Curriculum Transformation Phase 1
Part 1: Information Gathering

Background information on comparator institutions: PHYSICS

Table 1 shows data from the 2015/16 Destinations of Leavers from Higher Education survey (DLHE). Full details of work and further study destinations from this cohort is provided in **Appendix 1**.

Table 1: Destinations of Full-time First Degree Graduates UK & Other EU Domicile 2015/16

CRS Course Name	Work	Work + Further Study	Further Study	Unemployed	Other	Explicit refuser	Not Responded	Total
BSc (hons) Maths & Phys	1	1	1					3
BSc (hons) Maths & Phys w Plcmt					1		1	2
BSc (hons) Phys	8		3	2	1		2	16
BSc (hons) Phys w Plcmt	13	1	2	2			5	23
BSc (hons) Phys with Comptng	1							1
BSc (hons) Phys with Comptng w Plcmt	1		1					2
BSc Phys	1							1
MPhys	8	2	9				1	20
MPhys w prof plct	2							2
MPhys with Prof & Res Plcmt	1			1				2
MPhys with Res Plcmt	3		1	1			1	6
MPhys with SYA			2					2
MSci (hons) Maths & Phys w SYA	1							1
Physics Total	**40**	**4**	**19**	**6**	**2**		**10**	**81**

Table 2: Programme groupings for a range of competitor institutions

Programme Groupings	
Institution	Programmes
Bath	Physics (with Year Abroad) BSc (Hons) Physics BSc (Hons) Physics with Placement BSc (Hons) Physics with Astrophysics BSc Physics with Astrophysics with Placement BSc Physics with Astrophysics with Study Year Abroad BSc Mathematics and Physics BSc (Hons) Mathematics and Physics (Placement) BSc (Hons) Mathematics and Physics (Placement) BSc (Hons)
Durham	Physics BSc (Hons) / MPhys Physics with Foundation BSc (Hons) Physics and Astronomy MPhys Theoretical Physics MPHys
St Andrews	Mathematics and Physics BSc (Hons) 4yr Mathematics and Physics BSc (Hons) 3yr Physics BSc (Hons) 4yr Physics BSc (Hons) Physics and Astronomy (Gateway BSc) BSc (Hons) Physics and Astronomy (International Gateway BSc) BSc (Hons) Philosophy and Physics BSc (Hons) Computer Science and Physics BSc (Hons)
Birmingham	Physics (International Study) (4 years) BSc (Hons) Physics BSc (Hons) Physics and Astrophysics (International Study) (4 years) BSc (Hons) Physics and Astrophysics BSc (Hons) Theoretical Physics BSc (Hons) Theoretical Physics and Applied Mathematics BSc (Hons) Physics with Particle Physics & Cosmology BSc (Hons)
Bristol	Chemical Physics BSc (Hons) Physics BSc (Hons) Physics with Astrophysics BSc (Hons)

	Physics with a Preliminary Year BSc (Hons) Physics and Philosophy BSc (Hons) Computer Science and Electronics BEng (Hons) Mathematics and Physics BSc (Hons)
Nottingham	Mathematical Physics BSc (Hons) Physics BSc (Hons) Physics with Astronomy BSc (Hons) Physics with European Language (4 years) BSc (Hons) Physics with Medical Physics BSc (Hons) Physics with Theoretical Astrophysics BSc (Hons) Physics with Theoretical Physics BSc (Hons) Chemistry and Molecular Physics BSc (Hons) Physics and Philosophy BSc (Hons) Physics with Nanoscience BSc (Hons)
Manchester	Physics BSc (Hons) Physics with Astrophysics BSc (Hons) Physics with Theoretical Physics BSc (Hons) Mathematics and Physics BSc (Hons) Physics with Philosophy BSc (Hons)
Imperial	Physics BSc (Hons) Physics and Music Performance BSc (Hons) Physics with Theoretical Physics BSc (Hons) Mathematics with Applied Mathematics/Mathematical Physics BSc (Hons)
Warwick	Physics BSc (Hons) Mathematics and Physics BSc (Hons) Physics and Business Studies BSc (Hons)
UCL	Mathematics and Physics BSc (Hons) Mathematics with Mathematical Physics BSc (Hons) Chemical Physics BSc (Hons) Physics BSc (Hons) Physics with Medical Physics BSc (Hons) Theoretical Physics BSc (Hons)

