, by the writing of a scientific paper, a project report and by conference presentations.

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## 11.4 Transferable and Generic Skills

Having successfully completed this programme you will be able to:

1. communicate physical ideas in written form;
2. recognise the value of numeracy in the precise statement of ideas;
3. prepare and give an oral presentation using visual aids;
4. display data graphically and undertake basic word processing, including mathematical equations;
5. use information from a variety of sources including scientific journals, books and the internet;
6. manage a project with due attention to time and resource management;
7. work successfully as a team member.

### *Learning and Teaching Methods*

Written and oral communication forms part of all laboratory and project work. In the second year you will attend a scientific 'conference' where you and fellow -students present the results of their laboratory work.

Writing a dissertation on your research project, defending it in an oral examination, and delivering a seminar on it, are key elements of the learning process for fourth years.

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## 12.1 Programme Structure

The programme has a modular structure based on the School's unit course scheme. Each unit is worth 15 credit points and 120 credit points must normally be taken in each year. The programme comprises a core of compulsory physics, astronomy and mathematics courses spread over three years of the degree.

In addition you take a further option in the third year which may be selected from options available in physics, mathematics or other sciences. Your fourth year consists of a single unit worth 120 credit points spent abroad doing astrophysics research.

Semester 1	Semester 2
Year 1	
PHYS1001 Forces and Fields PHYS1003 Relativity and Quanta MATH1006/8 Introduction to Mathematical Methods PHYS1005 Introduction to Astronomy and Space Science	PHYS1002 Energy and Matter PHYS1006 Oscillations and Waves MATH1007 Mathematical Methods for Physical Science PHYS1008 Physics of the Solar System
Year 2	
PHYS2001 Electromagnetism PHYS2003 Quantum physics PHYS2006 Classical Mechanics PHYS2013 Galaxies	PHYS2005 Optics PHYS2004 Thermal physics PHYS2008 Physics of Materials PHYS2011 Design and Observation in Astronomy
Year 3	
PHYS3004 Crystalline Solids PHYS3008 Atomic physics PHYS3011 Photons in Astrophysics PHYS6005 Cosmology	PHYS3002 Nuclei and Particles PHYS3010 Stellar Evolution PHYS6004 Space Plasma Physics + One further Option
Year 4	
PHYS6xxx Astrophysics Research Project : 120 credit unit over both semesters	

During their year away there are two major assessment points. The first is 1 January, at which time the student submits a mid-year report on their work. This is assessed back in Southampton while the student remains abroad. The second and final point is 1 May when the student submits their full and final report on their work on the year away. This is assessed in Southampton and the student is required to attend for a viva and seminar presentation as part of the assessment. In addition, a brief interim report on the student's progress is submitted by the local supervisor midway between the student reports (i.e. on 1 November and 1 March).

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## 12.2 Progression Requirements

### Year 1 to Year 2

If you obtain a minimum of 40% in every unit you are qualified to proceed directly to Year 2. If you do not achieve this level of performance the School may require you to undertake additional study and/or reassessment during either the summer vacation or the following academic year before proceeding.

If you are successful but do not wish to proceed you may exit with a Certificate of Higher Education.

### Year 2 to Year 3

If you obtain an average mark of 70% or more over all courses and a minimum of 40% in every unit you are qualified to proceed directly to Year 3. (If you do not achieve this level of performance the School may require you to undertake additional study and/or reassessment during the summer vacation before proceeding.)

If you obtain a minimum of 40% overall you may either transfer directly to the final year of the B.Sc. Single honours physics with Astronomy programme or exit with a Diploma in Higher Education. If you obtain between 55% and 70% you may proceed to year 3 of the MPhys-with-Astronomy Programme.

### Year 3 to Year 4

If you obtain a minimum of 40% in every unit you may proceed directly to Year 4. If you do not achieve this level of performance the School may require you to undertake additional study and/or assessment before proceeding.

The full regulations concerning progression requirements may be found at [http://www.science.soton.ac.uk/hand\\_books/unit\\_course\\_guide](http://www.science.soton.ac.uk/hand_books/unit_course_guide).

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## 12.3 Honours Classification

The class of honours awarded is determined by your level of performance beyond year 1 with the weightings

Year 2 20%

Year 3 40%

Year 4 40%

The honours classification is based on your weighted score as follows:

70% or over First Class

60 – 69% Upper Second Class

50 – 59% Lower Second Class

40 – 49% Third Class

If your weighted score is just below a boundary, the Board of Examiners will consider your performance in detail before making a final decision: the External Examiners may invite you to attend a viva voce examination in order to obtain additional evidence.

