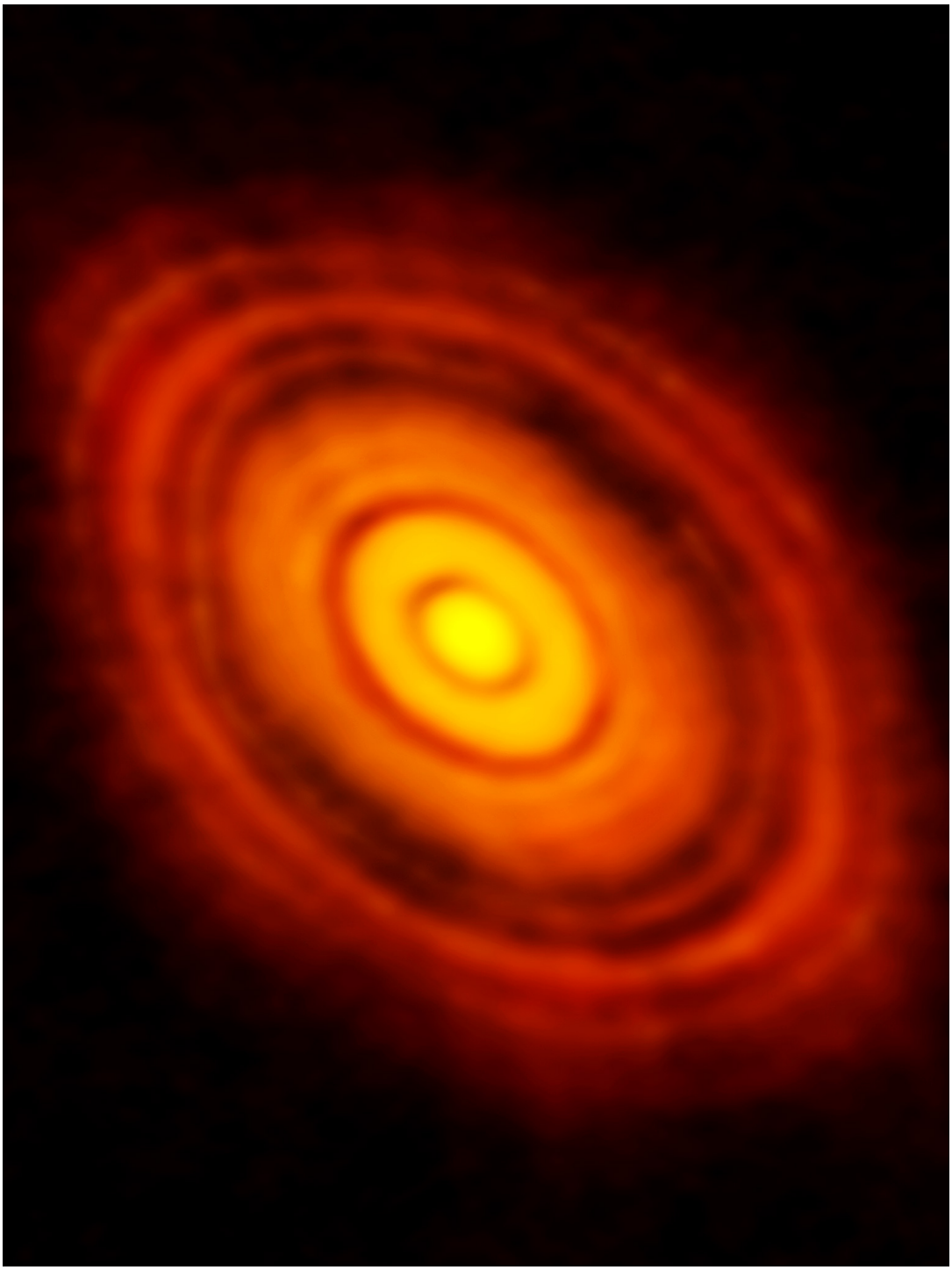
UNIVERSITY OF CAMBRIDGE

Cavendish Laboratory

Physics Course Handbook 2016/17



350 GHz image of the protoplanetary disk around the young star HL Tau, made with the Atacama Large Millimeter Array in Chile. Credit: ALMA (ESO/NAOJ/NRAO)

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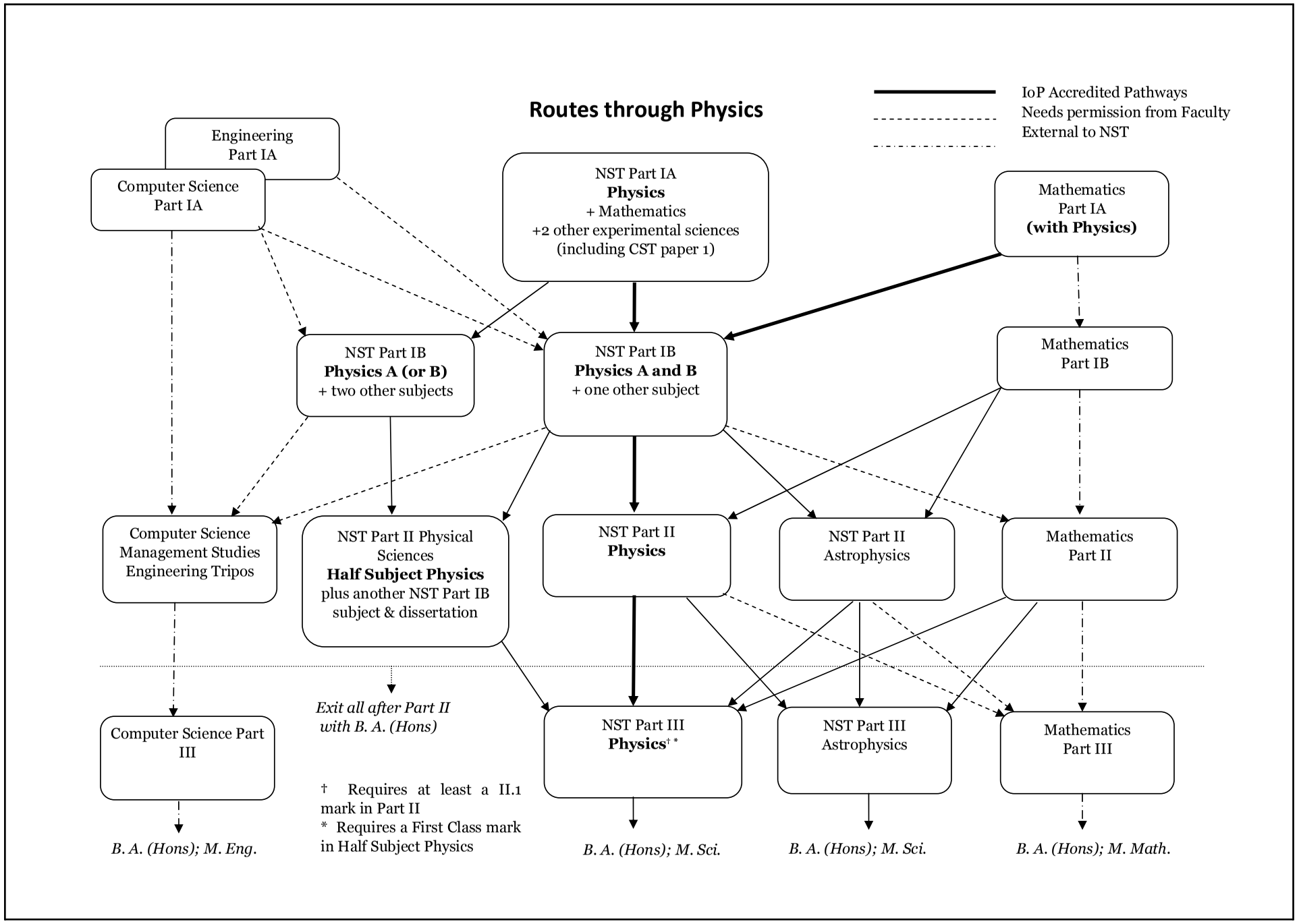
Routes through Physics
IoP Accredited Pathways
Needs permission from Faculty
External to NST
Engineering Part IA
Computer Science Part IA
NST Part IA
Physics
+ Mathematics
+2 other experimental sciences
(including CST paper 1)
Mathematics Part IA
(with Physics)
NST Part IB
Physics A (or B)
+ two other subjects
NST Part IB
Physics A and B
+ one other subject
Mathematics Part IB
Computer Science
Management Studies
Engineering Tripos
NST Part II Physical Sciences
Half Subject Physics
plus another NST Part IB subject & dissertation
NST Part II
Physics
NST Part II
Astrophysics
Mathematics Part II
Exit all after Part II with B. A. (Hons)
Computer Science Part III
NST Part III
Physics† *
NST Part III
Astrophysics
Mathematics Part III
† Requires at least a II.1 mark in Part II
* Requires a First Class mark in Half Subject Physics
B. A. (Hons); M. Eng.
B. A. (Hons); M. Sci.
B. A. (Hons); M. Sci.
B. A. (Hons); M. Math.

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- For the latest version of this Course Handbook and up to date information about lectures, practicals and exams, please consult the main Cavendish Laboratory undergraduate web pages: http://www.phy.cam.ac.uk/teaching.
- The Cavendish Laboratory's **Undergraduate Office** is situated in the Bragg Building, Room 212B. Helen Marshall is the Undergraduate Administrator, and can be reached at undergraduate-office@phy.cam.ac.uk.
- The Director of Undergraduate Teaching is Prof. John Richer, director-teaching@phy.cam.ac.uk, to whom suggestions for improvements should be sent.

1 Undergraduate Courses in Physics

1.1 Introduction

This document describes the structure of the courses in Physics offered in the University of Cambridge. It is a reference for both students and teaching staff of the laboratory.

The Department of Physics in Cambridge offers both three and four year courses in physics, which form the two basic routes to a first degree with specialisation in physics. The four-year course is designed for students who wish to pursue a professional career in physics, for example, in academic or industrial research: it leads to an honours degree of Master of Natural Sciences, M.Sci., together with an honours degree Bachelor of Arts, B.A. The three year course is designed for students with a deep interest in the subject but who may not intend to become professional physicists: it leads to an honours degree of B.A.

Physics graduates from Cambridge go in a wide range of directions. Nearly half embark on research leading to a higher degree, and about a quarter go straight into full-time employment in a wide variety of fields, such as teaching, business and finance, and computing. The remainder are spread over other types of postgraduate activities. Our graduates have an excellent record of finding employment promptly after graduation.

As regards research towards a Ph.D., at present the policy announced by the UK Research Councils is that an Upper Second or First Class in either the third or fourth years formally qualifies a student for a Ph.D. award. However, the policy of this Department and many others is that Part III is an essential preparation for a Ph.D.

In both the three and four year courses our aims are to provide a solid foundation in all aspects of physics and to show something of the very broad spectrum of modern physics. Vital basic areas such as Electromagnetism, Quantum Mechanics, Dynamics and Thermodynamics are covered in the first three years, where we also aim to develop experimental, computational and mathematical skills. Advanced work in the fourth year can include fundamental subjects such as Advanced Quantum Theory, Particle Physics, Condensed Matter Physics and Cosmology as well as applied topics such as Biological Physics and Geophysics. A substantial piece of independent project work is required in the fourth year, and there are also possibilities for experience of industrial research during the long vacations.

In the following sections, brief descriptions are given of the undergraduate courses currently offered by the department. The flow chart inside the front cover shows routes through the three- and four-year courses. The detailed synopses for all the courses to be delivered in the academic year 2016-17, as well as their aims and outcomes, are no longer printed in this handbook, but can be found and printed from the course website.

Students are reminded that they should use their college Director of Studies as the first point of contact for advice on academic aspects of their studies, in particular regarding their choice of courses.

The Physics Undergraduate Office is situated on the first floor of the Bragg building, Room 212B, tel. 65798. The office is run by Helen Marshall and is open for general enquiries and submission of written reports at regular times during full term.

Routine administrative matters regarding the course should be addressed to the Undergraduate Office in person, or via undergraduate-office@phy.cam.ac.uk, but please check first that your question is not answered in this handbook or the on the course websites.

The Director of Undergraduate Teaching in Physics is Prof. John Richer, and he is in overall charge of the undergraduate courses; he can be contacted at director-teaching@phy.cam.ac.uk.

If your still have unresolved issues, you can contact the Deputy Head (Education) at the Cavendish, Prof. Chris Haniff, or the Head of Department, Prof. Andy Parker.

Several websites support our Physics courses:

1. The main public webpages for undergraduates are at `http://www.phy.cam.ac.uk/teaching`, where this guide, course summaries, examination timetables, lecture lists, and links to useful materials are advertised.

2. The Teaching Information System (TIS or TiS) is a Cavendish-run system that is used to ad-

minister all of our courses. In particular it serves handouts and examples sheets for all the courses and beyond, plus past examination papers in Physics. Its web address is http://www-teach.phy.cam.ac.uk/ and access requires your CRSid and Raven authentication.

3. The University's timetable tool (http://timetable.cam.ac.uk) allows you to create your own timetable of lectures and practicals, and add to your own electronic calendar.

4. The University's Moodle Virtual Learning Environment (VLE: https://www.vle.cam.ac.uk) is not currently used a great deal in Physics, except for the IA Scientific Computing course. The TIS remains the preferred system for most of our courses.

1.2 Course Overview

1.2.1 The First Year (Part IA)

Students in the first year of the Natural Sciences Tripos (NST) choose three experimental subjects, plus a mathematics course, as detailed on the NST website: http://www.natsci.tripos.cam.ac.uk/.

