Programme Information & PLOs

Title of the new programme – including any year abroad/ in industry variants

BSc (Hons) Physics F300 (3 year)
MPhys Physics F303 (4 year)

BSc (Hons) Physics with Astrophysics F3F5 (3 year)
MPhys Physics with Astrophysics F3FN (4 year)

BSc (Hons) Theoretical Physics F345 (3 year)
MPhys Theoretical Physics F346 (4 year)

The above programmes augmented with a Year Abroad.
BSc (Hons) Physics with Year Abroad F302 (4 year)
MPhys Physics with Year Abroad F305 (4 year)*

BSc (Hons) Physics with Astrophysics with Year Abroad F3F7 (4 year)
MPhys Physics with Astrophysics with Year Abroad F3F8 (4 year)*

BSc (Hons) Theoretical Physics with Year Abroad F347 (4 year)
MPhys Theoretical Physics with Year Abroad F348 (4 year)*

The programmes augmented with a Year in Industry.
BSc (Hons) Physics with Year in Industry F301 (4 year)
MPhys Physics with Year in Industry F306 (5 year)

BSc (Hons) Physics with Astrophysics with Year in Industry F3F6 (4 year)
MPhys Physics with Astrophysics with Year in Industry F3F9 (5 year)

BSc (Hons) Theoretical Physics with Year in Industry F344 (4 year)
MPhys Theoretical Physics with Year in Industry F349 (5 year)

Programmes with different entry routes.
BSc (Hons) Physics with a Foundation Year F302 (4 year)
BSc (Hons) Physics via OpenPlus n/a (2 year)

*There is a proposal to the Physics BoS to modify the MPhys Year Abroad provision from a replacement year at Stage 3 to an additional year between stage 3 and 4, this will extend these programme to 5 years of study.

Level of qualification

Please select:	Level 7	

Please indicate if the programme is offered with any year abroad / in industry variants		**Year in Industry** Please select Y/N	Yes
		Year Abroad Please select Y/N	Yes

Department(s): Where more than one department is involved, indicate the lead department		
Lead Department	Physics	
Other contributing Departments:		

4. Programme Leader

Charles Barton

Purpose and learning outcomes of the programme

Statement of purpose for applicants to the programme

By studying **Physics at York**, you will join an **ambitious** and **inclusive** department that will challenge your understanding of physics and support your desire to explore the fundamental building blocks of the universe and technological society. You will have access to world-leading **experts** and **cutting-edge equipment** to support your quest for understanding. By completing your chosen programme, you will learn to appreciate the intellectual beauty, societal purpose, and wider applications of physics and become inspired for a lifetime of learning and exploration. **You will become a true physicist**.

The project provides opportunities for you to develop strong practical, organisational and communication skills and provides you with all the abilities and approaches you will need for **future careers**.
Our research continually evolves and spans topics of **astonishing diversity** such as:

- the **magnetisation** of the universe,
- the pursuit of **fusion** as an energy source,
- the design of **smart** materials and devices,
- being able to communicate **securely**,
- understanding how **biological systems** interact
- unveiling the intricacies of the **sub-nuclear** world.

All of our undergraduate degrees are accredited by the **Institute of Physics**.
The MPhys programmes meet all educational requirements for **Chartered Physicist** status.

- Our <u>Physics</u> programmes provide a balanced all-round physics education emphasising and instructing in the three methodologies of physics; experiment, theory and computation.

- The <u>Physics with Astrophysics</u> programmes also draw on these three methodologies whilst highlighting the importance of observation techniques and the use of core physics to solve astrophysics puzzles.

- The <u>Theoretical Physics</u> programmes develop advanced mathematical approaches to problem solving and highlight the use of computational modelling.

Programme Learning Outcomes

PLO	On successful completion of the programme, graduates will be able to:
1-MPhys	Apply independent learning strategies that incorporate core and advanced physics, mathematics and/or computational knowledge, techniques and understanding to synthesise and evaluate physical world problems.
1-BSC	Apply to assess and evaluate problems, providing solutions through the application of physics and mathematics knowledge and techniques.
2-MPhys	Plan and execute extended or complex scientific investigation using the principles of physics in investigating a hypothesis, and interpret outcomes.
2-BSc	Construct and execute a scientific investigation using the principles of physics in investigating a hypothesis, and interpret outcomes.
3-MPhys	Work independently and within a research team and apply group-specific research methodologies, including objective analysis and constructive criticism of research level literature, to extended or complex open-ended problems.

3-BSc	Communicate the integration and inter-relation of core physics, present sophisticated concepts and defend outcomes of physical studies succinctly in both written and oral formats to audiences in a logical way.
4-MPhys	Communicate succinctly to the general public and professional physicists through accurate and precise scientific record keeping, scientific report writing and presentations.
4-BSc	Interact and collaborate effectively within groups applying core physics themes and concepts to open-ended problems.
5-MPhys	Select and apply sophisticated digital tools for in-depth scientific investigation and in wider societal applications.
5-BSc	Use of appropriate digital technologies in data handling and understand the wider applications of these techniques in quantitative science.
6-MPhys (Ph)	Use sophisticated experimental design measurement and/or analysis methods to evaluate a physics model or theory whilst appraising the accuracy, correctness and limitations of the approach
6-BSc (Ph)	Discriminate between modern experimental and measurement methods and the limitations imposed by assessment of systematic and random errors in the experimental design and execution.
6-MPhys (AP)	Evaluate the use of mathematical, observational and/or experimental and/or computational techniques as applied in astrophysics within an extended line of investigation, assessing the limitations of the methodology.
6-BSc (AP)	Discriminate between modern astrophysics methods and articulate limitations imposed on understanding by assessing systematic and random errors in the interpretation of results.
6-MPhys (TP)	Design and successfully code computer simulations based on advanced computational and theoretical models to evaluate complex physical systems, addressing the accuracy, correctness and limitations of the simulation model.
6-BSc (TP)	Integrate a range of analytical, computational methods and the appropriate methodology to construct models of physical phenomena.

Programme Learning Outcome for year in industry (where applicable) For programmes which lead to the title 'with a Year in Industry' – typically involving an additional year – please provide either a) amended versions of some (at least one, but not necessarily all) of the standard PLOs listed above, showing how these are changed and enhanced by the additional year in industry b) an additional PLO, if and only if it is not possible to capture a key ability developed by the year in industry by alteration of the standard PLOs.
All our single subject programmes have a Year in Industry equivalent: Articulate how a physics-trained individual and physics approaches can contribute to successful industrial, commercial and/or non-academic environments.

Programme Learning Outcome for year abroad programmes (where applicable) For programmes which lead to the title 'with a Year Abroad' – typically involving an additional year – please provide either a) amended versions of some (at least one, but not necessarily all) of the standard PLOs listed above, showing how these are changed and enhanced by the additional year abroad or b) an additional PLO, if and only if it is not possible to capture a key ability developed by the year abroad by alteration of the standard PLOs.
All our BSc programmes (single and joint subject) and MPhys single subject programmes have a Year in Abroad equivalent: Be inspired by and articulate the advantages of successfully study in a non-UK academic environment and how this broadens your perspective and develop adaptability, flexibility, resilience and drive.
Explanation of the choice of Programme Learning Outcomes Please explain your rationale for choosing these PLOs in a statement that can be used for students (such as in a student handbook). Please include brief reference to:
i) Why the PLOs are considered ambitious or stretching?
The PLOs are far reaching and encompass the key competencies expected of a physicist. The PLOs are forward looking, drawing on the education and learning opportunities provided within the Physics, Physics with Astrophysics and Theoretical Physics BSc and MPhys degree programmes whilst highlighting the competencies a York student should aspire to attain by the time they graduate. The MPhys PLOs naturally follow from the BSc PLOs and show how a fourth year of study enhances a student's education and justifies the award of an Integrated Master's degree.
ii) The ways in which these outcomes are distinctive or particularly advantageous to the student:
Each PLO is distinct from each other and draws on the learning opportunities provided across many modules. Modules often use a common set of skills (e.g. algebraic, numerical, computational techniques for example) to address problems in specific topics. Seeing similar techniques in different contexts strengthens a student's knowledge of the technique, showing the power of the approach and its adaptability to many situations. The PLOs are clearly characteristics a Physicist should have and are distinct from the characteristics of students from other disciplines.
iii) How the programme learning outcomes develop students' digital literacy and will make appropriate use of technology-enhanced learning (such as lecture recordings, online resources, simulations, online assessment, 'flipped classrooms' etc)?
Physics (and its variants: Physics with Astrophysics, Theoretical Physics) is a highly 'digitally enabling' subject. The use of computing threads the degree at all levels encompassing programming (e.g. Python), instrument control (e.g. LabVIEW), digital measurement, data analysis (e.g. Origin, Excel) as well as report writing (e.g. Word, LaTeX) and presentations (e.g. PowerPoint, PDF). All our modules utilise the VLE (Yorkshare) with some modules using electronic question banks and videoed tutorials. All modules are 'opt-out' for audio-projector-capture using the Replay system. Where the equipment exists, the Department uses video capture to augment the audio-projector-capture systems to record blackboard and overhead projector work. The Department is introducing Mastering Physics to Stage 1 modules - this a commercial electronic resource and question bank associated with the recommended Stage 1 physics textbook.
iv) How the PLOs support and enhance the students' employability (for example, opportunities for students to apply their learning in a real world setting)? The programme's employablity objectives should be informed by the University's Employability Strategy:
http://www.york.ac.uk/about/departments/support-and-admin/careers/staff/
The PLOs have graduate characteristics at their heart, and reflect what a graduate might state to an employer. The PLOs demand that a student question, assess and construct solutions to problems through both independent and collaborative working and communicate the outcomes effectively. The PLOs highlight the need to establish effect competencies, e.g. intellectual, practical and transferable tools sets, to enable this. These competencies are particularly important and applied in a real world setting during the projects.
vi) How will students who need additional support for academic and transferable skills be identified and supported by the Department?

