



Promoting higher quality

**The Quality Assurance Agency
for Higher Education**

Subject Review Report

October 1999 Q20/2000

University of Reading

Physics and Astronomy

Reviewing the Quality of Education

The Quality Assurance Agency for Higher Education (QAA) was established in 1997. It has responsibility for assessing the quality of higher education (HE) in England and Northern Ireland from 1 October 1997 under the terms of a contract with the Higher Education Funding Council for England (HEFCE).

The purposes of subject review are: to ensure that the public funding provided is supporting education of an acceptable quality, to provide public information on that education through the publication of reports such as this one, and to provide information and insights to encourage improvements in education.

The main features of the subject review method are:

Review against Aims and Objectives

The HE sector in England and Northern Ireland is diverse. The HEFCE funds education in over 140 institutions of HE and 75 further education (FE) colleges. These institutions vary greatly in size, subject provision, history and statement of purpose. Each has autonomy to determine its institutional mission, and its specific aims and objectives at subject level.

Subject review is carried out in relation to the subject aims and objectives set by each provider. It measures the extent to which each subject provider is successful in achieving its aims and objectives.

Readers should be cautious in making comparisons of subject providers solely on the basis of subject review outcomes. Comparisons between providers with substantively different aims and objectives would have little validity.

Review of the Student Learning Experience and Student Achievement

Subject review examines the wide range of influences that shape the learning experiences and achievements of students. It covers the full breadth of teaching and learning activities, including: direct observation of classroom/seminar/workshop/ laboratory situations, the methods of reviewing students' work, students' work and achievements, the curriculum, staff and staff development, the application of resources (library, information technology, equipment), and student support and guidance. This range of activities is captured within a core set of six aspects of provision, each of which is graded on a four-point scale (1 to 4), in ascending order of merit.

The aspects of provision are:

- Curriculum Design, Content and Organisation
- Teaching, Learning and Assessment
- Student Progression and Achievement
- Student Support and Guidance
- Learning Resources
- Quality Management and Enhancement.

Peer Review

Reviewers are academic and professional peers in the subject. Most are members of the academic staff of UK HE institutions. Others are drawn from industry, commerce, private practice and the professions.

Combination of Internal and External Processes

The review method has two main processes:

- Preparation by the subject provider of a self-assessment in the subject, based on the provider's own aims and objectives, and set out in the structure provided by the core set of aspects of provision.
- A three-day review visit carried out by a team of reviewers. The review team grades each of the aspects of provision to make a graded profile of the provision, and derives from that profile an overall judgement. Provided that each aspect is graded 2 or better, the quality of the education is approved.

Published Reports

In addition to individual review reports, the QAA will publish subject overview reports at the conclusion of reviews in a subject. The subject overview reports are distributed widely to schools and FE colleges, public libraries and careers services. Both the review reports and the subject overview reports are available in hard copy and are also on the world-wide web (see back cover for details).

Introduction

1. This Report presents the findings of a review in October 1999 of the quality of education in physics and astronomy provided by the University of Reading.
2. The University developed from schools of science and art founded in Reading towards the end of the nineteenth century. After a period as a University College, the University received its Royal Charter in 1926. The University's 45 academic departments are grouped into five faculties, four of which are located at the Whiteknights campus, about a mile and a half from the centre of Reading. The University provides programmes for 9,632 full-time and 3,475 part-time students. The programmes covered by this Report are offered by the Department of Physics, which is based in the Faculty of Science on the Whiteknights campus.
3. The Department has 16 undergraduate students enrolled on the Foundation Year, 98 on the BSc courses, and 22 on the MPhys courses; almost all are full-time. There are also 15 postgraduate students enrolled on the MSc courses. There are 18 full-time and four part-time academic staff.
4. The following provision forms the basis of the review:

Undergraduate Degree Courses

- Foundation Year for Physics
- BSc Physics
- BSc Physics with a Year in Europe
- BSc Theoretical Physics
- BSc Physics and the Universe
- BSc Physics and Electronics
- BSc Physics and Optical Science
- BSc Physics with Computer Science
- BSc Physics and Meteorology
- BSc Mathematics and Physics
- MPhys Physics
- MPhys Physics with a Year in Europe
- MPhys Theoretical Physics
- MPhys Physics and the Universe
- MPhys or MMath Mathematics and Physics

Postgraduate Degree Courses

- Diploma in Applied and Modern Optics
- MSc Applied and Modern Optics
- MSc Physics Research.