The Part IA Physics course assumes either A2 level Physics (or equivalent), or A2 level Further Maths (including the Mechanics modules). Ideally students would have done both Physics and Further Maths, but this is definitely not essential.

The first-year course, Part IA Physics, covers fundamental principles in physics. The aim is to bridge the gap between school and university physics by providing a more complete and logical framework in key areas of classical physics, as well as introducing new areas such as relativity and quantum physics. The Part IA Physics course is given in three lectures per week plus a four-hour experiment once every two weeks. Subjects studied include Mechanics, Relativity, Oscillations and Waves, Quantum Waves, and Fields.

The first-year physics course is also available in Part IA of the Computer Sciences Tripos, where it is combined with courses in Mathematics for Natural Sciences and Computer Science Courses. It is also possible to read Part IA Physics as part of the Mathematical Tripos in the first-year course 'Mathematics with Physics'. Both of these routes provide for possible specialisation in physics in later years.

There is no limit on numbers. In 2015/16, there were about 450 students reading Part IA Physics.

1.2.2 The Second Year (Part IB)

There are two physics courses in Part IB: Physics A and Physics B. Physics A provides a grounding in quantum mechanics and solid-state physics, while Physics B covers the core of classical physics, including electromagnetism, dynamics and thermodynamics.

Most students choose to study both physics courses. The combination of Part IB Physics A **and** Physics B offers a firm grounding in key areas of physics – theoretical and experimental – and covers specialised topics that lead naturally to Part II/III Physics and other quantitative subjects. Students taking both courses combine them with one other IB subject. This third subject is often NST Part IB Mathematics, and this is useful for students wishing to pursue theoretical options in Part II Physics. However, choosing a different subject provides additional breadth and gives greater choice of Part II and Part III courses. Common choices for the third subject are Materials Science, Chemistry A, Earth Sciences A or History and Philosophy of Science. For students taking either Physics A or Physics B without NST IB Mathematics, additional lectures in Mathematical Methods are provided within the course.

There is no limit on the number of students taking IB Physics A and Physics B: in 2015/16, about 190 students took both. Most proceed into Part II Physics, but some go into other third-year science subjects or into other triposes.

Students come into the combination of IB Physics A and B mostly having taken both Physics and Mathematics in Part IA of the Natural Sciences or Computer Sciences Triposes. Of those who

have taken the first-year Mathematics with Physics course in the Mathematics Tripos, a significant proportion subsequently take IB Physics A and B.

A smaller number of students, usually ten to twenty, take IB Physics A as their *only* physics course. Part IB Physics A provides a self-contained package of quantum, condensed matter and experimental physics. It builds on Part IA Physics and offers a firm grounding in important areas of physics that is very useful for scientists with a wide range of career destinations. The students will normally take two other Part IB subjects, and then go into a wide range of third-year courses. Note that **Part IB Physics A alone is not an adequate preparation for Part II Physics.**

It is also possible, **though unusual**, for students to take IB Physics B as their only physics course, and this may suit students with a particular interest in the topics covered in that course. Note that **Part IB Physics B alone is not an adequate preparation for Part II Physics.** Further, the practical work draws heavily on material presented in Physics A in the Michaelmas Term: students taking just Physics B are advised to attend the Experimental Methods lectures for Physics A for necessary background. We expect that almost every student wishing to pursue a single physics course will find IB Physics A the more attractive option. Note that it is not normally possible to take Part IB Physics B with Animal Biology or Pharmacology.

1.2.3 The Third Year (Part II)

The aim of the third-year Part II Physics course is to complete instruction in core physics and to begin to introduce more advanced topics required for a professional career in research. The available courses cover a broad range of experimental, theoretical and computational subjects, with an element of choice that allows students to explore topics they find particularly interesting and, if they wish, to concentrate on more experimental or theoretical work. Professional skills are developed through lectures, example classes, computing exercises and extended experiments, depending on the courses taken.

In the Michaelmas term, there are core courses in Advanced Quantum Physics, Relativity, Optics and Electrodynamics, and Thermal and Statistical Physics.

In the Lent and Easter term, students have some choice amongst lecture courses including Astrophysical Fluid Dynamics, Particle and Nuclear Physics, Quantum Condensed Matter, and Soft Condensed Matter. Additionally there is a short course on Computational Physics, with associated (compulsory) exercises, and a short, more general course on Concepts in Physics.

Students are also required to submit three or more items of “Further Work”. You may choose an experimentally-biased course or one with a stronger emphasis on theory, or some intermediate combination of experiment and theory. For example, there is the option of carrying out up to two experimental investigations, each lasting two weeks. For theorists, there are two courses in Theoretical Physics, consisting of lectures plus examples classes, which run through the Michaelmas and Lent terms. Other possible units of Further Work include: the Computational Physics project, assessed Long Vacation work, the Physics Education course and a Research Review.

There is no limit on the number of students taking Part II Physics, provided they meet the entry requirements (i.e. successful completion of Physics A **and** Physics B in Part IB). In recent years we have had about 150 students, the largest class in any Part II Natural Science subject.

An alternative for the third year is Half Subject Physics in Part II Physical Sciences of the Natural Sciences Tripos. This is offered to students who wish to retain an interest in physics but to keep other options open at the same time. They select about half the workload from the third-year physics course, combined with a Part IB subject which they have not previously taken, such as History and Philosophy of Science, plus a Dissertation. We expect that students offering Half Subject Physics will have read IB Physics A or Physics B in the second year. Advice on suitable combinations of Part II Physics courses can be obtained from your Director of Studies.

1.2.4 The Fourth Year (Part III)

The fourth-year course, Part III Physics, is designed to provide the necessary foundation for a professional career in academic or industrial research. The course spans the spectrum from strongly

experimental to highly theoretical physics and offers the flexibility for students to select a wide range of different combinations of subjects, according to their career aspirations. Many of the courses reflect major research interests of staff of the Cavendish. There is a substantial amount of independent project work, which may be proposed by the students themselves, together with opportunities to include work in external laboratories and industry through assessed vacation projects.

There is an application process that runs in the Lent term for those wishing to read Part III Physics. There is currently no limit on places. The detailed entrance requirements are published in the Reporter: currently a 2:1 result or better in Part II Physics is required.

Our aim in the fourth year is to present physics as a connected subject of enormous flexibility and applicability. Lecture courses in the first and second terms provide more advanced treatments of major areas of physics and are selected to reflect broad areas of current interest. Many of them have an interdisciplinary character. Revision classes in general physics are given in the Easter Term and all students undertake a substantial project which is worth one third of the year's marks. The overall course provides excellent preparation for a research career inside or outside physics in either the academic or industrial sectors.

1.2.5 Master of Advanced Studies (MASt) in Physics

This is a taught one-year postgraduate course, which consists of exactly the same content and assessment process as Part III Physics. This course is designed for students who hold a 3-year undergraduate degree who wish to pursue a research degree. The entry requirement for the MASt is a qualification comparable to an upper second class or better UK Bachelor's degree in Physics. Students from all over the world join us to take this course and the goal is that they integrate effectively with the Part III class. In 2015/16, there were 13 students taking the MASt.

1.3 Mathematics Courses

The mathematical skills needed by students who follow the three or four-year physics course are quite varied. Students taking entirely experimental options may need much less sophisticated mathematics than those taking the more advanced theoretical options. The level of mathematics preparation at school is also variable. Some students entering Part IA Physics have studied two A2-levels in Mathematics and others have studied only one A2-level.

The aim of the Physics Department is to challenge the most gifted and best-prepared students, while providing access to theoretical courses for those less well prepared. The Mathematics course for Natural Scientists in Part IA assumes only single Mathematics A2-level.

In the second year, both IB Physics courses assume only mathematical material from NST IA mathematics. Other necessary mathematical techniques are taught alongside the physics or in NST Part IB Mathematics: for those not taking this course, there is a non-examined (but supervised) course in Mathematical Methods given in the Michaelmas Term. This covers all the mathematical material needed for the Part II core and options courses.

The optional theoretical courses in Part II (TP1 and TP2) prepare students for the theoretical options in Part III. Students intending to take TP1 and/or TP2, and who have not taken Part IB NST Mathematics, will find it helpful to do some extra preparation in the long vacation at the end of Part IB.

2 Aims and Objectives of the Physics Teaching Programme

2.1 The University's Aims And Objectives

The Quality Assurance Agency, through its institutional audit of the University, is concerned with the assurance of the quality of teaching and learning within the University. The University in turn requires every Department to have clear aims and objectives and to monitor their teaching and learning activities and consider changes where necessary. Students should be aware of these Aims and Objectives, which have been the subject of considerable discussion within the Department, with the

University and with the Physics Staff-Student Consultative Committee. If you have any comments on the Aims and Objectives of the Physics Teaching Programme, which are printed below, please contact Prof. John Richer, Director of Undergraduate Teaching, Cavendish Laboratory.

The University's stated aims are 'to foster and develop academic excellence across a wide range of subjects and at all levels of study'. Furthermore, the University aims 'to provide an education of the highest calibre at both the undergraduate and postgraduate level, and so produce graduates of the calibre sought by industry, the professions, and the public service, as well as providing academic teachers and researchers for the future'. The broad aims of the Department of Physics are identical with these.

In the context of the Departmental teaching programmes, the specific aims and objectives are given below.

2.2 Course Aims

- To provide education in physics of the highest quality at both the undergraduate and graduate levels and so produce graduates of the calibre sought by industry, the professions, and the public service, as well as providing the academic teachers and researchers of the future;
- To encourage and pursue research of the highest quality in physics, and maintain Cambridge's position as one of the world's leading centres in these fields;
- To continue to attract outstanding students from all backgrounds;
- To provide an intellectually stimulating environment in which students have the opportunity to develop their skills and enthusiasms to the best of their potential;
- To maintain the highest academic standards in undergraduate and graduate teaching and to develop new areas of teaching and research in response to the advance of scholarship and the needs of the community.

2.3 Course Objectives

By the **end of the first year** (Part IA Physics), students, whether continuing with physics or not, should have:

- attained a common level in basic mathematically-based physics, and so laid a secure foundation in physics for their future courses within the Natural Sciences or other Triposes;
- acquired a broad introduction to a range of sciences at University level, generally through having studied two other experimental subjects as well as mathematics;
- developed their experimental and data analysis skills through a wide range of experiments in the practical laboratories.

By the **end of the second year**, students taking Part IB Physics A and Part IB Physics B should have:

- been introduced to powerful tools for tackling a wide range of topics, including formal methods in classical and quantum physics;
- become familiar with additional relevant mathematical techniques;
- further developed their experimental skills through a series of whole-day experiments, some of which also illustrate major themes of the lecture courses, and developed their communication skills through group activities.

By the end of the second year, students taking Part IB Physics A should have:

- covered a wide range of topics in quantum and condensed matter physics with emphasis upon their practical applications and utility;
- further developed their practical skills through a series of whole-day experiments, some of which illustrate major themes of the lecture courses.

By the end of the second year, students taking Part IB Physics B should have:

- covered a range of topics in classical physics, including electromagnetism, dynamics and thermodynamics;
- further developed their practical skills through a series of whole-day experiments, some of which illustrate major themes of the lecture courses.

- have been introduced to scientific computing using the C subset of the C++ language.

By the **end of the third year** (Part II Physics), students taking Part II Physics should have:

- completed their study of core physics;
- substantially developed professional skills in experimental and/or theoretical and/or computational physics, or in Physics Education;
- had experience of independent work, including an introduction to aspects of research;
- had experience of the application of computers to physical problems;
- developed their communication skills
- had experience of independent work.

By the end of the third year, students taking **Half Subject Physics** in Part II Physical Sciences should have:

- enhanced their understanding of core physics, in the context of a broader exposure to science with the Natural Sciences Tripos;
- had some experience of independent work.

By the **end of the fourth year** (Part III Physics), students completing the four-year option should have:

- had experience of a number of broad areas of physics from a choice of options, taken to an advanced level, at which current research can be appreciated in some depth;
- carried out a substantial independent research project amounting to the equivalent of about six weeks of full-time work;
- maintained their skills in core physics;
- enhanced their communications skills;
- become well prepared for a career in academic or industrial research.

3 Late Submission of Coursework

The Department of Physics expects students to meet the advertised deadlines for the submission of all coursework, to ensure fairness to all students taking the course and allow prompt marking by the Department.

In accordance with the University's regulations, **work submitted after the advertised deadline will not count towards your final examination mark, unless the Department grants an extension of time on the grounds that there are significant mitigating circumstances**.

Any application for such an extension should be made by your college Tutor and Director of Studies to the Director of Undergraduate Teaching, c/o Undergraduate Office, Cavendish Laboratory, (undergraduate-office@phy.cam.ac.uk). Students must complete the form available from the teaching webpages, including supporting cases from Tutor and Director of Studies.

In such circumstances, you should submit the work as soon as possible after the deadline.

Part III Projects count for more than 10% of total Tripos marks, and are subject to special arrangements. Late submission of this report is a particularly serious matter, and will require your College to apply to the Applications Committee of the University.

4 Part IA Physics

4.1 Aims Of The Course

An important objective of the course is to develop an understanding of core physics at successively deeper levels, each stage revealing new phenomena and greater insight into the behaviour of matter and radiation.