Table 3: Programme features for a range of competitor institutions

	Durham	St Andrews	Birmingham	Bristol	Manchester	Imperial	Warwick	UCL
Programme	Physics BSc/MPhys	Physics BSc/MPhys	Physics BSc/MSci	Physics BSc/MSci	Physics BSc/MPhys	Physics BSc/MSci	Physics BSc/MPhys	Physics BSc/MSci
Typical offer	A*A*A	AAA	AAAA-A*AA	A*AA	A*AA-A*A*A	A*A*A	A*AA	AAA
Placement/ Study Abroad	Students are encouraged to apply during their degree for a year-long placement with one of the Physics Department's or the University's international partners, either in replacement of the third year of study within an MPhys degree or as an additional year of study		MSci Physics with International Study is similar to the standard MSci Physics route at the University, except that you spend your third year abroad studying comparable material in your host institution.	You can choose to spend a year in industry working on a challenging project, or to study physics at a partner university in Europe or beyond.	There are opportunities for a limited number of students to study abroad at an English-language university in their third year, as part of their Manchester degree. The Study Abroad programme is available to MPhys and MMath&Phys students on all degree programmes.		You may also extend the BSc degree by inserting an extra year (usually) between your second and what would otherwise be your third year. During this 'intercalated' year, you would study at a foreign university or laboratory.	
Structure	At the end of the second year you need to decide your degree title, choosing between: BSc Physics (F300) MPhys Physics (F301) MPhys Physics and Astronomy (FF3N) MPhys Theoretical Physics (F344).		Year in Computer Science**:** Between your second and third year, you can choose to do a year's study in Computer Science, ideal if you expect your final career to involve a significant amount of computing.	Year one gives you a comprehensive grounding in physics and mathematics, and year two focuses on the principles of physics. Flexibility and choice are key features of a Bristol Physics degree, and you are usually able to transfer between courses in the first two years.	In Years 1 and 2, the course provides a foundation in classical physics including dynamics, waves, electromagnetism and thermodynamics. At the same time newer concepts are introduced including the unification of space and time, the meaning of wave-particle duality and the relation between entropy and disorder. This introduction is taught through course units in special relativity, quantum mechanics and statistical mechanics. These modern concepts and the techniques of classical physics lay the foundation for study in Year 3 and 4 during which you may choose from a wide range of options designed to develop your expertise in diverse topics including: atomic and molecular structure, solid state electronic devices, electro-magnetic radiation, lasers, stars and cosmology, particle and nuclear physics and the more advanced aspects of theoretical physics. Our Honours Physics course has a 'core plus option' feature, which allows you to devote 20% of your time in the first three years to topics chosen from a wide range of optional units. You can typically choose a variety of subjects from different streams to suit your interests.	All of our physics courses follow the same core curriculum for the first two years. This gives you a good grounding in physics, mathematics and experimental methods, and prepares you for advanced study in later years.	https://warwick.ac.uk/fac/sci/physics/prospective/undergraduate_study/physics_courses/courses17.pdf The option scheme also allows a proportion of modules to be taken from outside of physics. We encourage you not only to consider obvious outside modules, for example in mathematics, but also modules introducing secondary school teaching, business studies, or a modern language	This programme is offered both as a three-year BSc and a four-year MSci, with common structures and subjects for the first two years. However, the additional fourth year of the MSci programme allows for a greater depth of study and we recommend you apply for an MSci initially, as this keeps more options open.
Level 1	Foundations of Physics 1 is the main lecture module in the first year, and is complemented with a practical laboratory module, including an introduction to programming. Two mathematics modules are taken in the Department of Mathematical Sciences. There is a further module of choice, with Introduction to Astronomy proving to be very popular.	All take the Physics 2A and 2B modules, which are designed for those entering with good Advanced Highers or A-level qualifications. All take Linear Mathematics and Multivariate Calculus. Direct Entry astrophysicists take a short astrophysics module in first semester, and a second level astrophysics module in second semester.	**Semester 1:** • Quantum Mechanics 1 • Optics and Waves • Classical Mechanics and Relativity • Mathematics for Physicists 1 • Physics Laboratory 1 • Physics and Communication Skills 1 • Module Outside the Main Discipline **Semester 2:**	Physics, including special relativity, mechanics, oscillations and waves, fields, properties of matter and laboratory work Mathematics Optional third subject	Mathematics 1; Dynamics; Quantum Physics and Relativity; Introduction to Astrophysics and Cosmology; First Year Laboratory; First Year Laboratory; Vibrations and Waves; Electricity and Magnetism; Properties of Matter	**Core modules:** • Advanced Electronics • Electricity and Magnetism, Relativity • Laboratory and Computing I • Mathematics • Measurement and Uncertainty • Mechanics, Vibrations and Waves • Professional Skills and Basic Electronics I • Project	Mathematics for Physicists, Classical Mechanics and Relativity, Physics Foundations, Electricity and Magnetism, Programming Workshop, Quantum Phenomena. There is a key skills module, which everybody takes. This involves working in the teaching laboratory, as well as computing and presentation work.	**Core or compulsory module(s):** Classical Mechanics Mathematical Methods I Mathematical Methods II Physics of the Universe Practical Skills 1C Practical Skills 1P Thermal Physics Waves, Optics and Acoustics