5. The statistical data in this Introduction are provided by the institution itself. The aims and the objectives are presented overleaf. These also are provided by the institution.

The Aims and Objectives for Physics and Astronomy

Aims

The Department of Physics' aims are based on the University Mission Statement and its emphasis on the provision of high-quality teaching and learning. In physics, we aim to provide access to quality undergraduate degrees for students from a wide range of academic backgrounds and a level of support to ensure that undergraduate students:

- (i) develop a secure and demonstrable knowledge and skills base in physics, fitting them for further study and for employment;
- (ii) realise their individual capabilities and develop their skills as independent learners.

Postgraduate students studying for an MSc degree in Physics Research or an MSc degree or Diploma in Applied and Modern Optics will, in addition:

- (iii) acquire specific training within a specialised area of physics.

Objectives

Undergraduate

In fulfilment of these general aims, the Department offers a range of courses leading to several named BSc and MPhys degrees. Each degree course has a common core of physics and mathematics, together with distinguishing material from either physics or a second discipline. MPhys candidates are required to have a greater command of the core material and of appropriate further topics, and to be more familiar with research methods through more extensive project work.

Implementation and evaluation of the courses is in terms of a set of general objectives and a set of course-specific objectives. The general objectives are that students should demonstrate at various stages:

- (i) a sound knowledge of core physics and the ability to apply this within the general areas of classical and quantum physics, including mechanics, waves, electromagnetism, optics, space and time, thermal and statistical physics, atomic and molecular physics, nuclear and particle physics and condensed matter physics;
- (ii) a sound knowledge of the mathematical techniques required to apply core physics concepts specified under (i);

- (iii) competence in the subject-specific skills of scientific methodology, mathematical and scientific modelling, experimental techniques, numerical and computational methods and problem solving;
- (iv) competence in the general transferable skills of independent learning, self reliance, information retrieval and organisation including information technology (IT), critical analysis, and interpersonal skills of communication and teamwork.

In addition to (i) to (iv) above, there are outcomes specific to the different named degree courses. In brief, these are that students should have the following:

Physics

- broad knowledge of physics and a comprehensive skills base to facilitate postgraduate study or a career in physics or a related discipline;

Physics with a Year in Europe

- broad knowledge of physics, a comprehensive skills base and the ability to communicate in a second language and study in a foreign environment;

Theoretical Physics

- broad knowledge of physics, biased towards theoretical, mathematical and computational issues, to facilitate postgraduate study or a career in physics or a related discipline;

Physics and the Universe

- broad knowledge of fundamental and philosophical aspects of physics, particularly as they relate to the evolution of the universe, reinforced with a comprehensive skills base;

Physics and Electronics

- knowledge of core physics, emphasising the principles and practice of analogue and digital electronics, reinforced with a comprehensive skills base, to facilitate a career in electronics;

Physics and Optical Science

- knowledge of core physics, emphasising optical and optoelectronic applications, to facilitate postgraduate studies or a career in optics;

Physics with Computer Science

- knowledge of core physics, combined with aspects of computer science which support computational modelling, to facilitate a career in physics or a related discipline;

Physics and Meteorology

- knowledge of core physics and its application to observing and modelling the atmosphere, to facilitate postgraduate studies or a career in physics, meteorology or a related discipline;

Mathematics and Physics

- knowledge of theoretical physics and associated applied mathematics, sufficient for a career in physics, mathematics or a related discipline;

Foundation Year for Physics

- broad knowledge and skills in introductory physics and mathematics, exceeding GCE A-Levels in depth and scope, with integration of the two subjects and matched to the requirements of the later parts of the physics degree course.