Students generally self-identify themselves either at the UCAS application stage or on first arrival. Supervisors during the first meeting with their new supervisees ask whether they wish to declare a disability. These students are asked to contact Disability Services at the Student Hub. Reports from disability services are considered by our Disability Officer (currently the Student Administration Manager) with support from the sciences Disability Advisor, deputy Chair of the Board of Studies. Information is shared with the supervisor, Year Tutors, Laboratory Coordinators and other staff as needed.

vii) How is teaching informed and led by research in the department/ centre/ University?

The Department undertook a major Programme Review in 2015/16. The review considered all taught materials in the single subject degrees (Physics, Physics with Astrophysics, Theoretical Physics), joint subject degrees (Maths and Physics, Physics with Philosophy), and Natural Sciences (pathways Biology-Chemistry-Physics, Biophysics Science, Chemistry-Maths-Physics, Maths-Philosophy-Physics, Nanoscience) aligning the early stages of each programme to the Institute of Physics core material, and ensuring that this delivers to all students the necessary prerequisites to study in-depth modules at Stage 4. These in-depth Stage 4 modules are inspired by and/or centred on the research interests of our academic staff. This design ensures that by the end of Stage 3 all students are exposed to the key ideas of each of our research groups. Further, the Department has refreshed its teaching laboratories to ensure a modern laboratory (experimental, astrophysics or computational) experience that enhances the taught parts of the programme. The Programme Review ensured each student undertakes a significant final year project. These projects are taxing requiring students to draw on and apply the breadth of training provided throughout their programme. They also expose many (particularly in Stage 4) to the research methodologies of specific disciplines within the physics department and beyond.

Stage-level progression

Please complete the table below, to summarise students' progressive development towards the achievement of PLOs, in terms of the characteristics that you expect students to demonstrate at the end of each year. This summary may be particularly helpful to students and the programme team where there is a high proportion of option modules.

Note: it is not expected that a position statement is written for each PLO, but this can be done if preferred (please add information in the 'individual statement' boxes). For a statement that applies across all PLOs in the stage fill in the 'Global statement' box.

Stage 0 (if your programme has a Foundation year, use the toggles to the left to show the hidden rows)							
On progression from the first year (Stage 0), students will be able to:				*Global statement*			
PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
Individual statements							
Stage 1							
On progression from the first year (Stage 1), students will be able to:				*During Stage 1: Develop learning strategies: through acquiring core physics and mathematics knowledge and techniques. Have the ability to combine physics and mathematics and apply these to problem solving, experiments and computational tasks.* *Will have prepared the necessary and basic physics skills sets needed to begin to establish independent learning skills during Stage 2.*			
PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8

Individual statements							
Stage 2							
On progression from the second year (Stage 2), students will be able to:				*During Stage 2: Establish independence skills: deepen core physics knowledge and mathematical approaches to solve more extended problems. Refine and add conceptual understanding to the core physics introduced at Stage 1. Extend experience in experimentation and computation and develop the ability to manage workloads. Use a solid independent learning skill set needed to address the ideas presented at Stage 3 and to effectively run and complete projects or advanced laboratories at Stage 3.*			
PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
Individual statements							
Stage 3							
(For Integrated Masters) On progression from the third year (Stage 3), students will be able to:				*During Stage 3: Effective self-sufficient learners: through the application of core knowledge and techniques to problem solving and interpreting new situations. Have experience in workload planning to enable effective attempts at open-ended or extended investigations (projects or advanced labs). Meet the BSc PLOs for the appropriate programme.*			
PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6-Ph	PLO 6-AP	PLO 6-TP
Apply to assess and evaluate problems, providing solutions through the application of physics and mathematics knowledge and techniques.	*Construct and execute a scientific investigation using the principles of physics in investigating a hypothesis, and interpret outcomes.*	*Communicate the integration and inter-relation of core physics, present sophisticated concepts and defend outcomes of physical studies succinctly in both written and oral formats to audiences in a logical way.*	*Interact and collaborate effectively within groups applying core physics themes and concepts to open-ended problems.*	*Use of appropriate digital technologies in data handling and understand the wider applications of these techniques in quantitative science.*	*Discriminate between modern experimental and measurement methods and the limitations imposed by assessment of systematic and random errors in the experimental design and execution.*	*Discriminate between modern astrophysics methods and articulate limitations imposed on understanding by assessing systematic and random errors in the interpretation of results.*	*Integrate a range of analytical, computational methods and the appropriate methodology to construct models of physical phenomena.*

Programme Structure

Module Structure and Summative Assessment Map

Please complete the summary table below which shows the module structure and the pattern of summative assessment through the programme.

‘Option modue’ can be used in place of a specific named option. If the programme requires students to select option modules from specific lists these lists should be provided in the next section.

From the drop-down select 'S' to indicate the start of the module, 'A' to indicate the timing of each distinct summative assessment point (eg. essay submission/ exam), and 'E' to indicate the end of the module (if the end of the module coincides with the summative assessment select 'EA') . It is not expected that each summative task will be listed where an overall module might be assessed cumulatively (for example weekly problem sheets).

If summative assessment by exams will be scheduled in the summer Common Assessment period (weeks 5-7) a single ‘A’ can be used within the shaded cells as it is understood that you will not know in which week of the CAP the examination will take place.

Stage 0 (if you have modules for Stage 0, use the toggles to the left to show the hidden rows)

Stage 1

Credits	Module		Autumn Term										Spring Term										Summer Term									
	Code	Title	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
20	PHY00020C	Electromagnetism, Waves and Optics												S												E	A					
20	PHY00019C	Human Uses of Energy with Professional Skills		S																							A					E
20	PHY00022C	Introduction to Thermal and Quantum Physics		S									A									E					A					
20	PHY00023C	Mapping the Universe with Professional Skills		S																							A					E
20	PHY00024C	Mathematical Modelling with Professional skills		S																							A					E
20	PHY00005C	Mathematics I		S									A													E	A					
20	PHY00021C	Newtonian and Relativistic Mechanics		S									A																			
20	PHY00012C	Experimental Laboratory I		S								A										A				E						

20	PHY00013C	Experimental Laboratory for Astrophysics I		S								A										A				E						
20	PHY00014C	Laboratory for Theoretical Physics		S								A										A				E						

Stage 2

Credits	Module		Autumn Term										Spring Term										Summer Term									
	Code	Title	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
20	PHY00028I	Astrophysical Technologies, Planetary Science with Professional Skills		S																						E	A					
20	PHY00008I	Computational and Mathematical Techniques for Theoretical Physics		S									A		A											E	A					
20	PHY00011I	Computational Laboratory		S								A										EA										
20	PHY00002I	Electromagnetism and Optics												S												E	A					
20	PHY00009I	Experimental Laboratory II		S								A										A				E						
20	PHY00010I	Experimental Laboratory for Astrophysics II		S								A										A				E						
20	PHY00029I	Experimental Techniques with Professional Skills		S								A														E	A					
20	PHY00030I	Mathematics II		S									A									E					A					
20	PHY00032I	Quantum Physics II		S									A									E					A					
20	PHY00031I	Thermodynamics and Solid State I		S									A									E					A					