			• Electromagnetism and Electric Circuits • Temperature and Matter • Mathematics for Physicists 1 • Physics Laboratory 1 • Module Outside the Main Discipline			• Quantum Physics and Structure of Matter		
Level 2	Core modules: • Foundations of Physics 2A/2B • Mathematical Methods in Physics • Laboratory Skills and Electronics (+programming).		**Semester 1:** • Classical Mechanics and Relativity 2 • Quantum Mechanics 2 • Particles and Nuclei and A Quantum Approach to Solids • Mathematics for Physicists 2 • Physics Laboratory 2 P • Physics and Communication Skill 2 **Semester 2:** • Electromagnetism 2 • Statistical Physics and Entropy • Mathematics for Physicists 2 • Physics Projects	Quantum mechanics, classical mechanics, cosmology, thermal physics, electromagnetism, mathematical physics, and nuclear and particle physics Practical laboratory, computing and science presentation skills.	Introduction to Quantum Mechanics; Electromagnetism; Introduction to Programming for Physicists; Mathematics of Waves and Fields; Second Year Laboratory; Amplifiers and Feedback; Professional Development (0 credits); Fundamentals of Solid State Physics; Wave Optics; Thermal and Statistical Physics	**Core modules:** • Atomic, Nuclear and Particle Physics • Electromagnetism and Optics • Laboratory and Computing II • Mathematics and Statistics of Measurement • Professional Skills II • Quantum Mechanics • Solid State Physics • Thermodynamics and Statistical Physics	Electromagnetic Theory and Optics, Mathematical Methods for Physics, Quantum Mechanics and its Applications, Thermal Physics II. You continue to work in the laboratory as part of the Physics Skills Programme. You also complete library research, data analysis and writing exercises. You choose about a further six modules (not all modules are the same length) from option lists.	**Core or compulsory module(s):** Atomic and Molecular Physics Electricity and Magnetism Mathematical Methods III Practical Physics 2A Practical Physics 2B Quantum Physics Statistical Thermodynamics
Level 3	Besides core courses in Foundations of Physics 3A/3B and Physics Problem-Solving, there is a wide choice of topics, for example in: • Planets and Cosmology • Theoretical Physics 3 • Maths Workshop • Physics into Schools • A Team Project • Laboratory Project. • A module taken in another department (subject to approval)		**Compulsory modules** • Quantum Mechanics 3 • Statistical Physics • Physics Laboratory 3 (20 credits) or Physics Laboratory 3 (10 credits) and Intro to C++ • Group Studies • General Physics	Core physics: semiconductors and magnetism, electrons in crystals, quantum physics Physics and astrophysics options might include condensed matter, nanophysics, biophysics, galaxies, high energy astrophysics, stellar structure and evolution, methods of theoretical physics.	