Postgraduate**MSc in Physics Research**

- students are required to have a sound knowledge of the basic methods of physics research, an analytical and planned approach to physics research and to make a scholarly contribution to a specialised area of physics;

MSc in Applied and Modern Optics

- students are required to have an advanced knowledge and skills base appropriate to a specialist career as an optical physicist or optical engineer and an ability to work under their own initiative;

Diploma in Applied and Modern Optics

- students are required to have a knowledge and skills base appropriate to a specialised career as an optical physicist or optical engineer.

Summary of the Review

6. The graded profile in paragraph 7 indicates the extent to which the student learning experience and achievement demonstrate that the aims and objectives set by the subject provider are being met. The tests and the criteria applied by the reviewers are these:

Aspects of provision

1. Curriculum Design, Content and Organisation
2. Teaching, Learning and Assessment
3. Student Progression and Achievement
4. Student Support and Guidance
5. Learning Resources
6. Quality Management and Enhancement.

Tests to be applied

To what extent do the student learning experience and student achievement, within this aspect of provision, contribute to meeting the objectives set by the subject provider?

Do the objectives set, and the level of attainment of those objectives, allow the aims set by the subject provider to be met?

Scale points

1
The aims and/or objectives set by the subject provider are not met; there are major shortcomings that must be rectified.

2
This aspect makes an acceptable contribution to the attainment of the stated objectives, but significant improvement could be made.

The aims set by the subject provider are broadly met.

3
This aspect makes a substantial contribution to the attainment of the stated objectives; however, there is scope for improvement.

The aims set by the subject provider are substantially met.

4
This aspect makes a full contribution to the attainment of the stated objectives.

The aims set by the subject provider are met.

7. The grades awarded as a result of the review are:

Aspects of provision	Grade
Curriculum Design, Content and Organisation	4
Teaching, Learning and Assessment	4
Student Progression and Achievement	4
Student Support and Guidance	4
Learning Resources	4
Quality Management and Enhancement	4

8. The quality of education in physics and astronomy at the University of Reading is **approved**.

The Quality of Education

Curriculum Design, Content and Organisation

9. The Department offers a range of undergraduate courses, allowing a depth of study in physics for single honours and the opportunity for students to combine this with another subject. The course structure is based on a common core of physics and mathematics with additional elements depending on the specific course followed. The one-year foundation course is for students who wish to study physics but who have an inadequate subject base, or for mature students with non-standard entry qualifications. The Department also provides an intensive three-week September course for well-motivated students whose examination results on entry are slightly below expectations. Degree courses have three parts (BSc) or four parts (MPhys and MMath). At postgraduate level, the Department offers an MSc and Diploma in Applied and Modern Optics and an MSc in Physics Research.

10. The Department meets its objective of integrating physics with mathematics by providing curricula with a choice of routes, either within physics or jointly with a related department. The broad, well-structured courses are taught in a variety of modes, including lectures, workshops, tutorials, computational and experimental laboratories, independent learning, presentations, problem-solving sessions and group projects. Course content is appropriate to each level, and quality and depth of study are consistently high.

11. There are many innovative aspects to the curricula. The Concepts in Physics course in Part 1 provides an introduction to, and overview of, the principal concepts of physics from Galileo to Schrödinger. Also in Part 1, a Professional Skills module addresses professional, study and transferable skills, a specific emphasis which is maintained throughout the curricula. These aspects are reinforced in each course unit, with the intended learning outcomes stressing general cognitive and transferable skills as well as knowledge, understanding and subject-specific skills. Personal development goes hand in hand with academic development within the curricula. In addition, courses on Problem Solving in Physics in Parts 1 and 3 develop the subject-specific skills of scientific methodology and mathematical modelling. The use of projects and open-ended assignments is innovative, and external examiners particularly praise the courses and projects on computational physics.

12. The research interests of the academic staff are reflected in the course content of the core units in Part 2 and beyond, and are self-evident in the options available in Parts 3 and 4 and in the projects. The new course on Physics and the Universe provides an excellent example of currency. All degree courses are recognised by the Institute of Physics and will be considered for accreditation in November 1999.