Stage 3

Credits	Module		Autumn Term										Spring Term										Summer Term									
	Code	Title	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
20	PHY00029H	Advanced Computational Laboratory		S																			A			EA						
20	PHY00028H	Advanced Astrophysics Laboratory		S																			A			EA						
20	PHY00027H	Advanced Experimental Laboratory		S																			A			EA						
20	PHY00047H	Atomic Physics, Lasers and Modern Optics		S																		E					A					
40	PHY00052H	BSc Astrophysics Project Incorporating Professional Skills	S																				A			A					EA	
40	PHY00052H	BSc Project Incorporating Professional Skills	S																				A								EA	
40	PHY00052H	BSc Theoretical Project Incorporating Professional Skills	S																			E	A								EA	
20	PHY00046H	Computational and Mathematical Techniques II		S																		E					A					
20	PHY00045H	Galaxies and the Interstellar Medium and Cosmology		S																		E					A					
20	PHY00048H	Introduction to Plasma Science and Technology and Stellar Physics		S									A									E					A					

20	PHY00044H	Advanced Theoretical Techniques and Introduction to Quantum Computing		S																		E				S	A					
20	PHY00043H	Nanoscale and Magnetism		S																		E					A					
20	PHY00042H	Relativity and Particle Physics		S																		E					A					
20	PHY00050H	Quantum Physics III		S									A									E					A					
20	PHY00049H	Statistical Mechanics and Solid State II		S									A									E					A					

Stage 4

Credits	Module		Autumn Term										Spring Term										Summer Term									
	Code	Title	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
20	PHY00030M	Advanced and Further Quantum Mechanics		S									A									E					A					
20	PHY00031M	Advanced Computational Physics		S									A									E					A					
20	PHY00032M	Advanced Nuclear Physics		S									A									E					A					
20	PHY00035M	Advanced Plasma Science and Applications		S									A									E					A					
20	PHY00033M	Biophysics		S									A									E					A					
20	PHY00036M	Light and Matter		S									A									E					A					
60	PHY00025M	MPhys Project and Research skill or Industrial Project in York	S																							A					EA	
20	PHY00034M	Nanomaterials: From Graphene to Spintronics		S									A									E					A					
10	PHY00001M	Plasma Physics for Fusion (IP)		S								E	A																			

10	PHY00022M	Molecular Biophysics (IP)		S							E	A																				
10	PHY00019M	Advanced Quantum Mechanics (IP)		S							E	A																				
10	PHY00012M	High Performance Computing (IP)		S							E	A																				
80	PHY00028M	MPhys Placement Project											S											A					EA	
10	PHY00024M	Nuclear Physics II (IP)		S							E	A																				
10	PHY00018M	Physics and Applications of Semi-Conductor Devices (IP)		S							E	A																				

Management and Admissions Information	
This document applies to students who commenced the programme(s) in:	2017/18

Interim awards available Interim awards available on undergraduate programmes (subject to programme regulations) will normally be: Certificate of Higher Education (Level 4/Certificate), Diploma of Higher Education (Level 5/Intermediate), Ordinary Degree and in the case of Integrated Masters the Bachelors with honours. Please specify any proposed exceptions to this norm.
Certificate of Higher Education (Level 4/Certificate) Generic Diploma of Higher Education (Level 5/Intermediate) Generic Ordinary Degree (Level 5/6) at least 60 credits at level 6 Physics For MPhys programmes) Physics BSc (Hons) Level 6/Honours Physics BSc (Hons) Level 6/Honours Physics with Astrophysics BSc (Hons) Level 6/Honours Theoretical Physics
Admissions Criteria
TYPICAL OFFERS Typical offers may vary for combined programmes A levels AAA (MPhys); AAB (BSc) IB Diploma Programme 36 points including HL 6 in essential subjects BTEC Extended Diploma DDD plus A at A level in Mathematics and Physics
Length and status of the programme(s) and mode(s) of study

Programme	**Length (years)**	**Status (full-time/part-time)** Please select	**Start dates/months** (if applicable – for programmes that have multiple intakes or start dates that differ from the usual academic year)	**Mode**		
				Face-to-face, campus-based	**Distance learning**	**Other**

BSc (Hons) Physics MPhys (Hons) Physics BSc (Hons) Physics with Astrophysics MPhys (Hons) Physics with Astrophysics BSc (Hons) Theoretical Physics MPhys (Hons) Theoretical Physics BSc (Hons) Physics with a Year Abroad MPhys (Hons) Physics with a Year Abroad BSc (Hons) Physics with Astrophysics with a Year Abroad MPhys (Hons) Physics with Astrophysics with a Year Abroad BSc (Hons) Theoretical Physics with a Year Abroad MPhys (Hons) Theoretical Physics with a Year Abroad BSc (Hons) Physics with a Year in Industry MPhys (Hons) Physics with a Year in Industry BSc (Hons) Physics with Astrophysics with a Year in Industry MPhys (Hons) Physics with Astrophysics with a Year in Industry BSc (Hons) Theoretical Physics with a Year in Industry MPhys (Hons) Theoretical Physics with a Year in Industry	3/5	Full-time	n/a	Please select Y/N	Yes	Please select Y/N	No	n/a
Language(s) of study								

English.

Language(s) of assessment

English.

Programme accreditation by Professional, Statutory or Regulatory Bodies (PSRB)

Is the programme recognised or accredited by a PSRB

Please Select Y/N:	Yes	if No move to next Section if Yes complete the following questions

Name of PSRB

BSc and MPhys: Programmes meet the requirements for accreditation by the Institute of Physics.

Are there any conditions on the approval/ accreditation of the programme(s)/ graduates (for example accreditation only for the full award and not any interim award)

Additional Professional or Vocational Standards

Are there any additional requirements of accrediting bodies or PSRB or pre-requisite professional experience needed to study this programme?

Please Select Y/N:		if Yes, provide details

(max 200 words)

University award regulations

The University's award and assessment regulations apply to all programmes: any exceptions that relate to this programme are approved by University Teaching Committee and are recorded at the end of this document.

Are students on the programme permitted to take elective modules?

(See: https://www.york.ac.uk/media/staffhome/learningandteaching/documents/policies/Framework%20for%20Programme%20Design%20-%20UG.pdf)

Please Select Y/N:		

Careers & Placements - 'With Placement Year' programmes

Students on all undergraduate and integrated masters programmes may apply to spend their third year on a work-based placement facilitated by Careers & Placements. Such students would return to their studies at Stage 3 in the following year, thus lengthening their programme by a year. Successful completion of the placement year and associated assessment allows this to be recognised in programme title, which is amended to include 'with Placement Year' (e.g. BA in XYZ with Placement Year'). The Placement Year also adds a Programme Learning Outcome, concerning employability. (See Careers & Placements for details). /

Programme excluded from Placement Year?	No	If yes, what are the reasons for this exemption:

/
Students on all programmes may apply to spend Stage 2 on the University-wide North America/ Asia/ Australia student exchange programme. Acceptance onto the programme is on a competitive basis. Marks from modules taken on replacement years count toward progression and classification. Does the programme include the opportunity to undertake other formally agreed study abroad activities? All such programmes must comply with the Policy on Study Abroad https://www.york.ac.uk/staff/teaching/procedure/programmes/design/

Please Select Y/N:	Yes	

Additional information

Transfers out of or into the programme

ii) Transfers into the programme will be possible? (please select Y/N)	Yes	
Additional details:		

Students may transfer to/from the BSc/MPhys in Physics or Physics with Astrophysics programme at any time during Stage 1, subject to satisfactory academic progress. Students may transfer to/from the BSc/MPhys in Theoretical Physics programme at any time during Stage 1 up to the end of Spring Term, subject to satisfactory academic progress.
Students on MPhys programmes may transfer to the corresponding BSc programme at any time during Stages 1 and 2. Students on BSc programmes may transfer to the corresponding MPhys programme as follows: in Stage 1 or 2 during the summer vacation period, subject to achieving a minimum stage average of 55%. Stage 2 students who fail to achieve the progression requirements for Stage 3 of the MPhys programme will automatically be transferred to Stage 3 of the BSc programme.

ii) Transfers out of the programme will be possible? (please select Y/N)	Yes	
Additional details:		

Students may transfer to/from the BSc/MPhys in Physics or Physics with Astrophysics programme at any time during Stage 1, subject to satisfactory academic progress. Students may transfer to/from the BSc/MPhys in Theoretical Physics programme at any time during Stage 1 up to the end of Spring Term, subject to satisfactory academic progress.
Students on MPhys programmes may transfer to the corresponding BSc programme at any time during Stages 1 and 2. Students on BSc programmes may transfer to the corresponding MPhys programme as follows: in Stage 1 or 2 during the summer vacation period, subject to achieving a minimum stage average of 55%. Stage 2 students who fail to achieve the progression requirements for Stage 3 of the MPhys programme will automatically be transferred to Stage 3 of the BSc programme.