The first year of the course has several distinct aims. First, it aims to bridge the gap between school- and university-level physics, and to bring students from different backgrounds to a common point. Second, it aims to consolidate school physics by providing a much more logical and analytical framework for classical physics, which will be essential for all years of the course. Third, it includes new themes such as special relativity and quantum physics, which foreshadow key topics to be developed in the subsequent years of the course. Fourth, the individual lecture courses aim to broaden your perspective, so that you can begin to appreciate the great flexibility and generality of the laws of physics and their application. And fifth, the experimental work is designed to developed your practical skills and prepare you for more advanced laboratory work in future years.

4.2 Induction

There is an **introductory talk at 1100 on the first Wednesday of Michaelmas full term (5th October 2016), at the Cavendish Laboratory, in the Pippard Lecture Theatre.** All students should attend this.

4.3 The Lecture Courses

The lecture courses are listed in the table below; detailed synopses are available online. Please check the course website for latest developments and contacts.

All lectures take place in the Bristol-Myers Squibb Lecture Theatre, Chemical Laboratory, Lensfield Road. Lectures take place on Monday, Wednesday and Friday at 0900 during the 8 weeks of full term (that is M.W.F.9 in Cambridge shorthand). Cambridge teaching weeks start on Thursdays, so the first lecture will be on a Friday.

Part IA Physics Lectures 2016/17		
lectures	**Course**	**Lecturer**
Michaelmas Term		
12	Dynamics	Prof. Val Gibson
12	Oscillating Systems	Dr John Biggins
Lent Term		
12	Waves and Quantum Waves	Prof. Jeremy Baumberg
12	Rotational Mechanics and Special Relativity	Dr Lisa Jardine-Wright
Easter Term		
12	Gravitational and Electromagnetic Fields	Prof. Mike Payne

4.4 Practical Work

Laboratory work takes place at the Cavendish Laboratory (West Cambridge). The experimental laboratories are open on M.Tu.Th.F between 1400-1745. The laboratory may be approached by the Madingley Road, or via the Coton cycle and footpath. For cyclists and pedestrians the latter is strongly recommended.

Laboratory work is continuously assessed. Students attend a physics practical for one afternoon once every two weeks. The primary aim of the class is the development of experimental skills,

which are important to all physicists. A second aim of the practical session is to illustrate ideas and concepts in physics. Some of the experiments are concerned with illustrating topics covered in the Part IA Physics lecture course, but this is not their main purpose.

Registration and assignment of days for practicals are dealt with centrally, via your College. You are expected to do your practical on the same day of the week in each term. The practicals are continuously assessed. In addition, to prepare for each practical you are asked to carry out a brief exercise beforehand, which you will hand in to your demonstrator at the start of the practical class. To give you practice in technical writing you are required to do two formal reports. The first, partial, report, to be written over the Christmas vacation, will be based on one of the experiments carried out over the Michaelmas term. The second, to be written over the Easter vacation, will be a full report on one of the Lent-term experiments. Full details are given in your practical class manual, and tips and further advice is given in the booklet entitled Keeping Laboratory Notes and Writing Formal Reports, which is handed out to students at the start of the year. The overall practical mark counts 25% towards the Part IA Physics examination. Around a third of the practical mark comes from the Formal reports.

4.5 The Examination

The Part IA Physics written examination consists of one three-hour paper. The exact content of the paper is a matter for the relevant examiners, but the expected pattern will consist of questions on general physics and the material covered in the lecture courses. Note that the Part IA syllabus was changed at the start of the academic year 2009-2010 and earlier examination papers will occasionally refer to topics which are no longer taught.

4.6 Books

There are two books recommended for the Part IA Physics course – these will be available in College libraries. Some lecturers will give references both to relevant sections of these books, and to worked examples in them, which help explain or expand on the material they present in their lectures. This is to encourage you to develop your skills in utilising the more extensive resource material provided in text-books to deepen your understanding of physics.

- Understanding Physics (Second Edition), Mansfield M & O'Sullivan C (Wiley 2011).
- Physics for Scientists and Engineers (Extended Version), Tipler P A & Mosca G (6th Edition, Freeman 2008).

4.7 Important Dates

Please note that this is not exhaustive, and may be superceded by announcements on the TIS or by email.

Part IA Physics: Important Dates		
Tue 4th Oct, 2016		Start of Michaelmas full term
Thu 6th Oct, 2016		Start of Week 1: lectures begin
Wed 5th Oct, 2016	1100	Introductory talk at the Cavendish Laboratory (Pippard Lecture Theatre)
Thu 1st Dec, 2016 or Fri 2nd Dec, 2016	1000-1600	Pick up notebook and instructions for formal report from IA Practical Class
Wed 30th Nov, 2016		End of Week 8: lectures end
Fri 2nd Dec, 2016		End of Michaelmas full term
Tue 17th Jan, 2017		Start of Lent full term
Tue 17th Jan, 2017 or Wed 18th Jan, 2017	1000-1600	Formal report must be handed in to the IA Practical Class
Thu 16th Mar, 2017 or Fri 17th Mar, 2017	1000-1600	Pick up notebook and instructions for formal report from IA Practical Class
Fri 17th Mar, 2017		End of Lent full term
Tue 25th Apr, 2017		Start of Easter full term
Tue 25th Apr, 2017 or Wed 26th Apr, 2017	1000-1600	Formal report must be handed in to the IA Practical Class
Fri 16th Jun, 2017		End of Easter full term

5 Part IB Physics A

5.1 Introduction and Course Aims

The objective of the IB Physics A course is to provide a self-contained package of courses in quantum physics, condensed matter physics, and waves. The course builds on IA Physics and offers a firm grounding in important areas of physics that are very useful for scientists with a wide range of career destinations. It can be taken by those not taking Physics B; in this case IB Physics A might, for able students, lead to Half Subject Physics in Part II Physical Sciences but does not by itself lead to Part II Physics (for which both Physics A and B are required).

While it is also possible to take IB Physics B without IB Physics A, for the majority of students wishing to take a single physics option in Part IB, Physics A is likely to be the more attractive option.

5.2 Induction

Students will be contacted by e-mail and asked to register on-line before the start of Michaelmas Term. There is an **introductory talk on the first Wednesday of Michaelmas full term (5th October 2016), at the Cavendish Laboratory, in the Pippard Lecture Theatre, for students taking either or both of the IB Physics courses.**

Practical slots will be allocated at this meeting; please arrive with a good knowledge of your timetable constraints.

Students taking the **common combination of Physics A, Physics B and Part IB NST Mathematics should arrive at 1400.**

Students taking **any other combination of courses should arrive at 1330.**

5.3 Course Content

The lecture course Oscillations, Waves and Optics covers central aspects of physical phenomena that underpin much of physics. The Quantum Physics course builds on this and treats quantum phenomena both from the Schrödinger equation and by means of operator methods. Condensed Matter Physics shows how ideas from waves and quantum mechanics can be applied to understand the properties of solids.

5.4 Mathematical Requirements

Physics A and Physics B both require mathematics beyond that in the syllabus for Part IA Mathematics for Natural Sciences; students not taking the Part IB NST Mathematics course should attend the lectures on Mathematical Methods given at the same time on weekdays during Michaelmas Term. This course is supervised, and covers all the additional mathematics required for both Part IB Physics courses, and for the Part II Physics core and options courses. It does not provide full coverage of the mathematics assumed for the Part II Theoretical Physics (TP) courses, but mathematically-able students would need to do some extra work during the long vacation after Part IB in order to catch up.

5.5 The Lecture Courses

Please check the course website for the latest version of the lecture timetable and lecture locations. The courses labelled with an asterisk are given in the Cockcroft Lecture Theatre, New Museums Site, M.W.F.12, unless otherwise detailed in the on-line lecture timetable.

Part IB Physics A Lecture Courses			
lectures	Course	Lecturer	A / B?
Michaelmas Term			
8	Experimental Methods*	Dr Liam O'Brien	A
16	Oscillations, Waves and Optics*	Prof. John Richer	A
16	Mathematical Methods* (For those NOT taking NST IB Mathematics)	Prof. Chris Haniff	A & B
Lent Term			
24	Quantum Physics*	Prof. Stafford Withington	A
Easter Term			
10	Condensed Matter Physics*	Prof. Sir Richard Friend	A

*In the Hopkinson Room †For location, check online timetable.

5.6 Practical Work in Part IB Physics

Students studying either Physics A or Physics B, or both, are required to undertake laboratory work, which is continuously assessed. The Practical Classes (for both Physics A and Physics B) take place at the Cavendish Laboratory (West Cambridge). The experimental laboratories are open M. 1400-1745, Tu. 1000-1745, Th. 1000-1745 and F. 1400-1745. Students will be allocated periods within these times at the induction session at the start of term.

The details of the experiments to be completed and the assessment methods are contained in the Laboratory Manual available from the TIS.

5.7 The Examination

The IB Physics A examination consists of two three-hour papers. (Note that the NST IB courses were changed considerably in 2007-08, with the previous 'Physics' and 'Advanced Physics' material re-arranged into 'Physics A' and 'Physics B'.) The practicals are continuously assessed and overall count approximately 25% towards the IB Physics A examination, with about 40% of this coming from a formal report on one of the experiments (for those not doing Physics B) or from a group presentation of an extended investigation (for those doing both Physics A and Physics B); full details are given in the class manual and additional help is given in the booklet Keeping Laboratory Notes and Writing Formal Reports.

5.8 Important Dates

Please note that this is not exhaustive, and may be superseded by announcements on the TIS or by email.

Part IB Physics: Important Dates		
Tue 4th Oct, 2016		Start of Michaelmas full term.
Wed 5th Oct, 2016	1330	Practical allocation at the Cavendish Laboratory (Pippard Lecture Theatre) for students **not** taking Physics A & Physics B & NST Mathematics
Wed 5th Oct, 2016	1400	Introductory talk at the Cavendish Laboratory (Pippard Lecture Theatre) for **all IB Physics students**, and practical allocation for students taking Physics A & Physics B & NST Mathematics
Fri 2nd Dec, 2016		End of Michaelmas full term
Mon 5th Dec, 2016	1600	Head-of-Class report must have been handed in to the IB Practical Class if chosen for submission (see synopsis of Physics A practical class for details)
Tue 17th Jan, 2017		Start of Lent full term
Wed 1st Mar, 2017— Wed 8th Mar, 2017		Presentation of results of the Extended Investigation during normal Laboratory hours (students taking Physics A and B)
Fri 17th Mar, 2017		End of Lent full term
Mon 20th Mar, 2017	1600	Head-of-Class report must have been handed in to the IB Practical Class if chosen for submission (see laboratory manual for details)
Tue 25th Apr, 2017		Start of Easter full term
Fri 16th Jun, 2017		End of Easter full term

6 Part IB Physics B

6.1 Introduction and Course Aims

The IB Physics B covers a range of topics that are complementary to the IB Physics A course. Students wishing to proceed to Part II Physics must take both Physics A and Physics B.

Students taking both courses combine them with one other IB subject. While NST IB Mathematics is frequently taken, and is useful for those wishing to pursue Theoretical Physics options within the Part II Physics course, students should be advised that this is both a demanding and constraining choice. (For students taking subjects other than Mathematics, appropriate support is provided through the Michaelmas Term course in Mathematical Methods.) The selection of a different subject in place of NST IB Mathematics provides greater breadth and gives greater choice of Part II/III subjects within the Natural Sciences Tripos, should Part IB physics not prove to be rewarding.

It is possible to take IB Physics B without IB Physics A, but this is not adequate preparation for Part II Physics. The practical work draws heavily on material from Physics A in the Michaelmas Term, and students taking just Physics B are advised to attend at least the Experimental Methods lectures from Physics A for necessary background. For the majority of students wishing to take a single physics option in Part IB, Physics A is likely to be the more attractive option.

6.2 Induction

Students will be e-mailed and asked to register online before the start of Michaelmas Term. For details of the induction session at the Cavendish Laboratory, please read section 5.2.

6.3 Course Content

The lectures on Electromagnetism cover key concepts in this important subject. Classical Dynamics provides more advanced approaches to classical problems than were given in Part IA, and introduces key concepts in fluid mechanics. Thermodynamics provides an introduction to classical thermodynamics and kinetic theory. The Computing course provides an introduction to C++ programming techniques and their application in physics-based problems.

6.4 Mathematical Requirements

Please read section 5.4 for details of the mathematical requirements of Physics B.

6.5 The Lecture Courses

Please check the course website and online timetable for latest developments, lecture timetable and lecture locations.

Part IB Physics B Lecture Courses			
Lectures	Course	Lecturer	
Michaelmas Term			
2	Introduction to Computing	Dr Chris Lester	B
20	Electromagnetism*	Prof. Chris Ford	B
4	Classical Dynamics*	Dr Dave Green	B
16	Mathematical Methods (for those NOT taking NST IB Mathematics)	Prof. Chris Haniff	A & B
Lent Term			
16	Classical Dynamics*	Dr Dave Green	B
8	Thermodynamics*	Dr John Ellis	B
Easter Term			
8	Thermodynamics*	Dr John Ellis	B

The courses labelled with an asterisk* are given in the Cockcroft Lecture Theatre, New Museums Site, M.W.F. 9 unless otherwise detailed in the on-line lecture timetable.

6.6 Practical Work

The practical work associated with this course is described in section 5.6 on page 13 .

6.7 The Examination

The IB Physics B examination consists of two three-hour papers. The practical elements of this course (i.e. the practicals and computing) are continuously assessed and overall count approximately 25% towards the IB Physics B marks (out of this, 18% is from the computing mark, so overall computing counts for 4.5%). Students should note that roughly 40% of the marks for the practicals will come from a Head of Class Report/Group Presentation. Full details are in the class manual and additional help is given in the booklet Keeping Laboratory Notes and Writing Formal Reports.