Applications of Quantum Physics or Mathematical Fundamentals of Quantum Mechanics; Introduction to Nuclear and Particle Physics; Thermal Physics of Bose and Fermi Gases; Third Year Laboratory; Cosmology; Particle Physics; Nuclear Physics; Solid State Physics	**Core modules:** • Comprehensive Physics • Fluid Dynamics • Light and Matter • Physics Laboratory III • Physics of the Universe • Professional Skills III Current areas covered in year three include: • Astrophysics • Medical imaging • Plasma physics • Cosmology • Laser technology • X-rays and ultrasound • Nuclear diagnostics and MRI	Quantum Physics of Atoms, Electrodynamics, Mathematical Methods III. You take further modules from the options listed for the third year of the BSc but must choose at least two of Galaxies, Condensed Matter Physics, The Standard Model and Plasma Electrodynamics.	**Core or compulsory module(s):** Electromagnetic Theory Experimental Physics Group Project Nuclear and Particle Physics Quantum Mechanics Solid State Physics
Level 4	Optional lecture course topics have in the past included: advanced and theoretical astrophysics (including general relativity and galaxy formation), biological and nanophysics, laser physics, advanced quantum physics and particle physics.	Those who do sufficiently well in levels two and three are given the option of carrying on their studies beyond level four for an additional year to obtain the integrated masters MPhys degree, which is a more advanced first degree than the BSc degree.	50 credits of the final MSci year is given over to a major research project. The remaining 70 credits are taken up by a wide range of advanced options which you can tailor to your interest	Final-year research project Current topics *or* student seminar and computational physics.		This course allows you to build on the BSc curriculum by completing an integrated year of study at **Master's level**, including a module preparing you for the research environment. **Core modules:** • MSci Project • Research Interfaces	During the fourth year, you join one of the research groups in the department (experimental or theoretical) and work in pairs on a research project You will also take around twelve (not all modules are the same length) modules with at least eight chosen from the list of physics modules	Physics Project
Dissertation/ Major Project	Research Project: Students will meet with a research supervisor for typically an hour per week during term-time, and depending on the project (laboratory based or theoretical) may be working in the department for an additional 12-15 hours per week.	All final year students undertake a major experimental or theoretical project, which is often associated with the research interests of the School.	50 credit research project	In your final year you will undertake a major project or dissertation, working in a research group with a member of staff. Our students' final-year projects address questions at the frontiers of our research fields, and the most successful have been published in scientific journals.	In the fourth year of this MPhys course, you will tackle two projects; one in each semester. We usually offer a choice of more than 50 fourth-year projects, and in previous years they have included topics such as simulating the human heart, the optical properties of graphene, quantum chaos, and calibration of the jet energy scales at the Large Hadron Collider.	All our courses include a substantial final-year project, usually within one of our research groups.	45 credit project	