Exceptions to University Award Regulations approved by University Teaching Committee

Exception Please detail any exceptions to University Award Regulations approved by UTC	**Date approved**

Date on which this programme information was updated:	
13/9/18	
Please note: The information above provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if they take full advantage of the learning opportunities that are provided. Detailed information on the learning outcomes, content, delivery and assessment of modules can be found in the module descriptions. The University reserves the right to modify this overview in unforeseen circumstances, or where the process of academic development, based on feedback from staff, students, external examiners or professional bodies, requires a change to be made. Students will be notified of any substantive changes at the first available opportunity.	
/	
Please note: the programme map below is in interim format pending the development of a University Programme Catalogue.	

Programme Map: Module Contribution to Programme Learning Outcomes

This table maps the contribution to programme learning outcomes made by each module, in terms of the advance in understanding/ expertise acquired or reinforced in the module, the work by which students achieve this advance and the assessments that test it. This enables the programme rationale to be understood:
· Reading the table vertically illustrates how the programme has been designed to deepen knowledge, concepts and skills progressively. It shows how the progressive achievement of PLOs is supported by formative work and evaluated by summative assessment. In turn this should help students to understand and articulate their development of transferable skills and to relate this to other resources, such as the Employability Tutorial and York Award;
· Reading the table horizontally explains how the experience of a student at a particular time includes a balance of activities appropriate to that stage, through the design of modules.

	Module	Credit	Core/ Option		Programme Learning Outcomes							
					PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6 - Ph**	**PLO6 - AP**	**PLO6 - TP**
					Apply independent learning strategies that incorporate core and advanced physics, mathematics and/or computational knowledge, techniques and understanding to synthesise and evaluate physical world problems.	**Plan and execute extended or complex scientific investigation using the principles of physics in investigating a hypothesis, and interpret outcomes.**	**Work independently and within a research team and apply group-specific research methodologies, including objective analysis and constructive criticism of research level literature, to extended or complex open-ended problems.**	**Communicate succinctly to the general public and professional physicists through accurate and precise scientific record keeping, scientific report writing and presentations.**	**Select and apply sophisticated digital tools for in-depth scientific investigation and in wider societal applications.**	**Use sophisticated experimental design measurement and/or analysis methods to evaluate a physics model or theory whilst appraising the accuracy, correctness and limitations of the approach**	**Evaluate the use of mathematical, observational and/or experimental and/or computational techniques as applied in astrophysics within an extended line of investigation, assessing the limitations of the methodology.**	**Design and successfully code computer simulations based on advanced computational and theoretical models to evaluate complex physical systems, addressing the accuracy, correctness and limitations of the simulation model.**
Stage 4	MPhys Project and Res Skills	60	Core	Progress towards PLO	Creatively apply independent learning strategies to tackle new research questions and/or unfamiliar problems in specialised areas of physics, interpreting and presenting results in an appropriate manner. Independently identify relevant data, methodologies, and approaches from a wide body of research literature, and incorporate them into project work as and when appropriate. Understand that a physics approach can be immensely powerful when applied to a vast range of problems.	Carry out independent research, access and use current literature and identify the most suitable approach to tackle a specific research question.	Work independently as part of a research group on a complex and open-ended research project incorporating methodologies and approaches garnered both from academic literature and from research groups here in York. Write a final report including critical appraisal of published data, results, and conclusions in the light of the outcomes of the research project.	Concisely, clearly, and comprehensively communicate the background, theory, methodology, and results of an advanced extended scientific investigation orally to peers in a large group, examiners in a viva-style defence, in formal dissertation writeup, and in a conference poster. Defend the poster before conference attendees (peers, research students, and academics). Keep accurate record of all experimental and theoretical work to accepted standards. Be able to articulate how a specific physics problem fits into the broader picture of our understanding of nature.	Show and articulate how a specific digital approach applied to a physics problem fits into the broader picture of our understanding of nature. Apply previously learned digitial approaches and techniques to unfamiliar problems, and understand that a physics approach can be immensely powerful when applied to a vast range of problems. Be inspired by the power of digital techniques through project work in an area of choice and conduct an extended independent investigation using it.	Carry out novel research, including experimental/computational design, appropriate selection of data acquisition/generation and analysis techniques, analysis, evaluation, and appraisal of the results obtained in the context of the strengths and limitations of the methodology used.	Carry out novel research, including experimental/computational design, appropriate selection of data acquisition/generation and analysis techniques, analysis, evaluation, and appraisal of the results obtained in the context of the strengths and limitations of the methodology used.	Carry out novel research, including computational design, appropriate selection of data generation and analysis techniques, analysis, evaluation, and appraisal of the results obtained in the context of the strengths and limitations of the methodology used.
				By working on (and if applicable, assessed through)	Completing independent project work, with support from project supervisor(s) as appropriate.	Planning and executing an independent research project, evaluating the data in relation to a hypothesis or hypotheses and the current status of the field and presenting results in formal written and oral formats.	Working both independently and as part of a wider group to produce research-level output incorporating all aspects of this PLO. Refining ability to search for and assess appropriate scientific literature.	Preparing research materials for dissemination in written form (e.g. in laboratory note books, dissertations), oral form (e.g. supervisor discussion, seminar, viva) and via other presentations (e.g. to supervisors and during the summer conference).	Enaging in project work, exploring within the project which tools are most effective in delivering results.	Working on research project design, realisation, and follow-up. Examined through formal written report and oral viva-style examination.	Working on research project design, realisation, and follow-up. Examined through formal written report and oral viva-style examination.	Working on research project design, realisation, and follow-up. Examined through formal written report and oral viva-style examination.

Stage 4	Adv Plasma Science and Applications	20	Option	Progress towards PLO	Creatively apply independent learning strategies incorporating core and advanced physics to understand and evaluate real-world plasma physics of relevance to inertial and magnetic fusion and astrophysics. Understand key plasma physics concerns behind both inertial and magnetic confinement approaches to fusion and basic plasma behaviour. Understand the relevence of plasma science to matters of clean energy and energy security.		Work both independently and collaboratively in order to explore complex problems involving terrestrial and astrophysical plasmas.	Through deep understanding, communicate the key plasma physics issues behind realising inertial and magnetic confinement approaches to fusion and basic plasma behaviour. Understand the relevence of plasma science to matters of clean energy and energy security. Appreciate how plasma physics knowledge - aquired and tested in terrestrial setting - is used to understand and interpret astrophysical systems.	Computational techniques are central to plasma physics, because the study of collective processes in many-body charged-particle systems are quite intractible to calculate by hand.			
				By working on (and if applicable, assessed through)	Regular independent assignments, engaging with teaching materials and problem class material, formal examination.		Regular assignments and engaging with problem class material.	Engaging with teaching materials, formal examination.	Engaging with teaching materials; private study time.			
Stage 4	Adv Nuclear Physics	20	Option	Progress towards PLO	Creatively apply independent learning strategies that incorporate core and advanced physics to evaluate real-world nuclear physics and astrophysics problems Understand the wider role of nuclear physics in the cosmos, and the power of small scale interactions to shape the universe.	Evaluate and analyse third-party data.	Work independently and within a research team to deliver thorough and complete solutions to complex exercises and assignments	Communicate advanced nuclear physics concepts via report writing and presentations		Evaluate sophisticated experimental measurements to evaluate nuclear physics and astrophysics models.	Evaluate sophisticated experimental measurements to evaluate nuclear physics and astrophysics models.	
				By working on (and if applicable, assessed through)	Regular independent assignments, engaging with lecture and problem class material, formal examination.	Applying the principles of nuclear physics and astrophysics to evaluate third-party published data	Engaging with group-work aspect of problem classes and assignments.	Engaging with lectures, problem classes and assignments		Engaging with teaching material, working on independent assignment.	Engaging with teaching material, working on independent assignment.	