6.8 Important Dates

Please refer to section 5.8 for the list of important dates.

7 Part II Physics

7.1 Requirements

Students wishing to be admitted to read Part II Physics are required to have successfully completed **both** the Part IB Physics A and Part IB Physics B courses, or equivalent courses in the Mathematics Tripos.

7.2 The Three- And Four-Year Courses In Physics

There are two paths to graduating in Physics, both leading to a wide range of career options. Both groups of students take the same course in the third year. The paths are:

- 3-year course leading to B.A. honours degree: this path is designed for students with a deep interest in the subject but who do not intend to become professional physicists. It is a challenging course and exposes students to core areas of physics at an advanced level. Students on this path will graduate at the end of the Part II course with a B.A. Hons.
- 4-year course leading to an M.Sci. honours degree (master of Natural Sciences), together with a B.A. honours degree: students who wish to pursue a professional career in physics (for example in academic or industrial research) take the usual third year Part II but do not graduate at the end of the third year. They must apply in the Lent term to read Part III Physics. Subject to requisite funding, college approval and achievement of a 2:1 result or better in Part II Physics, students are admitted to take Part III Physics in their fourth year. Both B.A. and M.Sci. degrees are conferred at the end of this fourth year.

The Part II Physics course is very flexible, and can range from strongly experimental to highly theoretical physics, with a range of specialist options. There are possibilities for substantial independent work and for experience of industrial research.

There is no limit on the number of students taking Part II Physics and in recent years we have had about 140-150 students taking the course.

7.3 Induction

The course will begin with a meeting on the first Wednesday of Full Term, **5 October 2016, at 0930 in the Pippard Lecture Theatre** at the Cavendish Laboratory, which all students should attend.

7.4 Outline Of The Course

The elements of the course are contained in the table in section 7.6.

Students taking Part II Physics must take all four Core courses in the Michaelmas Term, three or more of the Options courses in the Lent and Easter Terms, and Computational Physics. They must in addition take three or more courses from Physics Education, Theoretical Options and Other Further Work. There is a test (under exam conditions) of the material of the Theoretical Options at the start of the term following that in which each block, TP1 and TP2, is given.

All students are recommended to attend the non-examinable courses Concepts in Physics and Current Research Work in the Cavendish Laboratory.

Students taking Half Subject Physics as part of Part II Physical Sciences will take any two of the Core courses in the Michaelmas term and any one of the Options courses in the Lent and Easter terms. Candidates also take two units of further work selected from Theoretical Options, Physics Education and Experiments or Long Vacation Project. A prior knowledge of Physics equivalent to the material covered in Part IB Physics A and Part IB Physics B will be assumed.

Part II Physics contains work of two types: Core lectures in the Michaelmas term and Options lectures in the Lent/Easter terms, which are examined at the end of the year in the usual way, and units of ‘Further Work’, which are assessed during the year. Students take three or more of the Lent/Easter lecture courses together with at least three units of Further Work.

We do not expect any student to take more than the minimum number of units of work in any category. The great majority of students will find the workload demanding even at this level. We recognise, however, that some students may have good reasons for wishing to take additional courses for credit. Marks for all examination papers sat will appear on the students' University transcripts. Within any part of the examination (options courses, Further Work) the best results meeting the minimum requirement will count towards the class for the year.

The aim of the Michaelmas Term lecture courses is to complete basic instruction in physics. In this term, there are four core courses:

- Advanced Quantum Physics;
- Relativity;
- Optics and Electrodynamics;
- Thermal and Statistical Physics.

In the Lent and Easter terms, four option courses are offered, introducing broad areas of physics:

- Astrophysical Fluids;
- Particle and Nuclear Physics;
- Quantum Condensed Matter;
- Soft Condensed Matter.

All students are also expected to take the course on Computational Physics, which is assessed by a series of short exercises. In addition, an extended Computational Physics project is available as one of the optional units of Further Work.

The remainder of the Further Work offers a free choice. Students may select an experimentally-biased course by carrying out up to two experimental investigations (E1 and E2), each lasting two weeks. Alternatively, there are two possible courses in Theoretical Physics (TP1 and TP2), consisting of lectures plus examples classes, which run respectively in the Michaelmas and Lent terms. We expect that almost all students will offer at least one of E1 and TP1. Offering both TP1 and E1 is possible, but students should be aware that it does make for a difficult timetable in Michaelmas term. Further optional elements of Further Work are a Computing Project, Research Review, Physics Education or a Long Vacation Project.

There are also two unexamined courses, "The Physics of Astrophysics" and "Concepts in Physics", which are strongly recommended.

The full Part II course involves 10.2 units of credit: 7 of these are from examined courses, 3 from the main units of Further Work (FW), and 0.2 from the Computing Exercises. See the table for details. So, to a good approximation, each unit counts for one tenth of the total mark for the course (strictly 9.80%).

7.5 Further Work

Of the optional Further Work, note that not more than two Experiments may be offered. Other rules for choosing Further Work are set out in the table.

Students will be contacted by e-mail and should register on-line before the start of Michaelmas Term and to give an indication of which units of Further Work they intend to complete. In particular, they will be asked to make a provisional choice of experiments for E1 and E2 if they intend to take those options. These arrangements may be modified at the registration meeting at the beginning of term. Students wishing to change their choice during the course of the year (for example those wishing to take E2 instead of TP2 in light of their TP1 results) should contact the Undergraduate Office.

The arrangements for submitting and assessing Further Work are described below and in the online Course Synopses.

7.5.1 Computing

All students are expected to attend the Computational Physics lectures in Lent term, which build on the Part IB C++ course. Associated with the lectures are Computing exercises which are equivalent to 0.2 units of work, and are compulsory for all Part II Physics students. In addition, students may

elect to offer an extended Computing Project, which will involve analysing a physics problem, and writing a program to solve it. This project is optional, and counts as one unit of Further Work.

7.5.2 Experimental Investigations

Each experiment will involve 30 to 40 hours work and will be equivalent to one unit of Further Work. The E1 and E2 sessions are run in the Michaelmas and Lent terms respectively, with individual experiments starting on the first, third and fifth Mondays in Term. The details of these sessions will be announced during registration at the start of term. E1 is assessed during the Michaelmas Term so that any appropriate advice and constructive criticism can be given before a decision has to be taken on whether or not to offer E2. Students opting for E2 only after taking the TP1 examination are likely to be allocated to E2b or E2c. No student is allowed to offer more than two units of experimental investigation.

The experiments available in Part II are offered by the experimental research groups from within the Department. The experiments give you the chance to develop professional ability, both in performing a substantial experiment and in relating experiment to theory. Most students find these experiments more demanding and more satisfying than the short experiments of the Part I classes. They are assessed by a Head of Class write up followed by an oral examination.

7.5.3 Courses in Theoretical Physics

The Theoretical Physics Courses are challenging courses aimed at students who find mathematics relatively easy and who have a strong interest in the mathematical description of physical systems. The majority of students taking these courses will have taken Part IB Mathematics for NST, but the Mathematical Methods course offered as part of Physics A and B in Part IB provides nearly all of the necessary background. Usually the mark distributions for these courses have a tail of low marks obtained by students who would probably have scored higher marks if they had done experimental work.

Theoretical Physics Course TP1 is taken in the Michaelmas Term and students take a written test paper at the start of the Lent Term. The results will be made available to guide your choice of further work for the Lent term. A second Theoretical Course, TP2, is taken in the Lent Term and tested at the start of the Easter Term. TP1 and TP2 each count for one unit of Further Work. As well as lectures, four examples classes are given in each of TP1 and TP2.

7.6 Course Summary

Part II Physics Summary					
#	Course	Lecturer/Head of Class	FW	Half-subject	Physics
Michaelmas Term – Core courses					
18	Thermal and Statistical Physics	Dr Malte Grosche			✓
24	Relativity	Prof. Mike Hobson		choose	✓
24	Advanced Quantum Physics	Dr Richard Batley		2	✓
16	Optics and Electrodynamics	Prof. Henning Sirringhaus			✓
Lent/Easter Terms – Option Courses					
8	Computational Physics	Dr David Buscher	0.2	✓	✓
24	Astrophysical Fluid Dynamics	Dr Debora Sijacki			
22	Particle and Nuclear Physics	Dr Tina Potter		choose	choose
22	Quantum Condensed Matter	Prof. Dave Ritchie		1	3 or 4
22	Soft Condensed Matter	Prof. Eugene Terentjev			
Further Work (FW), (1 unit ≈ 1.5hrs examination)					
	Research Review	Dr Rachael Padman	1	✓(*)	
	Physics Education (limited numbers)	Dr Lisa Jardine-Wright	1		
	Computational project	Dr David Buscher	1	choose	choose
	Experiment E1	Prof. Pietro Cicuta	1	2	3
	Experiment E2	Prof. Pietro Cicuta	1		or more
	Theory: TP1	Dr Claudio Castelnovo	1		
	Theory: TP2	Dr Andreas Nunnenkamp	1		
	Long Vacation project (approval required)	Dr Rachael Padman	1		
			FW units	2	3+
			Exam units	3	7+
			Approx % FW	40%	30%

* Half Subject Physics students must choose a Research Review as the topic for their dissertation in Part II Physical Sciences; this is an extended version of the standard Research Review, see section 7.10.

7.6.1 Research Review

A Research Review is equivalent to one unit of Further Work, and consists of a review (of 3000 words max.) on some area of physics, approved in advance. Such a review must have a Supervisor. In about the sixth week of the Lent Term supervisors will organise a meeting at which students will have the chance to present their interim work to other students working on reviews in similar areas and their supervisors. As well as providing a chance to obtain feedback this should ultimately raise the standard of the submitted work. You receive 5% of the available marks for the Research Review for giving the presentation (irrespective of its quality). Research Reviews are assessed by two staff members with a short oral examination early in the Easter Term. This examination will usually begin with a short oral presentation.

7.6.2 Long-Vacation Work

Scientific work during the Long Vacation prior to your third year can count as project work worth one unit of Further Work. The full details can be obtained from Dr Padman (rp11@cam.ac.uk, Astrophysics Group), but you must get your proposal approved in advance, before the beginning of Michaelmas Term. Forms are available from the TIS. You will be required to name in advance a suitably qualified on-site supervisor who is willing to write retrospectively to Dr Padman describing the work you have done and giving an assessment of your effectiveness. Normally the programme must be of at least two months duration and must include a substantial element of independent or original work. It is important that the project includes a significant amount of physics and is not, for example, simply a series of routine measurements or entirely devoted to computer programming.

Vacation projects within the University may be offered through the Undergraduate Research Opportunities Programme (UROP). Some of these projects may be suitable as assessed Long-Vacation Work. Check the teaching web pages for more information.

7.6.3 Physics Education

The Physics Education course counts as one unit of further work. It offers the possibility of developing and presenting teaching material in a secondary school. It develops a wide range of transferable skills and provides a real opportunity to explore the possibility of a career in teaching. Details of the nature and scope of this course are given at length in the course synopsis. Numbers are restricted and students wishing to take part must attend the introductory session between 2-5pm on Friday 7th October 2016.

7.7 Supervisions and Examples Classes

Supervision for Part II is organised by the Department on behalf of the Colleges. During the Michaelmas term Physics students are supervised in all four core lecture courses, and Half Subject Physics students in two. Supervisions for these courses will be allocated automatically according to the option for which you are registered.

In the Lent term students choose their supervisions according to their choice of subjects for examination. The sign-up procedure is web-based, and you will be notified by email in plenty of time. We ask you to sign up by 1400 on the last Friday of Michaelmas Full Term, so that arrangements can be made during the Christmas vacation. Obviously this does not allow you to sample the courses: if you subsequently decide that you wish to change options, then please visit or email the Teaching Office to request a change of supervisor.

There will be 4 one-hour supervisions in each of the courses taken. Thus a student reading Part II Physics will receive 28 supervisions (7 courses), and those taking half subject physics will receive 12 supervisions (3 courses).

Supervision will normally be in groups of three, although you may occasionally find yourself in a two or a four, to allow supervisors to accommodate odd numbers or students who are wildly mismatched in their ability in a particular subject. You must be prepared to work much more independently than

at Part I. Difficulties that arise in lectures are often more conveniently discussed with the lecturers themselves at the end of lectures, or by arrangement at other times

You must take responsibility for ensuring that the supervisions go as far as possible in meeting your needs. Supervisors are usually willing within reasonable limits to be flexible about the detailed arrangements. You should expect to be asked to hand in work for each supervision, in time for your supervisor to look through the work and identify any potential problems. However, the quantity and complexity of the work at this level means that supervisors may be unable to provide the detailed personal marking that you experienced in Parts IA and IB

Supervisors may range from established lecturers with long teaching experience to relatively inexperienced graduate students. New supervisors are expected to seek advice on supervising, to attend the courses provided by the University, and to commit to the necessary preparation for each supervision. However, experience is the only real teacher, and inevitably some supervisors will be more confident than others, particularly at answering subtle and unexpected questions.

Without an influx of new supervisors the system will rapidly decay, so please be understanding. If you do have problems with your supervisor that cannot be solved by direct two-way discussion, please contact your Director of Studies in the first instance. If your DoS feels that intervention is warranted, they should contact the Supervisions coordinator (currently Dr Rachael Padman).

7.8 Non-Examined Work

There is a non-examinable course of 24 lectures in the Lent term on the Physics of Astrophysics given by staff of the Institute of Astronomy. These lectures should be interesting for all students and are intended to provide valuable background for those who are interested in pursuing Astrophysical courses in Part III

There is also a non-examinable course of 8 lectures in the Lent term on Concepts in Physics, intended to place in perspective some major themes of physics, to sketch connections between them and to investigate unresolved questions. Attendance is strongly encouraged for all students.