13. The content of the undergraduate courses provides good coherence but at the expense of flexibility, and apart from the additional subject in the joint courses there are few interdisciplinary possibilities. The Department is aware of these limitations and is addressing them.

14. The philosophies of the two MSc courses differ. The MSc in Applied and Modern Optics is a well-established course, highly regarded by the Engineering and Physical Resources Research Council (EPSRC) and external examiners; it has a high lecture content and a four-month project, and students are encouraged to work on their dissertations at an external industrial or governmental laboratory. The MSc in Physics Research, a comparatively new course, has a shorter lecture programme, balanced by a longer project within one of the five major research areas in the Department.

15. This aspect makes a full contribution to the attainment of the stated objectives. The aims set by the subject provider are met.

Curriculum Design, Content and Organisation:
Grade 4.

Teaching, Learning and Assessment

16. The Department achieves its aim of providing high-quality teaching and learning which is stimulating, effective and varied in method. The approach is very student-centred, demonstrates a progressive and coherent development in subject and skills at all levels, and uses a clear, fair and appropriate assessment strategy. Subject knowledge and graduate skills are progressively and fully met at undergraduate and postgraduate levels, and the specific aim to develop independent learners is achieved.

17. The reviewers observed 22 very successful teaching sessions, including lectures, workshops, laboratory sessions, tutorials and problem-solving classes across all parts of the undergraduate and postgraduate courses. Lectures met their stated learning objectives and were varied in style in relation to the subject matter and size of class. The printed notes served as useful learning aids.

The workshops, whether in support of subject or skills development, stimulated learning, were highly interactive and were much enjoyed by the students.

18. The laboratory programme was observed at various levels and demonstrated a planned, progressive and comprehensive development of practical skills. The provision of a training module in preparation for the final undergraduate project and the training programme for the advanced optics laboratory is highly commended by the reviewers. Students and graduates were most appreciative of these practical aspects of their course, in particular the preparatory training for research projects.

19. The progressive development of problem-solving is a key feature of this provision; units in Parts 1 and 3 are operational, and a Part 2 unit is under development. Observation of the Part 1 class showed students working in groups and enjoying the solution of a simple but intriguing physical problem, which they subsequently presented and discussed in detail as a full group.

20. The Flexible Learning Approach to Physics was pioneered at Reading and is used very successfully in the teaching of the Foundation Year, the September course and certain Part 1 modules where mathematics is integrated with physics. Its use is supported by diagnostic testing, with well-structured delivery and assessment, and students valued this approach in promoting effective student-centred learning.

21. In discussions with the reviewers, students clearly articulated the aims, benefits and progressive developments of their units and courses, and were highly complimentary of the readily available academic and personal support from the staff. They felt that workload was high in relation to other subject areas, but that it was manageable. They were also aware that the Department's research activities made valuable contributions to their learning experience.

22. Assessment methods are linked to the learning outcomes, which are designed to stimulate and develop student learning. In addition to formal examinations, assessment methods identified by the reviewers included: the uniform marking and prompt return of laboratory notebooks; moderated project reports and associated oral presentations; and moderated oral examinations. Feedback at the unit and course levels is provided by a range of methods, including returned work, one-to-one discussions and class presentations; students confirm that this feedback is always comprehensive and prompt. Appropriate procedures for initial and external moderation of examination papers and scripts and for coursework are established and operational.

23. This aspect makes a full contribution to the attainment of the stated objectives. The aims set by the subject provider are met.

Teaching, Learning and Assessment:
Grade 4.

Student Progression and Achievement

24. Over the last six years, the Department has received an average of about 290 UCAS applications, and intakes have averaged 46 students into Part 1 of the BSc/MPhys and 12 students into the Foundation Year. About 85 per cent of entrants have GCE A-Levels, with an average points score of 20.3, although the spread is wide. Approximately 85 per cent of the students are men, and some 12 per cent are mature students. The variety of teaching modes used satisfies the Department's aim of providing access to undergraduate degrees for students from a wide range of academic backgrounds.