Stage 4	Adv Computational Physics	20	Option	Progress towards PLO	Apply independent learning strategies to implement complex computational methods for the simulation of advanced physical problems, eg fast fourier transforms, parallel code etc	Plan and execute a computational scientific investigation using advanced parallel computing techniques including MPI, OpenMP, and CUDA. Compare and contrast different computational approaches to the same problem, including comparison of different compilers and programming paradigms.	Work independently and as a team implementing complex algorithms and applying them to extended and complex problems		Independently write complex pieces of code in a highly optimised way, to run on a particular target architecture (GPGPU etc). Critically assess different computational methods and their appropriateness for different physical problems, understanding the consequences of choosing poor methods upon the outcome. Demonstrate the power of computation to solve problems an predict physical behaviour.	Learn, modify, and apply a range of advanced computational techniques to modelling physical systems while considering their limitations.	Learn, modify, and apply a range of advanced computational techniques to modelling physical systems while considering their limitations.	Learn, modify, and apply a range of advanced computational techniques to modelling physical systems while considering their limitations.
				By working on (and if applicable, assessed through)	Participating in practical programming classes developing computational techniques, engaging with lecure material, formal examination.	Developing a high performance computer code to investigate the properties of a modelled system	Participating in supported lab sessions (practicals), and completing two long, complex, and open-ended computational assignments.		Engaging with teaching materials. Formally assessed via independent assignment.	Engaging with teaching material, partifipating in supported lab sessions (practicals), and completing two long, complex, and open-ended computational assignments.	Engaging with teaching material, partifipating in supported lab sessions (practicals), and completing two long, complex, and open-ended computational assignments.	Engaging with teaching material, partifipating in supported lab sessions (practicals), and completing two long, complex, and open-ended computational assignments.
Stage 4	Nanomaterials: From Graphene to Spintronics	20	Option	Progress towards PLO	Creatively use advanced physics concepts to evaluate given physical world questions Understand key physics phenomena underpinning the development of advanced experimental techniques used in Physics research. Appraise the suitability of different nanofabriacation and nanomanipulation techniques for the solution of a specific problem	Use advanced physics concepts to investigate complex physics problems.	Engage with the scientific literature to identify the most suitable methodology to solve a complex nanophysical problem.	Summarise complex research ideas to a professional audience in written form. Acquire and summarise in-depth knowledge and understanding of key physics phenomena underpinning the development of advanced 'nano' techniques research. Appraise and advise on the suitability of different nanofabriacation and nanomanipulation techniques for the solution of a specific problem. Appreciate the benefits and drawbacks associated with consumer products based on nanomaterials.		Produce an in-depth investigation on a particular topic identifying or designing the best methodology with which to approach a given physics problem.		
				By working on (and if applicable, assessed through)	Engaging with lecture and problem class material. Formal examination.	Participating in problem classes.	Completing an independent research-based assignment for formal assessment.	Completing formally examined written assignment.		Completing formally examined written assignment.		

Stage 4	Biophysics	20	Option	Progress towards PLO	Creatively adapt and apply core and advanced physics concepts to new situations.		Solve complex problems, partly working in a group within a small-group teaching environment.	Appreciate that physical principles are used to solve familiar and unfamilar problems related to biological systems. Communicate how a physics approach can be immensely powerful to solving problems from disparate fields of research.				
				By working on (and if applicable, assessed through)	Regular independent assignments, engaging with lecture material. Formal examination.		Working in groups in problem classes.	Engaging with teaching materials and working in groups to discuss problems				
Stage 4	Adv and Further Quantum Mechanics	20	Option	Progress towards PLO	Creatively adapt and apply core and advanced physics concepts to new situations.		Solve complex problems independently and during interactive problem classes.	Articulate the central importance and immense power of quantum mechanics. Understand and utilise the concepts of QM when discussing physical measurements and their reproducibility and accuracy.				
				By working on (and if applicable, assessed through)	Regular independent assignments, engaging with lecture material. Formal examination.		Working in groups in problem classes.	Engaging with teaching materials.				
Stage 4	Light and Matter	20	Option	Progress towards PLO	Develop expert knowledge and high-level understanding of semiconductors, lasers and light-matter interactions and their application to specific complex real-world physics problems		Develop expert knowledge and high-level understanding of semiconductors and their application to specific complex real-world physics problems	Articulate the behaviour of semiconductors, lasers and light matter interactions and the limitations of the approaches used.				
				By working on (and if applicable, assessed through)	Engaging with lecture and problem class material. Formal examination.		Working in groups in problem classes.	Engaging with teaching materials	.			
Stage	**Module**	**Credit**	**Core/ Option**		**Programme Learning Outcomes**							
					PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6 Ph**	**PLO6 AP**	**PLO6 TP**
					Apply to assess and evaluate problems, providing solutions through the application of physics and mathematics knowledge and techniques.	**Construct and execute a scientific investigation using the principles of physics in investigating a hypothesis, and interpret outcomes.**	**Communicate the integration and inter-relation of core physics, present sophisticated concepts and defend outcomes of physical studies succinctly in both written and oral formats to audiences in a logical way.**	**Interact and collaborate effectively within groups applying core physics themes and concepts to open-ended problems.**	**Use of appropriate digital technologies in data handling and understand the wider applications of these techniques in quantitative science.**	**Discriminate between modern experimental and measurement methods and the limitations imposed by assessment of systematic and random errors in the experimental design and execution.**	**Discriminate between modern astrophysics methods and articulate limitations imposed on understanding by assessing systematic and random errors in the interpretation of results.**	**Integrate a range of analytical, computational methods and the appropriate methodology to construct models of physical phenomena.**

Stage 3	BSc Project incorporating Prof Skills (Core BSc)	40	Core	Progress towards PLO	Use physics knowledge and understanding to pursue a (group) scientific investigation of independent choice.	Plan and execute a complex scientific investigation, including understanding the context of the problem by accessing current literature and using appropriate techniques.	Work effectively as part of a group to plan and execute a solution to an extended and open-ended physical problem.	Concisely and clearly communicate the background to and results of an extended research-style scientific investigation orally to peers in a large group, examiners in a viva-style examination, and in formal dissertation writeup. Keep accurate record of all experimental and theoretical work to accepted standards. Articulate how working on a specific physics problem provides experience and expertise that can be applied to broader range of situations.	Apply previously learned and new digital approaches and techniques to unfamiliar problems, and understand that a digital approach can be useful beyond the bounds of pure physics.	Select and apply as appropriate a range of appropriate experimental and analytical tools, techniques, and methodologies to make experimental measurements while minimising systematic and random errors as part of a larger research project, and make critical judgements on the effects of these techniques upon the quality and fidelity of the final result.	Select and apply as appropriate a range of appropriate experimental and analytical tools, techniques, and methodologies to make experimental measurements while minimising systematic and random errors as part of a larger research project, and make critical judgements on the effects of these techniques upon the quality and fidelity of the final result.	Select and apply as appropriate a range of appropriate theoretical and analytical tools, techniques, and methodologies to make theoretical predictions while minimising systematic and random errors as part of a larger research project, and make critical judgements on the effects of these techniques upon the quality and fidelity of the final result.
				By working on (and if applicable, assessed through)	Completion of the BSc Project work, examined through formal report, assessment of project lab book, and oral (viva-style) exam.	Planning, managing and executing the project work with support from project supervisors where appropriate	Working as a group to achieve a common goal and reviewing and assessing current literature on your topic.	Presenting a group oral presentation at the BSc project conference, individual oral viva-style defence and examination, formal written dissertation, examination of laboratory notebook.	Engaging with BSc project work and exploring the digital approaches that can advance the project.	Planning, executing and evaluating project work with support from project supervisors where appropriate.	Planning, executing and evaluating project work with support from project supervisors where appropriate.	Planning, executing and evaluating project work with support from project supervisors where appropriate.
Stage 3	Advanced Exp/Astro/Comp Lab (Core MPhys)	20	Core	Progress towards PLO	Experience how appropriate design and methodologies lead to reliable and repeatable scientific investigations. Experience and elucidate how the changing of parameters on a physical system can lead to different qualitative and quantitative outcomes.	Investigate an area of experimental or computational physics in a systematic way using appropriate experimental or computational techniques. Search and review the scientific literature to understand current approaches the problems addressed in the labs.	Collaborate effectlively with partners and, where applicable, interact with other groups and staff in the course of extended, complex experiments.	Reporting on a research strength of the department through an essay and press release. Communicate complex experimental outcomes in a formal written report, and record accurately all experimental activity in an accepted form.	Adapt and apply appropriate research-level compter-based techniques for data analysis, equation solving and/or simulation	Creatively select and apply as appropriate a wide range of appropriate advanced experimental and analytical tools, techniques, and methodologies to make specific experimental measurements, and make critical judgements on the effects of these techniques upon the quality and fidelity of the final result. This will feed directly into MPhys project work.	Creatively select and apply as appropriate a wide range of appropriate advanced experimental and analytical tools, techniques, and methodologies to make specific experimental measurements, and make critical judgements on the effects of these techniques upon the quality and fidelity of the final result. This will feed directly into MPhys project work.	Creatively select and apply as appropriate a wide range of appropriate advanced theoretical and analytical tools, techniques, and methodologies to make specific predictions, and make critical judgements on the effects of these techniques upon the quality and fidelity of the final result. This will feed directly into MPhys project work.
				By working on (and if applicable, assessed through)	Engagement with practical or computational experiments and the analysis of measurements	Completing open-ended experimental or computational activities in laboratory sessions.	Working in pairs on complex experiments, often using research-grade equipment, consulting scientific literature when necessary.	Assessed essay and press release. Engage in a thorough literature survey, summarise and report on the oucomes of the survey. Formal assessed dissertation and assessed laboratory notebooks.	Engaging with the experimental work and underlying theory of experiments carried out in laboratory sessions.	Completing open-ended experimental activities, assessed through laboratory notebooks and formal written reports.	Completing open-ended experimental activities, assessed through laboratory notebooks and formal written reports.	Completing open-ended theoretical activities, assessed through laboratory notebooks and formal written reports.

