Contents

Inside Physics at Liverpool 01
Why choose Physics at Liverpool? 02
Example student timetable 05
Invest in your future 06
Degrees 08
Module details 22
Inside Physics at Liverpool

LHCb VELO modules at the Science Museum, London
The LHCb experiment is one of four of the experiments at the Large Hadron Collider. The detector closest to the proton-proton interactions is called the Vertex Locator (or VELO) and was designed and built in Liverpool. The detector is a critical part of several hundred world’s best physics measurements of the subtle effects of matter/anti-matter differences and the heavy b quark decays.

Liverpool built more modules than were installed, as not all pass the rigorous quality control. The ones that were not used in the detector have been around the world, as part of the ‘collider’ tour produced by the Science Museum, London and have been seen by more than half a million people in five countries, finishing in Australia.

The Science Museum has accepted the VELO modules into their permanent collection, as one of the best example of the design, engineering and manufacture of a precision detector. It is also very beautiful, which was not a design requirement as the detector is in a steel vacuum vessel 100m under the French countryside.

Using tofu to make solar panels more cheaply
The chemical used to make tofu and bath salts could replace a highly toxic and expensive substance used to make solar cells.

Cadmium chloride is currently a key ingredient in solar cell technology used in millions of solar panels around the world. This soluble compound is highly toxic and expensive to produce, requiring elaborate safety measures to protect workers during manufacture and then specialist disposal when panels are no longer needed.

Now, a University of Liverpool researcher has found that it can be replaced with magnesium chloride, which is extracted from seawater and is already used in products such as tofu, bath salts and for de-icing roads.

Safe and at a fraction of the cost – $1,000 per tonne compared to $300,000 – it has also been shown, in the study, to be as effective as the expensive and toxic alternative.
Why choose Physics at Liverpool?

We are one of the UK’s leading physics departments, with a history of discovery that goes back over 130 years. We are internationally renowned for our work in particle physics, nuclear physics, condensed matter physics and accelerator physics and, as a student, you will be immersed in our research environment from the start.
Create a degree to suit you
In each of the programmes you will explore and apply fundamental principles that underpin modern physics. From electrodynamics and semiconductors to the startling conclusions of relativity and quantum mechanics. You can tailor your course to reflect your ambitions, with degree options ranging from Astrophysics to Nuclear Science, including four-year MPhys or three-year BSc courses. We realise that you may still be deciding which aspects of physics are of the most interest to you. Our programmes are designed to be flexible and allow the transfer of students up to the end of Year Two between any of the physics programmes. All of our degrees are informed by the research we do and taught by world experts in their fields.

Be part of a supportive community working together to do great science
Our open-door approach enables us to offer you a friendly and supportive learning environment.

Prepare for your professional career
All of our BSc and MPhys programmes are accredited by the Institute of Physics. Both the Physics with Nuclear Science and Physics with Radiation Protection courses are designed to provide skill sets necessary for the growing industrial and environmental careers related to nuclear science. The Physics with Medical Applications course is designed for those looking to work within the health care area. The skills developed in all physics courses can be applied in many careers and you will have many options after graduating.

Be at the forefront of modern physics
Our internationally renowned academics carry out, and often lead, research on three continents using state-of-the-art instruments developed and built in the Department. Working alongside them there are opportunities to carry out projects at the LHC at CERN and in many international and national research centres in the USA, Canada, Japan, Korea and many European countries.

Good to know:

86
Year One undergraduates in 2016

93%
of our students are employed or in further study within six months of graduating
(Destination of Leavers from Higher Education 2015/16)

98%
of the students found their programme “intellectually stimulating” (NSS 2016)

Offers study abroad opportunities

Offers a Year in China
Learn in our award-winning facilities

Our facilities are second to none; in particular our £23 million state-of-the-art Central Teaching Laboratories have transformed the way in which physical sciences are taught at the University. We also offer spacious, well-equipped research laboratories, a new projects laboratory and a powerful supercomputer. In-house facilities include the Materials Innovation Facility (opened in 2017), Liverpool Semiconductor Detector centre, the Stephenson Institute for Renewable Energy, Cockcroft Institute of Accelerator Science and Technology, the Surface Science Research centre and both nuclear instrumentation and magnetism laboratories.