Open Days (open to Part II and Part III students) will be held during the year and are intended to give an idea of the range of current research in the laboratory. Dates are given on-line.

Undergraduates are encouraged to attend the Cavendish Physical Society lectures, at 1600 on some Wednesdays. Part II students are also welcome at the many Research Seminars and other lectures in the Department, particularly those organised by the Cambridge Physics Centre. These are advertised on notice boards, and on the Cavendish groups' web pages.

7.9 The Examination

7.9.1 The Written Papers for Part II

The exact content of each Paper is a matter for the relevant Examiners. Each of the core and optional lecture courses is examined in a separate two hour paper.

7.9.2 Requirements

The written examinations consist of the core lecture course papers, plus three or four of the option lecture course papers. In addition to the computing exercises, three or more other units of Further Work must be offered and may be drawn from the various choices described in the table.

7.9.3 Examination Entries

You are required to make a preliminary indication of which papers you intend to offer when you fill in your exam entry on CamSIS at the start of Michaelmas term. You will then be required to specify which final combination of papers you intend to offer by modifying the exam entry during Lent term, in liaison with your College Tutorial Office. Any questions on completing the exam entry should be discussed with your Director of Studies.

7.9.4 Submission of Further Work

When any piece of Further Work is submitted it must be in a complete and final form.

Students are expected to meet the published deadlines for coursework. The departmental policy on late submission of coursework is stated in section 3.

Students are permitted to submit more than the minimum number of units of Further Work. Once a piece of Further Work has been submitted, it will be marked: the best marks for the required minimum number of units will count towards the class, but all marks will appear in the markbook.

TP1 and TP2 are assessed by written tests during the year, and are counted as units of Further Work. These tests are taken under normal exam conditions, but do not formally constitute Tripos Examinations. Once you have entered the room for the TP1 or TP2 test, that unit of Further Work will be included in the final marksheets and calculations.

The University Regulations require that assessed Records of Further Work be submitted to the Examiners via the Head of the Department; this happens automatically after assessment.

7.10 Half Subject Physics

Half Subject Physics is part of Natural Sciences Part II Physical Sciences. It comprises about half of the work load of Part II Physics, and may be combined with a subject from Part IB not previously taken.

Candidates offer

1. Two of the core lecture course papers.
2. One of the option lecture course papers.
3. Computing exercises and two units of Further Work (not including a Research Review).

In addition, Physical Sciences students must offer a dissertation on a topic consistent with their Half Subject. For Half Subject Physics this dissertation will be chosen on a topic from those offered for Research Reviews, but with a word limit of 5000 (rather than 3000 for a Research Review).

You will be required to specify which combination of papers you intend to offer by the third week of the Lent Term.

Vacation work may be arranged as described in section 7.6.2, and if approved as there detailed, may be counted as one unit of Further Work.

The arrangements for submitting Further Work are the same as those for Part II Physics candidates (see section 7.9.4).

7.11 Important Dates

This list is not exhaustive, and may be superseded by announcements on the TIS or by email.

Part II: Some Important Dates		
Tue 4th Oct, 2016		Start of Michaelmas full term
Wed 5th Oct, 2016	0930	Introductory talk (Pippard Lecture Theatre, Cavendish Laboratory)
Mon 10th Oct, 2016	TBD	Briefing for E1a, in relevant laboratory
Mon 10th Oct, 2016	1400	First TP1 lecture
Mon 10th Oct, 2016	1600	Vacation work report deadline
Tue 18th Oct, 2016	1400	First TP1 examples class
Fri 21st Oct, 2016	1700	E1a laboratories close
Mon 24th Oct, 2016	TBD	Briefing for E1b, in the relevant laboratory
Fri 28th Oct, 2016		Research review topics preliminary selection deadline
Mon 31st Oct, 2016	1600	E1a report deadline
Fri 4th Nov, 2016	1700	E1b laboratories close
Fri 4th Nov, 2016	2359	Final Research Review selection deadline
Mon 7th Nov, 2016	TBD	Briefing for E1c, in the relevant laboratory
Mon 14th Nov, 2016	1600	E1b report deadline
Fri 18th Nov, 2016	1700	E1c laboratories close
Mon 28th Nov, 2016	1600	E1c report deadline
Fri 2nd Dec, 2016		End of Michaelmas full term
Tue 17th Jan, 2017		Start of Lent full term
Wed 18th Jan, 2017	1030-1230	TP1 written test (Pippard Lecture Theatre)
Thu 19th Jan, 2017	1200	First TP2 lecture
Mon 23rd Jan, 2017	TBD	Briefing for E2a, in relevant laboratory
Fri 3rd Feb, 2017	1700	E2a laboratories close
Mon 6th Feb, 2017	TBD	Briefing for E2b, in the relevant laboratory
Mon 13th Feb, 2017	1600	E2a report deadline
Fri 17th Feb, 2017	1700	E2b laboratories close
Mon 20th Feb, 2017	TBD	Briefing for E2c, in the relevant laboratory
Mon 27th Feb, 2017	1600	E2b report deadline
Tue 28th Feb, 2017	1400	First TP2 examples class
Thu 23rd Feb, 2017— Wed 1st Mar, 2017		Presentations of Research Reviews (will be organised by your supervisor)
Fri 3rd Mar, 2017	1700	E2c laboratories close
Mon 13th Mar, 2017	1600	E2c report deadline
Fri 17th Mar, 2017		End of Lent full term
Tue 25th Apr, 2017		Start of Easter full term
Wed 26th Apr, 2017		TP2 written test (Pippard Lecture Theatre)
Mon 1st May, 2017	1600	Computing Report deadline
Mon 1st May, 2017	1600	Research Review deadline
Mon 1st May, 2017	1600	Physics Education deadline
Tue 2nd May, 2017— Fri 12th May, 2017		Oral examinations on Research Reviews (will be organised by your supervisor)
Fri 16th Jun, 2017		End of Easter full term

8 Part III Physics and the MASt in Physics

8.1 Introduction

The four-year course, of which Part III is the final component, is designed for students who wish to pursue a professional career in physics, in academic or industrial research. It leads to an honours degree of Master of Natural Sciences, M.Sci., together with a B.A., though the latter cannot be conferred until the end of the fourth year.

Part III Physics is a demanding course, and courses assume an upper second class level of understanding of the core and relevant optional material in Part II Physics. Candidates for the four-year course must achieve at least a 2:1 in Part II Physics, or have received from the Faculty Board a dispensation from this condition.

The requirements for admission to Part III Physics for those who have not taken Part II Physics are published in the Reporter.

You must have made financial provision by securing a four-year grant from your LEA or equivalent funding body during your second year. If you have any doubt about this, you should see your college Tutor or Director of Studies without delay.

8.2 Master of Advanced Studies (MASt) in Physics

This is a taught postgraduate course, which consists of the same content as Part III Physics. The course is designed for students who hold a 3-year undergraduate degree who wish to pursue a research degree. The entry requirement for the MASt is a qualification comparable to an upper second class or better Bachelor's degree in Physics.

8.3 Induction

Students will be e-mailed to register online before the start of Michaelmas Term. The course will begin with a meeting on the first Wednesday of Full Term (5th October 2016) at 1230 in the Small Lecture Theatre at the Cavendish Laboratory, after which a buffet lunch — kindly sponsored by BP — will be served.

8.4 Outline Of The Course

The course aims to bring you close to the boundaries of current research, and is therefore somewhat linked to the expertise from within the specific research groups. You make a series of choices as the year proceeds which allow you, for instance, to select a bias towards particular broad areas of physics such as condensed matter physics, particle physics, astrophysics, or semiconductor physics. You can also range over the spectrum from strongly experimental to highly theoretical physics, and choose from a range of specialist options.

All students undertake a substantial research project, which counts for one third of the total marks for the course.

The Michaelmas Term lectures are the Major Topics, which cover substantial areas of physics. You are examined in three or more of them at the start of the Lent Term.

The Lent Term lectures are the Minor Topics, which cover more specialised areas, mostly of active research interest in Cambridge. You are examined in three or more of them at the start of the Easter Term.

We do not expect any student to take more than the minimum number of units of work in any category. The great majority of students will find the workload demanding even at this level. We recognise, however, that students may have good reasons for wishing to take additional courses for credit. Marks for all examination papers entered will appear on the students' University transcripts. Within any part of the examination (Major Topics, Minor Topics) the best results meeting the minimum requirement will count towards the class for the year. You are of course free to attend as many lecture courses as you wish, without necessarily offering them for examination.

Some of the Major and Minor Topics are given by staff from other Departments such as the Institute of Astronomy and the Department of Earth Sciences. You can also take as Major or Minor Topics certain courses given in Part III of the Mathematical Tripos but you should note that the style of the Part III Mathematical Tripos Options and Examination is different from that experienced in the Part III Physics Options, reflecting the difference in approaches of the two Departments.

The possibility exists of undertaking a vacation project during the previous Long Vacation or the optional course on Entrepreneurship during the Lent Term, for credit in the Tripos by replacing a Minor Topic in each case.

Ability in general physics is fostered by examples classes in the Easter Term and examined by a general paper at the end of the Easter Term.

8.4.1 Project work

All students must undertake a project which is worth a third of the year's marks. A list of projects will be provided by the beginning of the Michaelmas Term. Many of these will be supervised by members of the Physics Department, but members of other Departments will also be involved. The projects can be experimental, theoretical, computational, observational, or some suitable combination of these. There will be scope for initiative and originality in carrying out a project, and it should form a valuable preparation for a research career.

Project work should begin in Michaelmas term as soon as projects are allocated. The work continues throughout the Lent and first part of Easter terms. Projects are submitted and assessed in the Easter term.

Communication skills are essential if you are to have a successful career in science. Toward the end of Lent term a meeting will be arranged in which you will have the chance to give a fifteen minute oral presentation on your project to other students working in similar areas and their supervisors. This presentation counts for 5% of the available marks for the project (irrespective of the quality of your presentation). You should note that about one-third of the total marks for the project will be based on an assessment of the quality of your written report and your ability to explain and defend your work in the viva.

Bench work on experimental projects should be substantially complete by the end of the Lent Term. You must submit your project report by the third Monday of the Easter Term, and it will be assessed by two staff members after an oral examination.

8.4.2 Major Topics

The lecture courses given during the Michaelmas Term cover major areas, and in each, physics is presented as a connected discipline drawing upon the material of the first three years to take the topic close to the frontiers of current research. Candidates choose three or more Major Topics for examination. The courses are listed in the table in section 8.9, and are examined at the start of the Lent Term (i.e. in January) by a 2-hour written paper.

Students who are especially strong in mathematics may wish to replace one of the Topics above with the Quantum Field Theory (QFT) course, also of 24 lectures, taken from Part III of the Mathematics Tripos. Students taking this course sit the same examination as the Part III Mathematics students in June (3 hour paper). **The QFT course and examination are entirely the responsibility of the Department of Applied Mathematics and Theoretical Physics (DAMTP), and their traditions in examinations differ somewhat from those in Physics. Students wishing to take this course should discuss this choice very carefully with their Director of Studies to ensure it will suit their skills and interests.**

8.4.3 Minor Topics and Other Lent Term Courses

You must choose for examination three or more of the large number of Lent Term courses listed in the table in section 8.9. The choices include:

Minor Topics These courses are given by the Department of Physics. They are more specialised than the Major Topics and most build upon the material presented in the Michaelmas Term. Some of them assume specific knowledge of particular Major Topics — the syllabuses make clear which. They are examined by 1.5 hour written papers at the start of Easter term (i.e. April).

IDPs There are three Interdisciplinary courses (IDPs), one of which (Materials, Electronics and Renewable Energy) is given by Physics. They are examined in separate papers/coursework at the end of the Easter Term.

Courses from Part IIB Engineering These are examined with the Part IIB Engineers at the start of Easter Term.

Course from Part III Mathematics The Advanced Quantum Field Theory (AQFT) course is taught and examined by Mathematics and may be substituted for one of the Minor Topics. The advice given in section 8.4.2 regarding the QFT course applies even more strongly in this case, and should be heeded by students considering this course.

8.4.4 Further Work: Long-Vacation Project

Scientific work during the Long Vacation prior to your fourth year can count as project work which may replace a Minor Option. The full details can be obtained from Dr Padman (rp11@cam.ac.uk, Astrophysics Group), but you must get your proposal approved in advance, before the beginning of Michaelmas Term. Forms are available from the the TIS. You will be required to name in advance a suitably qualified on-site supervisor who is willing to write retrospectively to Dr Padman describing the work you have done and giving an assessment of your effectiveness. Normally the programme must be of at least two months duration and must include a substantial element of independent or original work. It is important that the project includes a significant amount of physics and is not, for example, simply a series of routine measurements or entirely devoted to computer programming.

Vacation projects within the University may be offered through the Undergraduate Research Opportunities Programme (UROP). Some of these projects may be suitable as assessed Long-Vacation Work. The teaching web pages might offer some useful suggestions.

8.4.5 Further Work: Entrepreneurship

The course is given by the Judge Business School, and will be assessed by the completion of assignments as described in the synopsis. You may offer this course in substitution for a Minor Topic course.