25. Since the inception of the MSc/Diploma in Applied and Modern Optics in 1992, there has been an average of 26 applications each year, of which about half are accepted on to the course. The range of entry qualifications is wide, encompassing diplomas and all classes of honours degrees. Approximately 70 per cent of the students are men. The first intake to the MSc in Physics Research was in 1997, and in that and the subsequent year it has attracted six students, five of whom are men.

26. About 83 per cent of the Foundation Year entrants are successful, and most continue into Part 1 of the Department's degree courses. The pass rate at the end of Part 1 is commendably high, averaging about 98 per cent, and 82 per cent of all Part 1 entrants complete their degree within the Department. The progression of individual students is continuously and closely monitored through a policy of: assigning personal tutors; associating workshops or tutorials directly with many lecture courses; having a large fraction of continuously assessed coursework in Parts 1 and 2; and using major projects in Parts 3 and 4.

27. Over the last four years, 89 per cent of those graduating with a BSc have achieved an honours degree, including 33 per cent with a First or Upper Second, 57 per cent with a Lower Second or Third, and 10 per cent with an unclassified degree. About 13 per cent of students opt for the four-year MPhys degree; of these, 95 per cent achieve an honours classification, including 30 per cent with a First or Upper Second class degree. The reviewers note the regulations allowing complete compensation for progression at the end of both Part 1 and Part 2 stand at an overall pass mark of 40 per cent

even though some students may have failed some modules, and this may account for the percentage of lower degrees awarded at BSc level. Also, the previous 40 per cent mark (now raised to 50 per cent) for progression to Part 4 could account for the comparatively large fraction of lower degrees awarded at the MPhys level. About 91 per cent of entrants to the Applied and Modern Optics course achieve an MSc, including 34 per cent with Distinction, and 8 per cent achieve a Diploma.

28. External examiners praise the achievements of graduates, a high percentage of whom progress to further study or appropriate employment. The MSc in Applied and Modern Optics is recognised as a high-quality course, by both the EPSRC and external examiners. Progression on completion is excellent, with approximately half the students continuing to a PhD and the remainder taking up related employment. These various successes are strong indicators of good added-value at both undergraduate and postgraduate levels.

29. This aspect makes a full contribution to the attainment of the stated objectives. The aims set by the subject provider are met.

Student Progression and Achievement:
Grade 4.

Student Support and Guidance

30. The University offers centrally-based support systems, including counselling, health care and careers services, and also has the benefit of a special needs co-ordinator. The departmental strategy is to provide local academic and personal support in an informal and friendly way that complements the University's systems and that is geared towards individual needs. The Department maintains close links with the University's central services and refers students to them when necessary.

31. Recruitment procedures consist of open days, interviews with prospective applicants and involvement of the applicant's parents. Highly-qualified applicants are offered an industrial scholarship. The admission procedures are reviewed annually in the light of feedback from both staff and applicants. The University provides an effective and comprehensive induction week for new undergraduate and postgraduate students, and there are additional departmental induction sessions. The reviewers thought it would be useful if the Department urged all new postgraduate students to take advantage of the University's induction. Students are provided with very informative course handbooks on induction and are given a computer account and a library card allowing them access to the facilities provided by the University's library and IT services.

32. Students are assigned personal tutors at Part 1 and are required to meet them at least twice each term, but can see them as often as they wish under the Department's highly regarded open-door policy. Personal tutors receive an effective handbook and undergo compulsory training to help them provide solutions to both academic and personal problems. This training includes seminars led by experienced tutors to explain the support systems and structures. It focuses on enhancing skills such as active listening, coaching and action planning. The reviewers are very impressed by the good relationship between tutors and students and the overall enthusiasm of the students for the support system.

33. The University's counselling service is accessible to all students, and there are close contacts between this service and the tutors who refer students with potential problems. There is a student-based advice centre in the halls of residence, and extensive pastoral support is available from wardens, who are experienced members of staff. Effective support is also provided to students on industrial placements through frequent monitoring by the industrial liaison tutor, although the reviewers believe that exchange students abroad would benefit from more frequent and pro-active monitoring.