How you learn

Our research-led teaching ensures you are taught the latest advances in cutting-edge physics research. Lectures introduce and provide the details of the various areas of physics and related subjects. You will be working in tutorials and problem-solving workshops, which are another crucial element in the learning process, where you put your knowledge into practice. They help you to develop a working knowledge and understanding of physics. All of the lecturers also perform world class research and use this to enhance their teaching.

Most work takes place in small groups with a tutor or in a larger class where staff provide help as needed. Practical work is an integral part of the programmes, and ranges from training in basic laboratory skills in the first two years to a research project in the third or fourth year. You will undertake an extended project on a research topic with a member of staff who will mentor you. By the end of the degree you will be well prepared to tackle problems in any area and present yourself and your work both in writing and in person. In the first two years students take maths modules which provide the support all students need to understand the physics topics.

Study abroad

Studying abroad has huge personal and academic benefits, as well as giving you a head start in the graduate job market. Students on the four-year programmes can currently apply to one of our many worldwide partners including universities in Canada, America, Hong Kong, Australia or New Zealand. For more information visit www.liverpool.ac.uk/goabroad where all of our partner institutions are listed.

Year in China

The Year in China is the University of Liverpool’s exciting flagship programme enabling undergraduate students from a huge range of departments, including Physics, the opportunity to spend one year at our sister university Xi’an Jiaotong-Liverpool University (XJTLU), following XJTLU’s BA China Studies degree classes. See www.liverpool.ac.uk/yearinchina for more information.

I’ve really enjoyed the practicals. I’ve been able to get to grips with handling the equipment and the scientific methods – and it’s good to be able to apply the things you’ve learnt in lectures when you’re hands-on in the lab. I feel like I’ve learnt enough, and developed a lot of skills to be able to apply them in later life. I’m glad I came to the University of Liverpool.

David Turner
Physics MPhys
| Time  | Monday                                      | Tuesday                                      | Wednesday                                    | Thursday                                    | Friday                                      | Saturday                                    | Sunday                                      |
|-------|---------------------------------------------|----------------------------------------------|----------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|
| 09:00 | Thermal physics problem class               | Newtonian dynamics problem class             | Maths for physicists lecture                 | Maths for physicists workshops              |                                             |                                             |                                             |
| 10:00 |                                             | Newtonian dynamics lecture                   | Practical physics laboratory session         |                                             |                                             |                                             |                                             |
| 11:00 | Library-preparation for Working with physics problem class | Working with physics lecture                 | University sports event                      |                                             |                                             | Library work on essay and assignments       |                                             |
| 12:00 | Maths for physicists lecture                |                                             | Practical physics laboratory session         |                                             |                                             |                                             |                                             |
| 13:00 | Working with physics problem class          | Working with physics lecture                 |                                             |                                             |                                             |                                             |                                             |
| 14:00 | Maths for physicists lecture                | Working with physics lecture                 | University sports event                      | Practical physics laboratory session         | Library-update laboratory workbook          |                                             |                                             |
| 15:00 | Working with physics problem class          | Maths for physicists lecture                 |                                             | Thermal physics lecture                      | Reading for following week’s lectures       |                                             |                                             |
| 16:00 |                                             |                                             |                                             |                                             |                                             |                                             |                                             |
| 17:00 |                                             |                                             |                                             |                                             |                                             |                                             |                                             |
| 18:00 | Use Astro Society telescopes to see six moons of Jupiter and Saturn’s rings on observing trip to North Wales | Guild quiz night                             |                                             |                                             |                                             |                                             |                                             |
| 19:00 |                                             |                                             |                                             |                                             |                                             |                                             |                                             |
Invest in your future

Physicists are trained to solve a wide range of problems, that’s why graduates have gone on to explore careers in diverse areas. Physics graduates are currently among those earning the highest starting salaries in the UK, according to latest figures, and our graduates enjoy excellent opportunities for careers in research, industry, computing, teaching, business and finance.