8.4.6 Examples Class in General Physics

The Part III course is designed to build upon the physics covered in the first three years and will take many subjects to the frontiers of current understanding. However, it is important that core physics is reinforced at the same time, and the examples classes, which run during the Easter Term are designed to help with this. They will focus on the key topics covered in the core Physics courses and may include introductory summary talks and examples sheets modelled upon short questions and more general problems. For the purposes of this examination, core physics means the physics taught in Part IA Physics, Part IB Physics A, Part IB Physics B, and the Michaelmas term core courses of Part II Physics. The 2003 – 2016 General Papers indicate the type of question which will be set. They will be designed to emphasise the straightforward application of core physics to reasonable problems, and be an appropriate preparation for the three-hour examination in general physics which forms part of the final assessment.

8.5 Restrictions On Combination Of Courses

While every effort is made to arrange the timetable, it is inevitable that some combinations of courses will be ruled out by their schedule.

8.6 Supervisions

Supervisions take a different form in Part III. Lecturers are expected to provide some form of learning support, but the form it takes is up to the individual lecturer. It is likely to take the form either of examples classes, with or without demonstrators (depending on the number of students), or of large-group supervisions or seminars.

A consequence of this is that, neither students nor lecturers need wait before arranging sessions. The lecturer may choose to announce arrangements during the first lecture, or may announce them through the class email list.

The class email list depends on each student signing up for the particular course. You will be reminded about the sign-up before the start of each of Michaelmas and Lent Terms. If you decide to change options during the Term, you should make the necessary change on the teaching website, and also notify the relevant lecturers directly.

8.7 Non-Examined Work

In the Lent Term there are two non-examinable courses, one on Philosophy of Physics and one on Ethics of Physics.

To advertise research opportunities at the Cavendish various open days will be held which cover the activities of the major groups in the laboratory. Dates are will be posted on the Part II and Part III notice boards.

Part III students are also welcome at the large number of Research Seminars and other lectures in the Department, particularly those organised by the Cavendish Physical Society lectures at 1600 on some Wednesdays. These are advertised on notice boards, and summarised on the Cavendish web page.

8.8 The Examination

The course is assessed by project work and examinations. Major Topics and the Project each contribute approximately one-third of the total marks. The Minor Topics and General Physics Paper each contribute approximately one-sixth of the total marks.

The marks all courses will appear on the University transcript, with the best marks for the minimum requirement being used to establish the final class for the Examination.

8.8.1 Examination Entries

Examination entries are made through the CamSIS on-line system, and should be completed in consultation with your Director of Studies. The deadline is usually about the middle of November. You will have a further chance during Lent Term to modify your entry for the Minor Topics papers. These procedures are largely outside of the Department's control, and are continually evolving. We will provide further information about procedures for examination entries as it becomes available.

8.8.2 The Written Papers for Part III

Major Topics These examinations are taken at the beginning of the Lent Term (in January), and are 2 hour papers.

Minor Topics These are taken at the beginning of the Easter Term (usually April), and last 1.5 hours each.

General Physics Paper This is taken towards the end of the Easter Term, usually early June, and lasts 3 hours.

QFT/AQFT Those students who have substituted these Part III Mathematics courses for Major or Minor Topics will take the same examination as the Mathematics students, towards the end of the Easter Term (usually in June).

Interdisciplinary courses (IDP) Each of the interdisciplinary courses is treated as a Minor Topic. The interdisciplinary courses will all be examined in separate papers during the main Examinations Period at the end of Easter Term.

Nuclear Power Engineering, and Mathematical Biology of the Cell Students taking these Topics will be examined with the Part IIB Engineers in one and a half-hour papers at the start of the Easter Term.

8.9 Course Summary

Please check the course website for latest developments, lecture timetable and location.

Part III/MASt Physics 2016-17		
#	Course	Lecturer
Michaelmas Term – Major Topics: choose at least 3		
24	Advanced Quantum Condensed Matter Physics	Prof. Crispin Barnes
24	Atomic and Optical Physics	Prof. Zoran Hadzibabic
24	Particle Physics	Dr Chris Lester
24	Physics of the Earth as a Planet	Dr John Rudge/Dr David Al-Attar
24	Theories of Quantum Matter	Dr Austen Lamacraft
24	Relativistic Astrophysics and Cosmology	Prof. Anthony Lasenby/ Prof. Andy Fabian
24	Biological Physics	Prof. Pietro Cicuta/Dr Eileen Nugent
24	Quantum Field Theory*	Prof. B Allanach
Lent Term – Minor Topics and Other Courses: choose at least 3		
12	Exoplanets and Planetary Systems	Prof. Didier Queloz
16	Formation of Structure in the Universe	Prof. Roberto Maiolino
12	Frontiers of Observational Astrophysics	Dr Richard Saunders
12	Gauge Field Theory	Dr Ben Gripaios
12	Medical Physics	Dr Sarah Bohndiek
12	Non-linear Optics and Quantum States of Light	Prof. Mete Atatüre
16	Colloid Physics	Dr Erika Eiser
12	The Physics of Nanoelectronic Systems	Prof. Charles Smith
12	Phase Transitions	Dr Michal Kwasigroch
12	Quantum Information	Prof. Crispin Barnes
12	Superconductivity and Quantum Coherence	Prof. Gil Lonzarich
16	Atmospheric Chemistry and Global Change (IDP1)†	Prof J. Pyle/Dr A Maycock
16	Climate dynamics and critical transitions in the climate system: from past to future (IDP2)†	Dr. Luke Skinner and Prof. Eric Wolff
16	Materials, Electronics & Renewable Energy (IDP3)†	Prof. Neil Greenham
24	Advanced Quantum Field Theory*	Dr D. Skinner
12	Nuclear Power Engineering‡	Dr Geoff Parks
16	Mathematical Biology of the Cell‡	Dr T O'Leary & C Savin
Further Work (may substitute a Minor Topic)		
	Entrepreneurship§	Dr Shima Barakat
	Report of Vacation Project	Dr Rachael Padman
Other requirements		
	Research Project	Prof. Charles Smith
	General Paper	

*From Part III Mathematics
†Interdisciplinary Paper
‡From Part IIB Engineering
§Given by the Judge Institute for Management Studies

Students must offer three or more courses from Major Topics, together with three or more courses from Minor Topics. Quantum Field Theory may be substituted for one Major Topic. A Vacation project and courses from Interdisciplinary Topics, Advanced Quantum Field Theory, Nuclear Power Engineering, Mathematical Biology of the Cell and Further Work may each be substituted for one Minor Topic.

The courses from the Major Topics and Minor Topics and Nuclear Power Engineering, are examined at the start of the term following that in which they are given. Quantum Field Theory, and Advanced Quantum Field Theory and courses from the Interdisciplinary Topics will be examined in June. The Entrepreneurship course from Further Work is continually assessed.

All students are recommended to attend the Non-examinable courses.

8.10 Important Dates

This list is not exhaustive, and may be superseded by announcements on the TIS or by email.

Part III/MASt Physics: Some Important Dates		
Tue 4th Oct, 2016		Start of Michaelmas full term
Wed 5th Oct, 2016	1230	General Registration and Project Choice launch (Small Lecture Theatre, Cavendish Laboratory) followed by a buffet lunch.
Mon 10th Oct, 2016	1600	Vacation work report deadline
Fri 14th Oct, 2016		Supervisors can allocate projects
Fri 21st Oct, 2016		Deadline for choosing a project (but don't leave it this late!)
Fri 4th Nov, 2016	1600	Deadline for Risk Assessments for project to be submitted
Fri 2nd Dec, 2016	1600	Deadline for Initial Project Progress Report; hand in to the Undergraduate Office
Fri 2nd Dec, 2016		End of Michaelmas Full Term
Mon 16th Jan, 2017 — Wed 18th Jan, 2017		Major Topic Examinations
Tue 17th Jan, 2017		Start of Lent Full Term
Wed 8th Feb, 2017	1600	Deadline for brief Project progress card (outlining progress and confirming that you have adequate material to complete the project); hand in to the Undergraduate Office.
Mon 6th Mar, 2017 — Fri 17th Mar, 2017		Presentations of projects (will be organised by your supervisor; some supervisors prefer to do these early in Easter Term).
Fri 17th Mar, 2017		End of Lent Full Term
Tue 25th Apr, 2017		Start of Easter Full Term
Tue 25th Apr, 2017 — Fri 28th Apr, 2017		Minor Topic Examinations
Mon 15th May, 2017	1600	Project Report deadline
Tue 16th May, 2017 — Fri 26th May, 2017		Oral Examinations on Projects
Fri 16th Jun, 2017		End of Easter Full Term

9 Guide for Students

Administration The Department's central administration is located in the Bragg Building. Enquiries are usually dealt with via Room 206, between 9:00 and 12:30, and 14:00 and 17:00.

Aims and Objectives The Quality Assurance Agency, through its institutional audit of the University, is concerned with the assurance of the quality of teaching and learning within the University. The University in turn requires every Department to have clear aims and objectives and to monitor their teaching and learning activities and consider changes where necessary, and meet various criteria concerning management of the quality of its teaching provision. Students play a vital role in assisting with this quality assurance, and the Department welcomes constructive comment via the Staff-student Consultative Committee.

Appeals Information about the procedure for examination warnings, allowances and appeals is available at http://www.admin.cam.ac.uk/students/studentregistry/exams/undergraduate/exams.html.

Astronomical Society (CUAS) Astronomy and astrophysics are popular branches of physics, and the Astronomical Society provides an interesting and accessible series of lectures held on Tuesday evenings during the Michaelmas and Lent Terms in the Wolfson Lecture theatre, Chemistry department, as well as the opportunity to observe using the historic refractors owned by the Institute of Astronomy. Details can be found on the society's web page http://www.cam.ac.uk/societies/cuas. Members of the research groups of the Cavendish Laboratory concerned with astronomy and astrophysics are often lecturers in this series.

Battcock Centre for Experimental Astrophysics The Cavendish has a large and active astrophysics research group. Their research base is at the Battcock Centre, a new building located on the north side of Madingley Road opposite the Cavendish, and next to the Institute for Astronomy: Battcock Centre map.

Bicycles The Cavendish Laboratory provides several cycle sheds and racks in which you may leave your bike, but it should be locked with a sturdy security device when not in use. Several serious accidents occur every year involving students cycling in Cambridge: please cycle with care, use proper lights when required and wear a safety helmet.

Books The Physics Course Handbook lists the most important books to be used in conjunction with the lecture and practical courses. Reading and working through parts of these books are indispensable exercises which are usually considered part of the course. Many of the books are expensive, but they may be obtained at substantial reductions by attending book sales and looking out for bargains listed on College noticeboards and those in the Cavendish. All books recommended for Part I should be available in College libraries or the Rayleigh Library. If you notice any omissions, please fill in a request slip to ensure that the book is ordered.

Bookshops Cambridge is well equipped with bookshops. There is a discount available at the CUP bookshop with a University Card.

Buildings The present Cavendish Laboratory comprises the extensive buildings south of Madingley Road, the first of which opened in 1973. A map of the Cavendish Laboratory site is shown on the inside back cover. The original buildings on this site were the Rutherford, Bragg and Mott Buildings, named after former Cavendish Professors, and the workshop building between the Rutherford and Bragg buildings. These have in the past few years been supplemented by a building for the Interdisciplinary Research Centre (IRC) in Superconductivity (now the Kapitza Building), and a further building for the Microelectronics Research Group and Hitachi Cambridge Laboratory. Further recent additions to the site are the Magnetic Resonance Research Centre of the Chemical Engineering Department, the first phase of the Physics of Medicine (POM) building, which houses the laboratories for the Biological and Soft Systems sector (BSS), the Nanoscience Centre and the Terrapin Building. The most recent addition is the Battcock

Centre for Astrophysics, which houses the Astrophysics Group and is located on the north side of Madingley Road close to the Institute of Astronomy.

Calculators When considering which calculator to buy, you may wish to bear in mind that only certain types are permitted for use in Tripos examinations. Among these are the Casio models available from the Cavendish Stores. Calculators will also need the 'official' Board of Examination yellow sticker which can be obtained from the Undergraduate Office at the Cavendish.

CamCORS The supervision reporting system. See Databases (below)

CamSIS The student information system. See Databases (below)

CamTools This is a legacy Virtual Learning Environment (VLE), now being replaced by Moodle. See Databases (below)

Canteen See Common Room (below).

Careers The University Careers Service is located in Stuart House, Mill Lane (telephone number 338288), and is financed by the University to provide students with information about careers and assistance with application processes. The Service maintains an information room which can be used during normal office hours, and additionally provides expert staff to advise students about career-related issues. Ask at the reception desk.

Cavendish Laboratory The Cavendish Laboratory is the name of the building which houses (most of) the University's Department of Physics; the name has become synonymous with the department itself. The laboratory was established through the generosity of William Cavendish, Seventh Duke of Devonshire, who endowed the laboratory in the nineteenth century, together with the Cavendish Chair of Experimental Physics. The original Cavendish Laboratory building is located in Free School Lane in the centre of the city, and opened in 1874. The Department moved to the current buildings on the West Cambridge in 1973-74. The history of the Cavendish is well illustrated in the Cavendish Museum, located in the Bragg Building.

The two newest physics buildings in West Cambridge are the Physics of Medicine building ("PoM"), and the Maxwell Centre, which have a physical connection. The Maxwell Centre houses some Cavendish research groups and brings together industry and forefront research work in various areas: see Maxwell Centre for more details.

The University map shows the current site, but is not always completely up to date with new buildings: University Map of the Cavendish

Cavendish III A completely new laboratory for research and teaching is currently being designed by the architects Jestico + Whiles. This is the "Cavendish III" project, and it will be built on the paddock site in front of the veet school, opposite the Computer Laboratory, on J J Thomson Avenue. It will eventually replace the current 1970s buildings, and is currently undergoing detailed design.