Stage 3	Statistical Mechanics and Solid State II	20	Core	Progress towards PLO	Understand the underlying energy distribution of systems containing many particles. Understand the different models involved describing the electron-electron and electron-lattice interactions in solids.							
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), independent supported problem solving in problem classes, engaging with lecture material, formal examination.							
Stage 3	Quantum Physics III (core MPhys)	20	Option	Progress towards PLO	Adapt and apply the tools of quantum mechanics to build and test foundational models of atomic and nuclear systems. Interpret modern atomic and nuclear data in terms of sub-atomic phenomena.	Design experiment using specific observables to identify specific phenomena	Take a collaborative approach to solving problems in quantum mechanics, and achieve a deeper understanding of advanced concepts in nuclear physics through discussion with peers.	Articulate the central importance of quantum mechanics to modern physics and the application of nuclear physics to society.				
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), independent supported problem solving in problem classes, engaging with lecture material, formal examination.	Analysis of nuclear data in lectures and problem classes, identification of key observables	Engaging with the group-work aspect of problem classes.	Enagaging with lecture materials and some problem questions				
Stage 3	Intro Plasma Sci & Tech and Stellar Physics	20	Option	Progress towards PLO	Adapt and apply concepts and techniques to independently solve increasingly complex problems in plasma and stellar physics			Learn and be able to describe key plasma physics and behaviour, including plasma fusion. Understand the relevence of plasma science to matters of clean energy and energy security. Appreciate how plasma physics can aid in the understanding and interpretation of astrophysical systems. Understand the wider implications of plasma fusion.				
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), independent supported problem solving in problem classes, engaging with lecture material, formal examination.			Engaging with teaching materials, formal examination.				

Stage 3	Galaxies and the interstellar medium and Cosmology (Core AP)	20	Option	Progress towards PLO	Adapt and apply experimental techniques to solve a wide range of astrophysical problems and explain astrophysical phenomena		Discuss with others to develop routes to solutions of complex problems associated with the ISM and cosmology.	Discuss how the principles of astrophysical research are applicable to a range of physics problems.		Explore and understand the strengths and limitations of a physics approach to the interpretation of astronomical data. Use this understanding to analyse real and simulated data and discuss the results.	Explore and understand the strengths and limitations of a physics approach to the interpretation of astronomical data. Use this understanding to analyse real and simulated data and discuss the results.	n/a
				By working on (and if applicable, assessed through)	Participating in workshops with extended data analysis problems, formal examination.		Participating in problem classes/workshops - space for individual, paired and group work.	Participatingin problem classes/workshops - space for individual, paired and group work.		Participating in workshops in analysing real and simulated astronomical data from a range of different sources.	Participating in workshops in analysing real and simulated astronomical data from a range of different sources.	n/a
Stage 3	Computational and Math Techniques II (Core TP ONLY - Not an Option for any other stream)	20	Core	Progress towards PLO	Independently adapt and apply computational and mathematical techniques to solve complex physical problems.	Plan and implement complex scientific investigations using principles of computational physics		Present results of an independent computational investigation accurately and precisely for a target audience of physicists.	Implement an algorithm for simulating molecular behaviour based upon physical principles, and appraise how the results of such simulations can have applications in a variety of contexts.	Plan and execute a theoretical investigation drawing upon a range of techniques and approaches, and evaluate the correctness and limitations of computational methods.	n/a	Plan and execute a theoretical investigation drawing upon a range of techniques and approaches, and evaluate the correctness and limitations of computational methods.
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), engaging with lecture material, large independent assignment, formal examination.	Writing computer programs		Writing a formal research report for the molecular simulation component of the module.	Engaging with teaching materians, writing formal summative report.	Using computer programs to investigate physical systems, both in supported practical computer lab sessions and in independent assignments for assessment.	n/a	Using computer programs to investigate physical systems, both in supported practical computer lab sessions and in independent assignments for assessment.
Stage 3	Relativity and Particle Physics	20	Option	Progress towards PLO	Adapt and apply the principles of relativistic and non-relativistic quantum physics to describe and predict the behaviour of fundamental particles.			Understand and articulate the current state of knowledge about a particular aspect of a topic covered in lectures. Conduct a literature review on an area of the course chosen from a list, presenting and evaluating information from a range of research papers in a succinct and readable written form. This is good preparation for MPhys project work (MPhys students only).				
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), independent supported problem solving in problem classes, engaging with lecture material, formal examination.			Writing literature review/essay for summative assessment.				

Stage 3	Nanoscale and Magnetism	20	Option	Progress towards PLO	Adapt and apply core and more advanced physics concepts to new and familiar situations. Compare the suitability of differing measurement techniques for different types of sample/measurement.	Understand the origin of contrast and resolution, and hence be able to design an appropriate scientific investigation on the relevant length scales and beyond.		Describe and evaluate concepts in magnetism and measurement techniques clearly, quantitatively, and succinctly for a scientific audience. Understand the uses of nanoscale analysis techinques throughout a range of fields of physics and beyond.		Discriminate between and appropriately select techniques for both imaging and magnetic measurement.	Discriminate between and appropriately select techniques for both imaging and magnetic measurement. While many of the techniques are not directly applicable to astrophysics study, many of the principles of understanding limitations and errors and interpretation remain the same.	
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), engaging with lecture material, formal examination, open-book magnetism assignment.	Interpreting images from different microscopy techniques and calculating the associated errors. Discussing different magnetic measurement techniques in lectures. Assessed in essay format.		Open-book, independent assignments, writing for a scientific audience. Researching and writing solutions to an open-book summative assignment.		Interpreting images from different microscopy techniques and calculating the associated errors. Discussing different magnetic measurement techniques in lectures. Assessed in essay format.	Interpreting images from different microscopy techniques and calculating the associated errors. Discussing different magnetic measurement techniques in lectures. Assessed in essay format.	
Stage 3	Advanced Theoretical Physics and Intro to Quantum Computing	20	Option	Progress towards PLO	Adapt and apply sophisticated theoretical and mathematical tools, including quantum algorithms, integral and general linear transformations, to solve unseen problems across many fields of physics.		Understand and be able to apply key mathematical techniques for theoretical and mathematical physics to a range of increasingly complex physical problems.		Exploit the links between quantum mechanics and quantum computing to understand the potential benefits of quantum computing when applied to certain mathematical and physical problems.			
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), independent supported problem solving in problem classes, engaging with lecture material, formal examination.		Engaging with teaching material.		Engaging with teaching materials.			
Stage 3	Atomic Physics & Lasers and Modern Optics	20	Option	Progress towards PLO	Adapt and apply concepts and mathematics to independently solve unfamiliar problems in atomic physics, laser physics, and modern optics	Use demonstrations to show various optical phenomena, interpret the results	Use a mathmatical approach to predict the diffraction pattern for a range of foundational optical systems.	Become aware of the applications of optics in a range of scientific and consumer applications and how thse applications depend upon atomic physics/laser physics/modern optics.	Understand how modern digital image capture, analysis, and manipulation can be used to make optical measurements which would otherwise be unfeasible.			
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), independent supported problem solving in problem classes and in closed examination.	Engaging with lecture content.	Engaging with teaching material.	Engaging with teaching materials.	Engaging with teaching materials.			
Stage 2	Thermo and Solid State Physics	20	Core	Progress towards PLO	Apply and adapt a range of basic tools, models, and physical principles to evaluate physics problems of increasing complexity			Appreciate and be aware of the wider applications of thermodynamics and quantum mechnaics as topics which underpin much of modern physics.				

				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), small-group problem solving in problem classes, engaging with lecture material, formal examination.			Engaging with teaching materials				
Stage 2	Quantum Physics II	20	Core	Progress towards PLO	Use a range of mathematical tools and physical principles to evaluate physics problems of increasing complexity, and be able to articulate the real-world implications of this. Demonstrate the use of quantum mechanics for solving problems in other areas of physics and beyond.							
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), small-group problem solving in problem classes, engaging with lecture material, formal examination.							
Stage 2	Electromagnetism and Optics	20	Core	Progress towards PLO	Use a range of mathematical tools and physical principles to evaluate physics problems of increasing complexity. Understand the wide-ranging applicability of electromagnetism to solving problems from a variety of other fields of physics and beyond.							
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), small-group problem solving in problem classes, engaging with lecture material, formal examination.							
Stage 2	Mathematics II	20	Core	Progress towards PLO	Be able to select and apply a range of mathematical tools to evaluate suitable physics problems. Understand the foundational importance of mathematics in the study of physics and physical systems. Vector calculus component feeds very strongly into Stage 2 Electromagnetism and Optics (EMO).							