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### 13 Support for Student Learning

There are systems for the support of student learning in the School as well as those available from central University facilities. School Support includes the following:

1. all students have a personal tutor, with whom they meet regularly, particularly during the first year where small group tutorials are used to discuss the core physics courses and associated problem sheets. Tutors offer help on both academic matters, such as choice of option courses, and on pastoral matters;
2. the Year Directors of Studies and the Deputy Head of School Education are available to give help and advice as required;
3. the student Physoc (physics Society) organizes a “parenting” scheme in which all new arrivals are looked after by senior physics students;
4. in the second year each core unit has an associated compulsory problems class where individual help on coursework problems is available;
5. students work in pairs on the projects, which are supervised by a member of academic staff who is likely to be an internationally respected expert;
6. most courses provide printed lecture notes that are either distributed or are available on the Departmental website <http://www.phys.soton.ac.uk>;
7. key transferable skill are embedded throughout our courses, particularly those which contain coursework or laboratory work; The School 's Key Skills web pages describe how these key skills are embedded.
8. provision is made for any student who specifically wishes to consult a female member of staff;
9. the School is proud of its friendly atmosphere. Members of staff are happy to be approached for help. The School office is open from 9 am. to 4.30 p.m. from Monday to Friday. It contains a library of course materials and is a source of helpful advice.
10. During year 4, students will have a local project supervisor in the host institute, who will be responsible for their day-to-day activities. In addition, a member of staff from the University of Southampton will visit the student during the first 3 months to ensure satisfactory progress. At all stages the student will remain in email communication with their personal tutor.

University Support for Student Learning addresses both academic and pastoral matters in support of learning and is provided through:

1. library services;
2. computer workstations, including some in the physics building;
3. University Study Skills website;
4. Student Advice and Information Centre (Students' Union);
5. Careers Advisory Service;
6. NHS general practices on campus;
7. University counselling service;
8. Chaplaincy;
9. day nursery;
10. student loans office;
11. hardship fund;
12. disability coordinator and Learning Differences Clinic (including dyslexia).

You can see details about many of these support services by searching the University's website <http://www.soton.ac.uk>.

## **14 Methods for Evaluating and Improving the Quality of Learning and Teaching**

You will have opportunities to have your say on the quality of the programme in the following ways:

- \$ middle of unit questionnaires, which allow immediate response to any problems in the delivery of the unit;
- \$ end of unit questionnaires, which are used to review and improve the unit;
- \$ the School Staff-Student Liaison Committee, which meets at least once a term, and provides a forum where any aspect of the teaching can be discussed. The chair of the committee undertakes to take forward suggestions or any matters requiring action and provides feedback to student representatives;
- \$ student membership of the School Board and Science Faculty Board;
- \$ informal discussions with personal tutors and the Directors of Studies for each year;
- \$ students can discuss any matters in confidence with their personal Tutor or with the Deputy Head of School Education.

The ways in which the quality of the programme is assured and enhanced, both inside and outside the University include:

- \$ external examiners, who moderate assessment and submit reports which are considered by the School, the Faculty and the University;
  - \$ annual evaluation of each unit by the coordinator and consideration of statistical data on examinations by the School examiners;
  - \$ periodic in-depth unit and programme reviews;
  - \$ external inspection by the Quality Assurance Agency for Higher Education;
  - \$ the Programme is periodically reviewed by the Institute of physics to confirm its accreditation;
  - \$ all academic staff regularly undergo observation of their teaching by colleagues who provide constructive comments on their teaching methods.
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## 15 Criteria for Admission

In our selection process we take account of every aspect of your experience, but your achievements in physics and mathematics are the most important.

In terms of the new UCAS tariff you should have at least three A2 options and you must achieve 240 points in physics and mathematics. If you are taking only A2 options then you should have at least 340 points in total from 18 courses. If you are taking additional AS options then you should have at least 360 points from 21 courses. These correspond approximately to AAB. These offers are the normal ones but they may be varied to take individual circumstances into account.

Equivalent levels of performance in other internationally recognised qualifications (including BTEC, the International Baccalaureate, the European Baccalaureate, the French Baccalaureate, the German Abitur, Scottish Highers and the Irish Leaving Certificate) are also acceptable.

We welcome mature students.

We welcome international students. If your first language is not English you will be asked to achieve a satisfactory standard in an approved English Language test.

All applicants are invited to visit the School ; parents are also particularly welcome. If you wish to discuss any aspect of your application you are welcome to request an individual meeting with a member of the Admissions Staff.

Contact details:

Admissions Secretary	Miss Kim Lange	telephone	023 8059 2068
		fax	023 8059 3195
		email	<a href="mailto:entry@phys.soton.ac.uk">entry@phys.soton.ac.uk</a>
Admissions Tutor	Dr Christian Kaiser	telephone	023 8059 2073
		email	<a href="mailto:crk@astro.soton.ac.uk">crk@astro.soton.ac.uk</a>

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