Cavendish Stores Next to the Common Room in the Bragg Building is the central stores of the whole laboratory, the opening hours of which are 0800-1645. The stores sell approved calculators for examinations.

Cheating The Department and the University consider any act of cheating as a serious matter, and any incident will be reported to the Head of Department, who will normally refer the case to the University Proctors. It is unacceptable to:

- cheat during oral or written tests;
- copy the work of others and submit as your own;
- falsify and/or invent experimental data.

In the practical classes, some experiments are designed to be carried out individually and some in collaboration with other students. Discussion among students and with demonstrators and Heads of Class is encouraged and you may use any help or insights gained in these discussions to improve your experiment, your understanding of the physics and your written report. However, your report should be written by you, following the guidelines on writing reports, and only data collected in your experiment should be presented as your own.

The Department has access to the latest anti-plagiarism software tools and will use them from time to time to monitor coursework submissions for plagiarism, and so ensure fairness for all students.

Classing Criteria The Department of Physics has a policy that examiners will mark to agreed criteria for written examinations. Due to the way in which marks from different subjects are combined to create the final list in Parts IA and IB, the criteria used in Physics are not reflected directly in the class list. For Parts II and III, the examinations are under the direct control of the Department, in conjunction with scrutiny by External Examiners. The criteria for classing in Physics are available at http://www.phy.cam.ac.uk/students/teaching/current-courses/classing

College Your College ordinarily admits you to the University, provides you with accommodation and arranges for your supervisions in Parts IA and IB. Usually, but not always, your Director of Studies in Physics will be a member of staff of the Cavendish, and will be directly in touch with the Department. Most Colleges aim to provide supervision at a rate of about one hour per week for each of Part IA Physics, Part IB Physics A and Part IB Physics B. Part II and Part III supervision is provided on behalf of the Colleges through a scheme administered in the Department.

Common Room The Cavendish contains a large Common Room which is open to all students of Physics. It is open for light refreshments from 10:30-16:30, and for lunch from 12:30-13:45, on Mondays to Fridays. In addition there is an area for relaxation outside the lecture theatres, where there are vending machines for food and drink. Room 700 on the bridge between the Rutherford and Bragg buildings, above the metal stores is available for private study for Pt II and III students.

Complaints If you have a complaint about the teaching or administration in the Department, take it up first, if possible, with the person directly concerned in a constructive manner. If this is not effective, or if the matter seems to be of general interest, you may wish to discuss it with your course representative on the Staff-Student Consultative Committee. It may also be useful to discuss the matter with your Director of Studies or Tutor. If your complaint is substantial, by all means take it to the Director of Undergraduate teaching or the Head of Department. There is also a formal University Complaints Procedure, of which you should have received details. If you need advice on whether or how to proceed with a formal complaint, you could ask your College Tutor or Director of Studies, or your CUSU representative, or any physics member of staff. (See also Harassment, below.)

Computing The Department relies on the University Information Services http://www.uis.cam.ac.uk/ for provision of computing facilities for undergraduates. The `eduroam` wifi service is available throughout the laboratory. The Managed Cluster Service (MCS) is located close to the Practical laboratories, where you can use networked PCs with a range of software for word-processing, spreadsheet calculation and dataplotting. Most colleges also provide some facilities. The Department makes increasing use of computers in practical work, and aims to develop specific skills in the use of computers for solving problems in physics.

Counselling The University Counselling Service http://www.counselling.cam.ac.uk/ exists to help members of the University who have problems of a personal or emotional nature which they wish to discuss in confidence. The Service is widely used, so it can be busy. In times of particular stress a special effort will be made to see you quickly.

Advice on personal matters is always available in your college through your Tutor.

Special assistance is provided by Linkline (internal telephone 44444) and the Samaritans (telephone 364455).

Databases Students taking courses in Physics will come across a number of different on-line databases. Because these all use the same login method ("Raven" authentication: see below), it is not always obvious that these are different systems, which for the most part do not (yet) talk to each other. The main databases are:

- CamCORS – the Cambridge Colleges Online Reporting System. Supervisors use this to report to Directors of Studies and Tutors on the progress of their supervisees, and to claim from the colleges for the supervisions provided. If colleges choose to release the information, students can view their supervision reports here directly. See http://www.camcors.cam.ac.uk/
- CamSIS – the student information system. Students use this to enter for exams, and (when the results are uploaded) to check their Tripos results. Part IB NST students also indicate their Part II subject choice through this system. See http://www.camsis.cam.ac.uk/
- The Teaching Information System (TIS) – a web database system run by the Department of Physics. All course resources are provided here. It is important that all students register directly with the TIS each year, in addition to entering for examinations on CamSIS. (see Registration: below). See http://www-teach.phy.cam.ac.uk
- The University's timetable tool (http://timetable.cam.ac.uk) allows you to create your own timetable of lectures and practicals, and add to your own electronic calendar.
- Moodle: The Department of Physics currently makes little use of Moodle (https://www.vle.cam.ac.uk) since the TIS permits better integration with other Departmental systems. The exception is the Part IA Scientific Compting Course with uses Moodle extensively.

Department of Physics The Department of Physics is the administrative unit in the Faculty of Physics and Chemistry which provides teaching in physics leading to the Part II and Part III examinations in Physics. The Head of Department is Professor Andy Parker. Your direct contact with the Department can be through your College (your Director of Studies in the first instance) or through the staff you encounter in lectures and practicals. The needs of students in Part I are usually met fully through College contacts; in later years direct contact with the Department increases. The Department provides various facilities specifically to help you in your study of physics, many of which are described in this document.

Director of Studies You will have been assigned a Director of Studies in your College - possibly one for Physics and another for Natural Sciences overall. This person will assign you to supervisors during your first two years, will monitor your progress and try to assist you if you have problems. If you get into difficulties with the course you should discuss this with your Director of Studies, or with your Tutor. If for any reason you feel unable to do this any member of staff of the Department will willingly try to assist you.

Disability The Department works closely with the University's Disability Resource Centre (DRC) to ensure that the needs of students with disabilities are accommodated. Students with disabilities should seek support from their College and the DRC, and the DRC will then inform the Department regarding the any special arrangements that need to be made. It is also helpful to inform the Undergraduate Office in good time to allow arrangements to be made; you can also disclose relevant information on the TIS, so that your teachers will be made aware.

Email Email is the key communication channel between students and the department. Please ensure you read and monitor your University inbox regularly.

Examinations The marks upon which your degree classification is based are derived from a combination of continuously-assessed work, set pieces (such as projects and research reviews) and written examination papers.

You may find these two links which describe the classing criteria used helpful. For part IA and IB, the NST guide is at http://www.cam.ac.uk/about/natscitripos/exams/. For Parts II and III, the departmental criteria are described at http://www.phy.cam.ac.uk/students/teaching/current-courses/classing.

The Physics Department has produced some guidance on exam preparation which you might find helpful and is available on the teaching pages on the web at http://www.phy.cam.ac.uk/students/teaching/exam_skills. If you have problems it is worth discussing them with your supervisor, Director of Studies or your Tutor, who may be able to assist by suggesting alternative approaches.

Information on the various styles of questions is available at http://www.phy.cam.ac.uk/students/teaching/exam_questions, and you will find a brief description of how examiners work at http://www.phy.cam.ac.uk/students/teaching/exam_workings. Internal examiners are appointed each year for each Tripos examination; two external examiners are also appointed for Parts II and III. The names of examining committee members are available in the Reporter and on the Physics teaching webpages. For each subject there is a Senior Examiner drawn from the staff of the Department, and they take the responsibility for the setting and marking of the examination papers, assisted by the other examiners. You may also find interesting the reports on exams made by the Senior and External Examiners which are available on the TIS.

You should note that, by tradition – in order to ensure that the examination process is beyond reproach – direct contact with the examiners is not encouraged. If you have a problem that you believe should be brought before a particular body of examiners, the proper channel is through your Tutor or Director of Studies.

Selective Preparation for Examinations: There has been some discussion with past students about the advisability of 'ditching a course' in preparation for the examinations. The Department gave the following advice:

- Departmental policy is that the examinations should test the whole course taken by students. The examinations are designed to test the wide range of skills and knowledge that has been acquired.
- In any section of an examination paper, there is likely to be a range of questions which you will find to have differing degrees of difficulty and also testing different aspects of each course.
- It is very dangerous indeed to 'ditch courses'. It results in a very limited range of questions which can be answered - how do you know they are not all going to be very demanding? It requires enormous effort to be sure that you can answer well any question which can be set on any given course. It is much safer, and educationally much sounder, to prepare for all the courses for which you are entered in the Tripos examinations. You are much more likely to find two questions out of four in which you can perform well.

Examples Classes From the third year onwards Examples Classes are provided as an important aid to your learning. They explore in greater depth some particular issues related to parts of the lecture course, and with a number of demonstrators on hand they should be used to strengthen your grasp of the course material.

Examples Sheets Examples sheets are provided to accompany every lecture course, and are usually distributed outside the lecture theatre. It is the policy of the Department to provide examples which cover a wide range of difficulty, so don't expect to be able to do all of them without some assistance from your supervisor. You should try to produce satisfactory solutions to all of the designated 'core' examples for your subsequent use in revision, after discussion of the material in a supervision. Many of the questions are taken from past Tripos papers, so they provide good practice in handling material in the lecture courses, chosen to reflect the present content of the course.

Faculty of Physics and Chemistry The Department of Physics is part of the Faculty of Physics and Chemistry.

Feedback The Department makes a great effort to provide excellent courses and facilities. We greatly appreciate feedback from students which helps us improve our courses. Your input is most helpfully directed through your representative on the Staff-Student Consultative Committee (see below). You will be emailed links to feedback questionnaires. Please fill these in with constructive comments – these responses are the key input to the Consultative Committee, and the information is then passed on to the lecturers, Heads of Class and supervisors.

You can also send suggestions or comments to the Director of Undergraduate Teaching (director-teaching@phy.cam.ac.uk) or the teaching office (undergraduate-office@phy.cam.ac.uk).

Students often believe their comments are not taken seriously or acted upon. This is absolutely not the case! Lecturers and other staff read feedback carefully and attempt, where possible and sensible, to respond. Almost every course we give has been positively improved by constructive student feedback. It really makes a difference.

Fire Alarms All buildings are equipped with fire alarms, and you should take note of the instructions, which are posted around the buildings, for the procedure to follow in case of fire. There is a fire drill at some time each year. If you hear a fire alarm leave the building quickly and quietly by the nearest fire exit. Do not stop to collect your possessions. Do not use lifts. Fire doors in corridors close automatically when the alarm system is activated; they must never be obstructed. The system is tested between 0730 and 0830 each Monday.

If you discover a fire, raise the alarm by breaking the glass at the nearest Fire Alarm Point, and evacuate the building by the nearest safe route. If it is possible to do so without taking personal risks call the Fire Brigade (telephone 1999 from a University network telephone).

Formulae A booklet of standard mathematical formulae, identical to the one that is made available in certain examinations, is available for purchase from Cavendish Stores and Classes Technicians, or for downloading from here. You are urged to use and become familiar with the contents of this booklet, because it has become clear in recent Tripos examinations that many students are not aware of the time it can save them in an examination.

Handbook The Physics Course Handbook is updated each year, and distributed to students of all years, although the defintive source of information about the courses is to be found online. The individual course synopses are available on the TIS. Students may be informed of corrections, and updates, during the year, e.g. in course handouts or by e-mail. It is also available on the web. Please send any comments, on errors or omissions, by e-mail to undergraduate-office@phy.cam.ac.uk.

Harassment The University is committed to creating and maintaining an environment for work and learning which is free from all forms of discrimination. The central authorities of the University regard racial, sexual and disability harassment and bullying as wholly unacceptable behaviour. The information about harassment is available at `http://www.cambridgestudents.cam.ac.uk/welfare-and-wellbeing/dignitystudy`.

Institute of Physics The Institute of Physics is a national body that exists to promote physics. The Student Liaison Officer for the Institute of Physics is Esther Mander (Esther.Mander@iop.org). Prof. Mike Payne (mcp1@phy.cam.ac.uk) is the Cambridge Representative, from whom application forms can also be obtained. Following graduation you may obtain (according to experience) various grades of professional membership, Chartered Physicist status, and several other benefits which may have some bearing on obtaining a job.

Laboratory Closure The Cavendish Laboratory opens at 8:00 and closes at 18:00 Monday to Friday. Over Christmas and New Year the Laboratory is completely closed.

Late Submission of Work The departmental policy on submission of course work after published deadlines is described in section 3.

Lecture handouts Handouts, containing material to supplement lectures, are usually distributed at the time of the relevant lecture outside the lecture theatre. The amount of material prepared is at the discretion of the lecturer. Diverse opinions have been (vociferously) expressed by students each year about handouts - some want very little material, others wish to have copies of lecture overheads, others want a substitute for a book. When lecture overheads are supplied there are often criticisms that the lecturer is reading from the handout! It is impossible for the Department to provide courses and handouts which satisfy every different preference. Lecture handouts should be regarded as assistance beyond the lecture material, optionally provided by the lecturer, but they cannot substitute for your own reading through the wide range of textbooks available throughout the University, and you cannot reasonably expect them to. Lecture handouts are available from the TIS.

Lectures Details of lecture times and locations will be found at http://www.phy.cam.ac.uk/students/teaching.

Most Part IA lectures are usually held in the Bristol-Myers Squibb Lecture Theatre, The Chemical Laboratory.

Most Part IB Physics A and Physics B lectures are usually held in the Cockcroft Lecture Theatre on the New Museums Site.