**Work experience opportunities**
For those who are studying Physics on our master’s programme (F303) there will be opportunities to carry out summer work at an international research laboratory. This typically takes place during the summer break between Year Three and Four.

The results obtained during your summer project will be brought back to Liverpool for a project report, with a member of staff as your adviser and may form the basis for a more detailed project in your fourth year. Laboratories we have a close research relationship with include TRIUMF in Vancouver, CERN in Geneva, the European Synchrotron Radiation Facility in Grenoble and the Cockcroft Institute at the Daresbury Laboratory, Warrington.

**A passion for learning: postgraduate opportunities**
The knowledge, skills and experience that our graduates develop during their degree are in high demand by employers and researchers. This means our graduates benefit from superb postgraduate study opportunities particularly in the fields of condensed matter physics, nuclear physics, particle physics, nanoscience and energy. The Department has significant achievements in research and attracts considerable research income. As a consequence, there are excellent opportunities for our undergraduates to study for research degrees and there are exceptional facilities at their disposal.

**Make yourself employable**
The skills you will develop are highly valued by employers, such as a practical approach to problem solving, strong powers of analysis, numeracy, good IT skills and the ability to communicate well. At the University of Liverpool, we ensure our students graduate with the skills employers need. Our stakeholders group, including industry leaders, advises on all relevant aspects and entrepreneurship is introduced as a key skills through project work.
Doing the final year project made me realise that I wanted to go into research, and as my project was also in Nuclear Physics I got to work closely with some members of the Nuclear Physics group. I established a good working relationship with them, which gave me the platform to make a successful application to do a PhD project. Doing a research project gave me a great insight into real research that takes place at universities. I think that this was the most valuable part of my degree because of the insight it gave me and because it was a great opportunity to learn independently and to work with an expert in the subject. What I enjoyed most about my time in Liverpool was meeting lots of like-minded people and spending time together in a great city.

Michael Lewis
Physics MPhys
# Degrees

<table>
<thead>
<tr>
<th>Degree</th>
<th>Code</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics BSc (Hons)</td>
<td>F300</td>
<td>3 years</td>
</tr>
<tr>
<td>Physics MPhys</td>
<td>F303</td>
<td>4 years</td>
</tr>
<tr>
<td>Physics with Astronomy BSc (Hons)</td>
<td>F3F5</td>
<td>3 years</td>
</tr>
<tr>
<td>Astrophysics MPhys</td>
<td>F521</td>
<td>4 years</td>
</tr>
<tr>
<td>Physics with Medical Applications BSc (Hons)</td>
<td>F350</td>
<td>3 years</td>
</tr>
<tr>
<td>Physics with Nuclear Science BSc (Hons)</td>
<td>F390</td>
<td>3 years</td>
</tr>
<tr>
<td>Physics with Radiation Protection BSc (Hons)</td>
<td>F351</td>
<td>3 years</td>
</tr>
<tr>
<td>Physics for New Technology BSc (Hons)</td>
<td>F352</td>
<td>3 years</td>
</tr>
<tr>
<td>Physics with Education MPhys</td>
<td>N/A</td>
<td>4 years</td>
</tr>
<tr>
<td>Physical Sciences entry route leading to BSc (Hons) (4-year route including a Foundation Year at Carmel College)</td>
<td>F308</td>
<td>4 (1+3) years</td>
</tr>
</tbody>
</table>