Professional skills/accreditation	Institute of Physics		Institute of Physics	Institute of Physics Juno status in recognition of our contribution to the representation of women in physics. We are also proud holders of an Athena SWAN bronze award.	Institute of Physics	Institute of Physics Associateship of the Royal College of Science (ARCS) on completion of this course		Institute of Physics
Key resources		University Observatory - the largest operational optical telescope in the UK. Although the School is relatively small, the nearly 40 academic staff work with a further about 60 research staff and about 80 PhD research students [2014]		Within the beautiful, Gothic architecture of the Physics Building are exceptional modern facilities including state-of-the-art teaching labs, a dedicated physics library, well-equipped lecture theatres and a six-metre radio telescope, integral to our astrophysics teaching and research.	The School of Physics and Astronomy is housed across two buildings on south Campus, the Schuster building and the Alan Turing building; and the Jodrell Bank Observatory in North Cheshire, about 30 km (20 miles) south of campus.			
Teaching & Learning	In the first year, students typically attend 12 hours a week of lectures, one three-hour laboratory session per week, one one-hour Physics tutorial each week and two one-hour Mathematics tutorials. A similar balance holds in the second year, although with a change from tutorials to module-specific workshops. In the workshops, typically three supervisors circulate among typically 50 students to provide support. By the end of the second year, students will have covered the vast majority of the material specified in the Institute of Physics 'Core of Physics', required for any accredited Physics degree, allowing them considerable flexibility in the choices for the remainder of their degree.	Some of the above programmes contain a substantial amount of choice of modules. Practical work is provided for astrophysics and experimental physics students, and optionally for theoreticians. Small group and whole-class tutorials allow for further discussion and exploration of the science. A module on transferable skills provides additional development in communication, research, and team skills. The relatively small size of the School means that there can be real interaction between students and staff. For example, in second year physics classes weekly tutorials consist of four or five students with one tutor. Lecture classes are also relatively small, ranging from about 150 students down to groups of just a few. Well-equipped teaching-laboratories and the observatory allow students to explore their science. The teaching staff are proud to have the reputation of being accessible to students, and enjoy explaining the excitement of physics and astronomy to their students.	Throughout your Physics programmes you can expect an average of about 20 hours of contact time per week comprising of lectures, laboratory based activity and tutorials. In your first year, the course is delivered as lectures, small group workshops, laboratories, computer-based activities, enquiry-based learning and tutorials. Much of your learning will be carried out in small groups, including laboratory work, examples classes, and tutorials. There's a strong emphasis on project work throughout your degree, especially in your final year. During your first year you will undergo a formal 'transition' review to see how you are getting on and whether there are particular areas where you need support. This is in addition to your tutor who is based in Physics and can help with any academic issues you encounter.	Your degree will include large lectures, individual computational work and laboratory work in pairs. Smaller group activities include tutorials, workshops and problem classes which help to consolidate your learning. In addition to your degree you can get involved in communicating science via Discover Science days and school visits.		Practical work is an important part of the Physics curriculum at Imperial, and you will have access to state-of-the-art facilities as well as data collected from major experiments such as CERN. You will take laboratory classes to equip you with a wide range of skills such as using apparatus, conducting experiments, interpreting data, and presenting your results. You will also gain a solid understanding of how to use computers as tools to help model and understand the physics of complicated phenomena. This includes using computers to make advanced calculations and analyse data, and how to use the programming language Python.	We have research strengths in a number of branches of physics, and can offer authoritative and coherent accounts of those recent developments likely to be of most interest to you. In the third and fourth years, you will benefit from interacting with our research groups when you undertake research-style projects.	Teaching is delivered through lectures, laboratory (and as appropriate, observatory) practical sessions, and supervised problem-solving tutorials. These tutorials are designed to deal with lecture-based questions, enlarge on topics addressed in lectures, and allow clarification and in-depth discussion of new concepts.
Assessment			Each module is assessed independently with most containing some components of continuous assessment. Typically, year one and two lecture modules contain 20% continuous assessment in the form of weekly problem sheets. Some modules are completely assessed by coursework. Assessment methods include end-of-year examinations in May and June, written assignments, oral and poster presentations, computer-based tests, and laboratory and project reports.	Assessment is by written examinations, assignments and written reports and interviews for computational and lab work.	Course units are normally assessed formally at the end of the semester via examinations. Laboratory or computer based course units also employ assignments and other methods of continuous assessment.			Assessment will normally involve end-of-year examinations, and an element of assessed coursework. Practical work will be continuously assessed.

Employability	85% are in employment or further study six months after graduating Of those in employment: • 97% of those are in graduate level employment • Median salary £26,766		94% of our graduates are in graduate-level employment or further study six months after graduation	Around half of our MSci graduates pursue a higher degree in physics or related disciplines leading to careers in research and teaching.	More than two-thirds of graduates make direct use of their knowledge of physics and obtain scientific, technical and computing jobs or go on to postgraduate research. Others go into the commercial, financial and business sectors where they pursue careers in areas such as management, accountancy and marketing where analytical and technical skills developed during the course are highly valued.	Industry Club, which brings a number of direct benefits including supporting a third-year exchange programme with MIT (USA) and an annual recruitment fair.		Around half our graduates choose to pursue further study for an MSc or PhD.