Part II and Part III lectures are usually held in the lecture theatres and seminar rooms at the Cavendish Laboratory, or in the Sackler Lecture Theatre at the Institute of Astronomy.

Libraries Library provision in Cambridge is outstanding. Your College will probably provide a core of physics books to supplement those you buy. Usually the College Librarian will welcome suggestions for additional purchases if you find omissions of important books from the College Library.

The Department provides the Rayleigh Library, located in the Bragg building, and a special section has been set aside for use by Part II and Part III students (see Part II and Part III Library, below).

The University Library has an extensive physics collection.

Physics journals are held in the Rayleigh Library and in the Moore Library in Wilberforce Road (see below). Online access to many physics journals is available within the cam domain.

MASt This is a taught postgraduate course, which consists of the same content and assessment as Part III Physics. The course is designed for students who hold a 3-year undergraduate degree who wish to pursue a research degree. The entry requirement for the MASt is a qualification comparable to an upper second class or better UK Bachelor's degree in Physics. In recent years we have had a MASt class of 10-20 students who join us from degree programmes in the UK and worldwide. The intention is that they become fully integrated with the Part III class.

Managed Cluster Service (MCS – formally PWF) The MCS is a network of PCs supported by the Computing Service and located close to the Practical classes. It is used to assist with data analysis, document preparation and specific computing exercises. You will need to register as a user. See also Computing (above). Printing facilities are available.

Moore Library The University's main collection of physical sciences, technology and mathematics journals is kept in the Moore Library in the Centre for Mathematical Sciences in Wilberforce Road (close to the Cavendish, just turn left at the end of the footpath leading from the Cavendish into town, instead of continuing down Adams Road; the large building on the right near the far end of the road is the CMS). To use the collection you need to have a University Card. It is unlikely to be useful to you until the Third and Fourth years.

Natural Sciences Tripos The Natural Sciences Tripos (NST) is the official title of the degree examinations covering the Natural Sciences, including Physics. The participating Departments of the University work together to provide a wide choice of subjects which can be combined in a great variety of ways to cater for the interests of each student.

Many students seem unclear about how the Part II and Part III examinations are Classed. The following is an extract from notes prepared in order to clarify the Department's position on this:

Part III of the Tripos is classed in the usual way - 1st, 2.1, 2.2, 3rd. Parts II and III of the Tripos are independent and marks are not carried forward from one to the other.

Degrees as such are not classed. Students graduate from the University as a B.A. 'with Honours' and, if they are classed in Part III, as an M.Sci. The classes are attached to a particular Tripos. Thus if, for example, a student obtains a First in Part II, they will be entitled to say that they obtained 'First Class Honours in Part II of the NST' whatever their results in Part III. If they also obtain a good result in Part III then they can add that to their curriculum vitae. If future employers, postgraduate grant funding agencies, etc. require more detailed information than just the degree certificate, they will normally receive from a College or the University the full profile of the student's achievements during their years here, not just their result in the final year. This should enable them to give proper weight to the Part II results.

It is worth noting that many of the key decisions about job offers and places in research groups will be made before the Part III results are known, so the Part II classes are likely to be an important factor in those choices. The Research Councils normally require a specific standard to be met if students are to be eligible for postgraduate support. At present a student is eligible for a Research Council grant if at least an Upper Second has been attained in either Part II or Part III. It is unlikely that a poor result in Part III would lead to an offer of a place from any university, even if the formal requirement had been attained at Part II.

See also Classing Criteria, above.

Part II and Part III Library An area is set aside in the Rayleigh Library for use by Part II and Part III students, and there is an extensive collection of textbooks on all aspects of physics. These, and books from the main section of the Library, may be borrowed overnight after completing the borrowing procedure at the desk next to the main door to the Library. A quiet area for study is also available in the Part II/III study area accessible from the link bridge between the Bragg and Rutherford buildings.

Past Tripos papers Recent papers are available on the web at http://www-teach.phy.cam.ac.uk/dms/dmsSearch.php?type=examPapers. Remember that the course content changes, so past papers may contain questions on material with which you are not now expected to be familiar!

Philosophical Society The Philosophical Society is a long-established society in the University which, among its various functions, puts on evening lectures in the Bristol-Myers Squibb Lecture Theatre, Department of Chemistry. Some of these are by eminent physicists and all are intended for a broad audience - you are therefore most welcome to attend. More details are available at http://www.cambridgephilosophicalsociety.org/

Physics Course Handbook See Handbook (above).

Photocopying Photocopying may be carried out in the copy room of the Rayleigh Library.

Physics Society (CUPS) The Physics Society organises a range of functions, including evening lectures. Joining is easy at the first evening lecture or at the Societies' Fair. More details are available at http://physics.soc.srcf.net/.

Plagiarism See Cheating (above).

Practical Classes The Practical Classes are an important and examinable part of your course, and are conducted in the Cavendish Laboratory. Registration procedures are outlined in the relevant section of this Handbook.

Rayleigh Library The Rayleigh Library is primarily a resource for research, but it includes a great many useful reference works as well as original research journals. Here you can also find New Scientist, Scientific American, Physics World (for those who don't have their own copy!) and Physics Today. All of these are excellent sources of information about the fast-advancing frontiers of physics. Next to the section with these and other current journals is the Part II & III Library. There is limited space for private working.

Raven Raven is the University of Cambridge web authentication server. You will need your Raven password to log in to the Teaching Information System (q.v.), and to access "cam-only" material (such as past examination papers) on the teaching website from outside the cam.ac.uk domain. If you use the Hermes mail-store, then you can get your Raven password at https://jackdaw.cam.ac.uk/get-raven-password. If you don't use Hermes, then you can request a Raven password from http://www.cam.ac.uk/cs/request/raven.html. If you have a Raven password and your login is rejected by the teaching system, please let the Undergraduate Office know your CRSID so that we can enable your account. If you have lost your Raven password, or it doesn't work, then see http://www.cam.ac.uk/cs/docs/faq/n3.html.

Recording of Lectures Audio or video recording of lectures is not allowed, unless special permission has been granted. If recording is required to accommodate a disability, then the Disability Resource Centre should be approached. If there are other specific reasons for needing to record a lecture then a request should be made to the Undergraduate Office, who will consult the relevant lecturer. The Department may require that the recording is made by the lecture theatre technician.

Refreshments See Common Room.

Registration The Department runs an extensive set of teaching databases, and uses these, for example, to contact all students in any particular category. In order for us to reach you, we first need to know that you are here. You should receive, from the Department and/or your DoS, an invitation to register shortly before the start of the academic year. This does NOT enter you for examinations, or have any official function outside the Physics Department, but it does get you into the system so that we know you are here, and what you are doing. We are then able to allocate departmental supervisions where appropriate, and to give you access to all relevant information.

Reporter The University Reporter is the official publication of the University in which announcements are made. The paper version of the Reporter is no longer be produced. For all official notices concerning examination procedures see http://www.admin.cam.ac.uk/reporter/.

Research The Cavendish is a large and thriving research laboratory, with a wide range of present-day interests in physics. Check the Cavendish website for details of the various research groups currently active in the department.

Safety Safe conduct is legally the individual responsibility of everyone in the workplace, whether they be student or staff member. Additionally the Department has specific legal obligations regarding health and safety, which are monitored by the Department Safety and Environment Committee. You will be given information about health and safety in the Practical Classes in particular; please take in this information, and accord it the importance it deserves. Particular rules apply to Part III Project work; they are detailed in the section describing the arrangements for projects. The Departmental Safety Officer is Saba Alai (Room 220, Ext. 37397, sa792@.cam.ac.uk).

Central Science Library The University's main collection of scientific journals has been split into two. Journals related to the physical sciences, technology and mathematics are kept in the

new Moore Library in the Centre for Mathematical Sciences in Wilberforce Road (close to the Cavendish, just turn left at the end of the footpath leading from the Cavendish into town, instead of continuing down Adams Road; the large building on the right near the far end of the road is the CMS). The other journals are kept in the SPL in Bene't Street, which was originally the Philosophical Society's Library and still houses the offices of the Society. To use the collection you need to have a University Library card. It is unlikely to be useful to you until the third and fourth years.

Smoking The entire Department of Physics has been designated a NO SMOKING AREA.

Staff-Student Consultative Committee The SSCC is the official channel for the communication of students' concerns to the Department. There are one or two student representatives for each of the courses provided by the Department. Elections to the SSCC take place early in the Michaelmas term during lectures. The Consultative Committee is chaired by Dr Julia Riley, and the other members are the Head of Department, the Director of Undergraduate Education, and the Secretary of the Undergraduate Committee. The Committee meets at the end of each term, just after lectures finish, and a major part of its business is to discuss in detail the feedback on each course, particularly as reflected by questionnaires. The Committee also provides feedback to the Undergraduate Committee on general teaching issues.

The Committee's minutes are considered in detail by the Undergraduate Committee and by the Head of Department, and are made available on the web for access within Cambridge (http://www.phy.cam.ac.uk/students/teaching/resources-links/committees where the current membership may also be found).

Supervisions Supervisions are organised through your college for Parts IA and IB, and by the Department for Part II. Supervision in larger groups is organised by the Department for Part III. You are normally expected to attend every supervision which you have arranged, as a courtesy to your supervisor as well as in order to benefit your own studies. You should expect to be asked to hand in work for each supervision, in sufficient time for your supervisor to look through the work and identify any potential problems.

If for some reason you have problems, please contact your Director of Studies in the first instance, even for supervisions arranged by the Department.

Synopses Moderately detailed synopses are published for every course offered by the Department; the synopses have been arrived at after long deliberation, consultation, and debate within the Department. The relationship between courses is handled by the Undergraduate Committee, and every effort is made to refine the sequence in which material is presented. Some problems remain; these should just be the ones for which no clear-cut solution was available, but in case there are difficulties for you which have not been identified in advance, the Staff-Student Consultative Committee always welcomes direct feedback via your representative.

Undergraduate Committee The Undergraduate Committee concerns itself with all aspects of teaching and learning in the Department of Physics. It oversees the structure of lecture courses and practicals, and weighs up information about the success of the courses regularly during the academic year. The best route for communicating information to the committee is through your representative on the Staff-Student Consultative Committee, which itself reports to the Undergraduate Committee. The Chair of the Committee is Prof. John Richer (Director of Undergraduate Education) and the Secretary Dr Richard Batley.

Teaching Information System (TIS) The TIS is a web interface to the various teaching databases maintained by the Department: it is available at http://www-teach.phy.cam.ac.uk/. Part IA students can view their practical marks on the web; Part II and III students can select Research Reviews and Projects here, and can view their further work marks in the same way if they have been released. All supervisions arranged by the department are listed, and you can use the

system as an easy way to email your supervisors and supervision partners (for Parts II and III). All handouts, for all years, are available via the TIS.

Note that you must first be registered (see ”Registration”) for the current year in order to gain access to these facilities, and that many of them require you first to log in, using your Raven password (see under ”Raven”).

Telephones The internal telephone network of the university provides ‘free’ calls between extensions, most of which have a five-digit number.

To reach an extension from another exchange line outside the network, the number is prefixed with a 3. (Some recent lines have 5-digit number beginning with a 6, for which the prefix when dialling from outside is a 7).

For details, see the internal telephone directory.

Undergraduate Office The Physics Department has an Undergraduate Office which is situated in the Bragg building, Room 212B, tel. 65798. The office is run by Helen Marshall and is open for general enquiries and submission of written reports at regular times during full term. Enquiries can also be made to its e-mail address: undergraduate-office@phy.cam.ac.uk.

University Library The University Library is an amazing resource for the University (and in many disciplines, for the international academic community). You may be surprised at how useful it can be for you. However, since it is so large it can be a little complicated.

Your University Card is required to gain access to the University Library.

You cannot take bags etc. into the library for security reasons, but you can leave them in the metal lockers to be found down a few steps on the right hand side of the entrance hallway. The keys are released by the insertion of a £1 coin, which is returned to you when you open the locker.

Most of the relevant physics books are to be found on the shelves in ‘South Front, Floor 4’ - easily located on the maps displayed throughout the building. You need to know that in order to maximise storage, books are shelved in catalogue sequence, but split into different size categories. This means that you might find four different sets of books on, say, atomic physics - the size is indicated by a letter a,b,c in the catalogue number. They are easy to find once you know this! Periodicals (‘serials’) have numbers prefixed with P.

An increasing proportion of the 7,500,000 items in the inventory of the library are appearing on the computer catalogue, which can be accessed from any computer terminal which can connect to the network. The catalogue will tell you where the book should be found (eg SF4 i.e. South Front Floor 4) and whether or not it is out on loan (and if so, when it is due back). The same catalogue system allows you to check your College library catalogue (for most of the colleges) and that of the Rayleigh Library. The UL catalogue is available at `http://www.lib.cam.ac.uk/`.

Website The Cavendish Laboratory’s home page `http://www.phy.cam.ac.uk/` has notices about events in the Cavendish, lists of staff and details of the activities of the various research groups, as well as teaching material and information. This Physics Course Handbook and teaching material for various courses can be found at `http://www.phy.cam.ac.uk/students/teaching/`. The Teaching web pages also provide links to the Teaching Information system (q.v.), and to certain material that is not generally available to addresses outside the cam.ac.uk domain.

West Cambridge This is the name of the campus on which the Cavendish buildings sit, extending from the current Cavendish buildings to the M11 motorway in the west. The whole of the University’s West Cambridge site is currently under active development, with many new buildings being constructed, and many more planned. It will become the principal physical sciences campus of the University.