34. A foreign language programme offers courses for students who require a foreign language for a job or for an ERASMUS exchange programme. The University makes considerable efforts to support special needs students, and the Department liaises with the University's special needs co-ordinator through a special needs representative.

35. The University's efficient and comprehensive careers advice service organises training courses for students, including a career capabilities scheme that leads to a Certificate of Integrated Management Studies. The Department runs an impressive Professional Skills unit that includes material on writing job applications, curriculum vitae and preparing for job interviews.

36. This aspect makes a full contribution to the attainment of the stated objectives. The aims set by the subject provider are met.

Student Support and Guidance:
Grade 4.

Learning Resources

37. The University is currently investing £730,000 to concentrate IT services in the library building and create a new integrated Learning Resource Centre for the entire Whiteknights campus. The departmental learning resource strategy is to provide well-equipped teaching laboratories and to ensure that learning resources meet

requirements by maintaining a complete collection of recommended physics books in the university library and up-to-date collections of other physics-related material. The reviewers find that the extensive range of resources available within the J J Thompson Physics Building allows the Department to maintain good support for the curriculum and its associated teaching and learning activities. There are also effective arrangements for replacing and updating resources.

38. The university library holds a comprehensive collection of over a million volumes and provides a wide range of effective services. There are subscriptions to 71 physics-related journals and a further 31 are available electronically. The library catalogue is accessible through all networked PCs across the campus, and students have access to databases such as Bath Information Data Services. The Department has a very pro-active departmental 'bookman' who serves on the Faculty of Science Library Committee and interacts with the physics liaison librarian in the university library. Additional departmental library services include a Learning Resource Centre and a library/common room that also contain study and discussion spaces. Students are very satisfied with these arrangements and find the departmental facilities particularly useful for private study.

39. The Physics Building houses two undergraduate laboratories, an optics laboratory, three computer laboratories and a number of research laboratories. There are also mechanical, electronics/IT and glass workshops designed to support these laboratories, and the reviewers found them equipped with a broad and appropriate range of experimental apparatus. The Department has lost space recently and has coped well by adopting a policy of flexible usage whereby there is multipurpose use of laboratory and teaching space, sometimes simultaneously by more than one group.

40. There are three IT laboratories within the Department that house 72 PCs, two Sun workstations, a silicon graphics server, 11 workstations, and one PowerMac. Additionally, the University provides 229 PCs, 47 Macs, 49 Sun workstations, four silicon graphic workstations and seven X-terminals across the Whiteknights campus, and these are available to physics students. Out of the 13 halls of residence, 10 have communal networked computer rooms, and 4,500 student rooms have been cabled for telephone connection, allowing access to the University's network. Students are very satisfied with the level of access to computing and IT facilities.

41. Central IT services organise a wide range of courses to develop computing and IT skills, such as Word, Excel and Access. Almost all physics students are taught

MATLAB and FORTRAN 95, which is appreciated by students and employers as useful transferable skills. There is formal liaison between the Department and central IT services.

42. This aspect makes a full contribution to the attainment of the stated objectives. The aims set by the subject provider are met.

Learning Resources:
Grade 4.

Quality Management and Enhancement

43. Arrangements for quality management are robust and comprehensive. Teaching quality is managed at several levels, ultimate responsibility resting with Senate, advised by the University Board for Teaching and Learning. Quality assurance processes applicable to physics teaching are contained in the Faculty of Science's quality assurance handbook. Boards of study are responsible for degree courses, and the Undergraduate Teaching Committee (UTC) is responsible for most of the Physics Department's taught units. Faculty scrutiny groups approve new degree courses. Unit co-ordinators produce annual reports for current degree courses, based on assessment data and input from students, staff and external examiners. The reviewers are impressed with the careful way in which the Department monitors its work and continually seeks to respond to the evolving needs of students.