				By working on (and if applicable, assessed through)	Regular independent assessed assignments (PPQs), engaging with lecture material, independent suported problem-solving sessions (maths practicals), formal examination.							
Stage 2	Exp Tech with Prof Skills (Ph only)	20	Core	Progress towards PLO	Apply mathematical and physical principles to understand data acquisition and analysis problems, use this understanding to inform the development of analysis methodologies for physical systems.	Learn the nuances of advanced experimental techniques, and their interplay with appropriate experimental design and methodology, and quantify how these govern the reliability of a scientific investigation. Develop further your ability to search for information within the scientific literature.	Understand and be able to apply key techniques for experimental investigation to a wide range of experimental problems. Make use of research-level literature in groups to draw internally consistent and succinct conclusions to an open-ended problem. Make use of research-level literature to investigate a topic of choice (from a list), presenting the findings to a small group for assessment. These skills will all be crucial for BSc or MPhys projects.	Communicate results of private study clearly, succinctly and confidently to peers in an oral presentation format, collaboratively write a report drawing upon literature sources to draw definite conclusions.	Understand the benefits and uses of digital data acquisition in experimental science while being aware of the potential pitfalls (quantisation error, aliasing etc). Use digital collaboration tools to enable group research and group report writing.	Understand and discuss the applications and limitations of various experimental measurement and analysis techniques. Be able to work as a group to develop a proposed experimental approach to make a specified measurement.	n/a	n/a
				By working on (and if applicable, assessed through)	Regular independent assessed assignments (PPQs), engaging with lecture material, group research and presentation projects, formal examination.	Engaging with teaching material, engaging with academic literature.	Engaging with teaching material, contributing meaningfully to a group investigation and engaging with academic literature.	Giving a short peer-assessed and staff-assessed oral presentations, writing an assessed report as a group collaboration, and completing a group assignment and presentation on measurement systems.	Engaging with teaching materials.	Engaging with teaching material and working on group experimental measurement assignment.	n/a	n/a

Stage 2	Astrophysical Techniques & Planetary Science with Prof Skills (AP only)	20	Core	Progress towards PLO		Work independently to investigate an unfamiliar area of the subject. Develop further your ability to search for information within the scientific literature.	Understand and be able to apply key techniques for astrophysical investigation to a wide range of astrophysical problems. Make use of research-level literature either in groups or independently to draw internally consistent and succinct conclusions to an open-ended problem. Make use of research-level literature to investigate a topic of choice (from a list), presenting the findings to a small group for assessment. These skills will all be crucial for BSc or MPhys projects.	Communicate results of private study clearly, succinctly and confidently to peers in an oral presentation format, collaboratively write a report drawing upon literature sources to draw definite conclusions.	Use digital collaboration tools to enable group research and group report writing.	n/a	Carry out an investigation into an exoplanet, identifying and assessing evidence from relevant scientific literature to supplement taught material. Elucidate and justify any limitations to the conclusions drawn.	n/a
				By working on (and if applicable, assessed through)		Carry out an investigation on an exoplanet, incorporating module learning	Engaging with teaching material, contributing meaningfully to a group investigation and engaging with academic literature.	Giving short peer-assessed and staff-assessed oral presentations, and writing an assessed report as a group collaboration.	Engaging with teaching materials.	n/a	Engaging with teaching materials and scientific literature.	n/a
Stage 2	Comp & Math Techniques for TP with Prof Skills (TP only)	20	Core	Progress towards PLO	Select and use a range of mathematical and computational techniques to address problems in complex analysis and differential equations	Understand the impact of the choice of a computational or mathematical technique upon the eventual outcome of the experiment or investigation. Develop further your ability to search for information within the scientific literature.	Understand and be able to apply key techniques for theoretical and mathematical physics to a range of idealised physical problems. Make use of research-level literature both in groups or independently to draw internally consistent and succinct conclusions to an open-ended problem. Make use of research-level literature to investigate a topic of choice (from a list), presenting the findings to a small group for assessment. These skills will all be crucial for BSc or MPhys projects.	Communicate results of private study clearly, succinctly and confidently to peers in an oral presentation format, collaboratively write a report drawing upon literature sources to draw definite conclusions.	Select and use a range of mathematical and computational techniques to address problems in complex analysis and differential equations Articulate how computational, analytical, and digital problem-solving skills are useful in business and wider society Use digital collaboration tools to enable group research and group report writing.	n/a	n/a	Develop a deeper knowledge of a selection of mathematical and computational techniques, including understanding their ranges of applicability, and their limitations.

				By working on (and if applicable, assessed through)	Engaging with lecture material, regular independent assignments (PPQs), small-group problem solving in problem classes, tailored small-group sessions (tutorials), formal examination.	Engaging with teaching material.	Engaging with teaching material, contributing meaningfully to a group investigation and engaging with academic literature.	Short peer-assessed and staff-assessed oral presentations, and an assessed report written as a group collaboration.	Engaging with teaching materials, writing a practice CV, pro forma, and application letter; all for assessment.	n/a	n/a	Engaging with teaching materials.
Stage 2	Stage 2 Lab (Exp lab, Exp lab with Astrozone, Comp lab	20	Core	Progress towards PLO	Apply content from lectures modules to conceptually challenging practical situations, while understanding how the choice of methodology and tools governs the reliability of the scientific data collected. TP - Understand the concept of numerical simulation and use idealised simulations to solve physical problems while accepting the limits of numerical simulation.	Ph - Execute longer and more nuanced experimental investigations Comp + AP - develop and run a numerical code to solve real problems	Ph - Work effectively with another student on longer and more involved investigations to achieve a specified result. This is preparation for BSc projects (BSc students) and Stage 3 advanced laboratory (MPhys students) AP - Work effectively with another student on longer and more involved investigations to achieve a specified result. This is preparation for BSc projects (BSc students) and Stage 3 advanced experimental astrophysics (MPhys students) TP - Work independently on longer and more involved computational investigations to achieve a specified result. This is preparation for BSc projects (BSc students) and Stage 3 advanced computational laboratory.	Keep lab book to an accepted and well-defined standard capturing an accurate and comprehensive account of methodologies and results, and effectively communicate results and ideas via formal reports. This is good preparation for the more extended and independent work in Stage 3, in BSc projects (BSc students) or in advanced experimental laboratory (MPhys students).	Ph, AP: Proficiently use digital tools, both computer-based (eg LabView, Cassylab) and integrated digital systems (eg digital oscilloscopes) to acquire and analyse experimental data. Use digital data manipulation to interpret and present data in graphical form to publishable standards. TP: Learn and apply some more advanced principles and techniques of computational physics. Use digital data manipulation to interpret and present data in graphical form to publishable standards.	Understand and discuss the implications and limitations of various experimental approaches, with an emphasis on errors	Understand and discuss the limitations of experiments and where significant errors arise. Propose improvements for experimental techniques.	Understand and discuss the limitations of simulations and where significant errors arise. Propose improvements for theoretical techniques.
				By working on (and if applicable, assessed through)	Engaging with the underlying theory of experiments carried out. Working in pairs on experiments with pre-defined outputs. Independently writing formal reports for assessment. TP - Working individually on numerical computation problems.	Conducting lab experiments, writing a formal report; practicals	Ph, AP - Working in pairs and independently to effectively conduct practical work. TP - Working independently to effectively conduct computational investigations.	Writing a formal scientific report, lab book record-keeping for assessment.	Practical, hands-on engagement with methodologies and underlying principles of both experimental and computational investigations.	Discussion of experiment in assessed laboratory notebooks, discussion in formal reports.	Discussion of experiment in assessed laboratory notebooks, discussion in formal reports.	Discussion of experiment in assessed laboratory notebooks, discussion in formal reports.
Stage 1	Intro to Thermal and QP	20	Core	Progress towards PLO	Solve foundational numerical problems by application of relevant mathematical and physical principles	Gain an understanding of the core importance of quantum mechnics to the science of measurement.						

				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), small-group problem solving in problem classes, tailored small-group sessions (tutorials), formal examination.	Engaging with teaching materials and links to other modules.						
Stage 1	Newt and Rel Mech	20	Core	Progress towards PLO	Understand, discuss, and apply central concepts of classical and relativistic mechanics to solve unseen problems.	Understand the use of a mathematical framework to support the solution of physical problems.				Testing relativity requires sophisticated experimental design, and there is still active research attempting to determine the limits of its applicability. This can form a good base upon which students can develop their own experimental design skills later in the course.	Testing relativity requires sophisticated experimental design, and there is still active research attempting to determine the limits of its applicability. This can form a good base upon which students can develop their own experimental design skills later in the course.	
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), small-group problem solving in problem classes, tailored small-group sessions (tutorials), formal examination.	Engaging with teaching materials.				Engaging with teaching material.	Engaging with teaching material.	
Stage 1	EM, Waves and Optics	20	Core	Progress towards PLO	Apply problem solving techniques and apply them to weekly problems in an independent way.	Understand that wave mechanics can be used to understand parts of other larger problems beyond those taught explicitly in the course.						
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), small-group problem solving in problem classes, examples given in lectures, tailored small-group sessions (tutorials) formal examination.	Engaging with teaching materials.						
Stage 1	Mathematics I	20	Core	Progress towards PLO	Being able to inspect and understand the meaning of an equation and apply it in familiar contexts.	Learn foundational mathematical tools in order to be able to carry out valid scientific investigations and draw valid scientific conclusions			Learn the mathematics behind many theoretical and computational techniques; these will be introduced in subsequent modules.	Understand the mathematical basis of common physical systems and measurement errors and be able to discuss these in relation to idealised experiments.	Understand the mathematical basis of common physical systems and measurement errors and be able to discuss these in relation to idealised experiments.	Understand the mathematical basis of common physical systems and measurement errors and be able to discuss these in relation to idealised experiments.
				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), small-group problem solving in problem classes, examples given in lectures, tailored small-group sessions (tutorials) formal examination.	Engaging with teaching materials.			Engaging with teaching materials, looking at idealised applications of foundational mathematical principles.	Engaging with teaching materials.	Engaging with teaching materials.	Engaging with teaching materials.

Stage 1	Laboratory (Exp, w/ Astro project, w/ programming	20	Core	Progress towards PLO	Apply content from lecture modules to practical situations	Ph - Execute straightforward, well-defined, and structured experimental investigations Comp + AP - Execute straightforward, well-defined, and structured computational investigations	Ph, AP - Working with another student using a predefined methodology to achieve a specified result. This is preparation for longer and more complex experiments in later years. TP - Working independently using a predefined methodology to achieve a specified result. This is preparation for longer and more complex computational experiments in later years.	Keep an accurate record of methodologies and results in lab books, communicate results of a core experiment via formal report.	Use professional data analysis and plotting tools to visualise, interpret, and present scientific data. Comp + AP - Plan and execute investigations using numerical computational techniques and coding skills.	**Become familiar with the use, application, and limitations of foundational experimental techniques.**	Become familiar with the use, application, and limitations of foundational experimental techniques.	Become familiar with the use, application, and limitations of foundational theoretical techniques.
				By working on (and if applicable, assessed through)	Working in pairs on experiments with closely-defined outputs. Independently writing formal reports for assessment.	Ph - Working in pairs and following instructions to carry out an experiment and interpret data to arrive at a verifiable result. TP - Working independently following instructions to carry out a theoretical investigation and interpret data to arrive at a verifiable result.	Ph, AP - Working in pairs to effectively conduct practical work. TP - Working independently to conduct computational investigations.	Writing a formal scientific report, lab book record-keeping for assessment.	Engaging with teaching materials, applying taught methodologies to new datasets collected experimentally and theoretically.	Working on well-defined experiments covering a range of different experimental approaches and fields of study.	Working on well-defined experiments covering a range of different experimental approaches and fields of study.	Working on well-defined theoretical tasks covering a range of different approaches and fields of study.
Stage 1	Math Modelling with Prof Skills (TP core)	20	Option	Progress towards PLO	Apply a variety of mathematical techniques to solve physical problems	In both experimental and computational laboratories, solve a variety of simplified problems and interpret the results. Understand the importance of searching and using information from the scientific literature in making informed conclusions.	Working with another student using a predefined methodology to achieve a specified result. This is preparation for longer and more complex experiments in later years.	In laboratories, keep an accurate record of methodologies and results in lab books, communicate results of a core experiment via formal report. In the mini conference, orally present and discuss an area of physics with peers with an aim to enthuse and inspire one another.	Learn the basics of Wolfram Alpha (a programmatic mathematics package) and use it to solve a range of both numeric and mathematical problems that would be intractible by hand. Understand the limitations of such approaches. Learn the basis of programming in Python, including 3D visualisation, modelling of idealised physical systems, and numerical approximation. Understand the limitations of numerical approaches to problem solving. Compare different computational approaches to solving the same problem.	Understand the application of statistics to experimental design, data analysis and interpretation. Become familiar with foundational experimental techniques.	n/a	Understand some foundational principles of theoretical physics and theoretical methodologies. This will feed in to later modules.

				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs) and small-group problem solving in problem classes, supported computational assignments (in python), formal examination.	Working in pairs and following instructions to carry out an experiment and interpret data to arrive at a verifiable result	Working in pairs to effectively conduct practical work in experimental laboratory.	Writing a formal scientific report, lab book record-keeping for assessment, presenting at mini-conference.	Engaging with teaching materials, participating in computational lab sessions, completing independent and supported assignments for assessment.	Participating in workshops on experimental techniques, practical laboratory sessions.	n/a	Engaging with teaching materials.
Stage 1	Mapping the Universe with Prof skills (AP core)	20	Option	Progress towards PLO	Use astronomical theory and techniques to investigate data and draw well-reasoned conclusions	Solve a variety of simplified problems and interpret the results in both experimental and computational laboratories. Understand the importance of searching and using information from the scientific literature in making informed conclusions.	Working with another student using a predefined methodology to achieve a specified result. This is preparation for longer and more complex experiments in later years.	Labs - keep an accurate record of methodologies and results in lab books, communicate results of a core experiment via formal report. Mini conference - orally present and discuss an area of physics with peers.	Learn the basics of Wolfram Alpha (a programmatic mathematics package) and use it to solve a range of both numeric and mathematical problems that would be intractible by hand. Understand the limitations of such approaches. Learn the basis of programming in Python, including 3D visualisation, modelling of idealised physical systems, and numerical approximation. Understand the limitations of numerical approaches to problem solving. Compare different computational approaches to solving the same problem.	Understand the application of statistics to experimental design, data analysis and interpretation. Become familiar with foundational experimental techniques.	Understand the foundational principles of astrophysical observation and measurement.	n/a
				By working on (and if applicable, assessed through)	Workshops on exoplanet techniques, supported computational assignments (in python), formal examination.	Workshops on exoplanet techniques, working in pairs and following instructions to carry out an experiment and interpret data to arrive at a verifiable result.	Using published data to draw conclusions about exoplanets (exoplanet workshops), working in pairs to effectively conduct practical work in experimental laboratory.	Writing a formal scientific report, lab book record-keeping for assessment, presenting at mini-conference.	Engaging with teaching materials, participating in computational lab sessions, completing independent and supported assignments for assessment.	Participating in workshops on experimental techniques, practical laboratory sessions.	Engaging with teaching materials.	n/a
Stage 1	Human uses of energy (HUE) with Prof skills	20	Option	Progress towards PLO	Solve a variety of seen and unseen problems. Apply computational techniques to physical problems. Understand and apply general techniques for problem solving.	In both experimental and computational laboratories, solve a variety of simplified problems and interpret the results. Understand the importance of searching and using information from the scientific literature in making informed conclusions.	Working with another student using a predefined methodology to achieve a specified result. This is preparation for longer and more complex experiments in later years.	Labs - keep an accurate record of methodologies and results in lab books, communicate results of a core experiment via formal report. Mini conference - orally present and discuss an area of physics with peers.	Learn the basics of Wolfram Alpha (a programmatic mathematics package) and use it to solve a range of both numeric and mathematical problems that would be intractible by hand. Understand the limitations of such approaches. Learn the basis of programming in Python, including 3D visualisation, modelling of idealised physical systems, and numerical approximation. Understand the limitations of numerical approaches to problem solving. Compare different computational approaches to solving the same problem.	Understand the application of statistics to experimental design, data analysis, and interpretation. Become familiar with foundational experimental techniques.	n/a	n/a

				By working on (and if applicable, assessed through)	Regular independent assignments (PPQs), small-group problem-solving in problem classes, supported computational assignments (in python), formal examination.	Working in pairs and following instructions to carry out an experiment and interpret data to arrive at a verifiable result	Working in pairs to effectively conduct practical work in experimental laboratory.	Writing a formal scientific report, lab book record-keeping for assessment, presenting at mini-conference.	Engaging with teaching materials, participating in computational lab sessions, completing independent and supported assignments for assessment.	Participating in workshops on experimental techniques, practical laboratory sessions.	n/a	n/a