44. In 1999, the degrees in physics were subjected to a six-yearly periodic review. The report of the review panel was thorough and positive and highlighted several areas for attention, including the provision of personal computers and accessibility of some textbooks. Departmental and faculty funds were rapidly deployed to improve the provision in these areas and within seven months action in response to the report was almost complete. The periodic review was effective in enhancing the students' learning experience and demonstrates the responsiveness of the quality assurance system at faculty and departmental levels.

45. Physics students have a significant input to quality assurance processes. The Department's staff-student liaison committee (SSLC) meets once a term and has 11 student members. Student course representatives gather views from their peers and report on their unit prior to each meeting. These are distributed by email, and the reports, staff comments and minutes of meetings are available to students and staff on the physics intranet. Student evaluation questionnaires are issued for all units, and response rates are high. Unit co-ordinators analyse the responses and include the results in their reports

circulated to the SSLC and UTC. Students confirmed the effectiveness of these processes in picking up concerns and dealing with them promptly, such as improvements to the delivery of classes, improvement of facilities and alterations to assessment.

46. Employers demonstrate commitment to the Department by continuing to fund industrial placements and scholarships. External examiners confirm that standards are high and procedures fair and efficient.

47. The formal arrangements for staff development are highly effective in enhancing teaching. New and inexperienced teaching staff attend the new lecturers workshop programme administered by the Centre for Staff Development and Training. New staff are guided by a mentor from within their Department and thought highly of the arrangements for their introduction to teaching. The University appraises academic staff regularly, and additionally the Department of Physics conducts biennial peer reviews of teaching. The postgraduate and postdoctoral demonstrators the reviewers saw had been thoroughly trained and were well prepared for their work.

48. The self-assessment document is an accurate reflection of the provision, and the reviewers found the documentation provided during the visit to be well organised and definitive.

49. This aspect makes a full contribution to the attainment of the stated objectives. The aims set by the subject provider are met.

Quality Management and Enhancement:
Grade 4.

Conclusions

50. The quality of education in physics and astronomy at the University of Reading is approved. All aspects make a full contribution to the attainment of the stated objectives and the aims are met. The reviewers come to this conclusion, based upon the review visit together with an analysis of the self-assessment and additional data provided.

51. The positive features of the education in physics and astronomy in relation to the aspects of provision include the following:

- a. Broad, well-structured courses with many innovative features (paragraphs 10; 11).
- b. Staff research interests that are reflected in the content of the courses and in teaching and learning (paragraph 12).
- c. A highly regarded MSc course in Applied and Modern Optics, with a large proportion of students' project work undertaken in industrial and governmental laboratories (paragraph 14).
- d. Excellent development of key graduate skills, with progressive training in problem-solving, independent learning and experimental skills (paragraphs 18 to 20).
- e. Innovative teaching using the Flexible Learning Approach to Physics to enable access and the integration of maths and physics (paragraph 20).
- f. A varied and effective assessment programme, providing prompt and effective feedback which is well managed and moderated (paragraph 22).
- g. A wide variety of teaching modes, providing access to undergraduate degrees for students from a wide range of academic backgrounds (paragraph 24).
- h. Good progression and completion rates, with high levels of achievement and strong added-value (paragraphs 26 to 28).
- i. Excellent first-employment statistics, both at undergraduate and postgraduate levels (paragraph 28).
- j. Impressive academic and personal support, provided by personal tutors, and a highly regarded open-door policy (paragraph 32).
- k. An attractive Professional Skills unit, combined with good careers advice services (paragraph 35).
- l. An extensive range of resources within the Physics Building, with effective arrangements for replacement and updating (paragraph 37).
- m. A useful departmental Learning Resource Centre and pro-active liaison with the comprehensive central library (paragraph 38).
- n. Laboratories equipped with a broad and appropriate range of apparatus, coupled with good access to computing and IT facilities (paragraphs 39; 40).
- o. The effective periodic review process operated by the Faculty of Science, and the thorough and expeditious response by the Department of Physics to the periodic review of physics degrees in February 1999 (paragraph 44).
- p. The involvement of students in the monitoring of quality and in the enhancement of learning and teaching through evaluation questionnaires, unit reports and the staff-student liaison committee (paragraph 45).