**Degrees offered with other departments**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Code</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geophysics (Physics) BSc (Hons)</td>
<td>F656</td>
<td>3 years</td>
</tr>
<tr>
<td>Geology and Geophysics MESci (Hons)</td>
<td>F641</td>
<td>4 years</td>
</tr>
<tr>
<td>Geophysics (Geology) BSc (Hons)</td>
<td>F640</td>
<td>3 years</td>
</tr>
<tr>
<td>Geophysics (North America) MESci (Hons)</td>
<td>F660</td>
<td>4 years</td>
</tr>
<tr>
<td>Mathematical Physics MMath</td>
<td>FGH1</td>
<td>4 years</td>
</tr>
<tr>
<td>Theoretical Physics MPhys</td>
<td>F344</td>
<td>4 years</td>
</tr>
<tr>
<td>Ocean Sciences (Physics pathway) BSc (Hons)</td>
<td>F700</td>
<td>3 years</td>
</tr>
<tr>
<td>Ocean Sciences (Physics pathway) MOSci (Hons)</td>
<td>F710</td>
<td>4 years</td>
</tr>
</tbody>
</table>

*Foundation programmes have flexible entry requirements.
Contact E: degree@carmel.ac.uk for details.*

See [www.liverpool.ac.uk/study/undergraduate/courses](http://www.liverpool.ac.uk/study/undergraduate/courses) for current entry requirements.

---

You get to find out answers to how the world works that most people would probably never know. What’s surprised me most about my programme is how wide-ranging it is, we’ve covered all sorts of areas of physics from relativity on the very large scale to quantum mechanics on the very small.

*Amelia Ross*

Physics BSc (Hons)
Physics BSc (Hons)  
UCAS code: F300  
Programme length: 3 years

Physics is the most fundamental of the sciences. New Concepts, such as quantum mechanics and relativity, are introduced at degree level in order to understand nature at the deepest level. These theories have profound philosophical implications because they challenge our view of the everyday world. At the same time they have a huge impact on society since they underpin the technological revolution. **While studying one of the most intellectually satisfying disciplines, you will acquire transferable skills including numeracy, problem solving and an ability to reason clearly and communicate well.**

Physics degrees are highly prized in the flexible labour market of today and our graduates have excellent career opportunities in academic research, industrial research and development, teaching, computing, business and finance.

**Programme in detail**  
Modules include: **Newtonian dynamics; Wave phenomena; The material universe; Working with physics; Practical physics; Maths for physics; Electromagnetism; Condensed matter; Quantum and atomic physics; Nuclear physics and Particle physics.**  

You will also take mathematics, computing and experimental physics modules in support of these studies. The programme includes a one-semester project in one of the research groups.

**Key modules**  
**Year One**  
Core modules  
- Foundations of modern physics  
- Mathematics for physicists I  
- Mathematics for physicists II  
- Newtonian dynamics  
- Practical physics I  
- The material universe  
- Wave phenomena  
- Working with physics I.

Selected optional modules  
- Working with medical physics I  
- Working with nuclear science I.

**Year Two**  
Core modules  
- Condensed matter physics  
- Electromagnetism  
- Mathematics for physicists III  
- Mathematics for physicists IV  
- Nuclear and particle physics  
- Practical physics II  
- Quantum and atomic physics  
- Working with physics II.

**Year Three**  
Core modules  
- Advanced electromagnetism  
- Advanced practical physics  
- Quantum mechanics and atomic physics.

Selected optional modules  
Choose one of the following modules:  
- Group physics project  
- Project (BSc)  
- Undergraduate ambassadors project.

In addition to 30 credits from the following:  
- Communicating science  
- Materials physics  
- Nuclear physics  
- Planetary physics  
- Semiconductor applications  
- Statistical and low temperature physics  
- Stellar astrophysics  
- Surface physics.

And, 30 credits from the following:  
- Accelerators and radioisotopes in medicine  
- Condensed matter physics  
- Introduction to particle physics  
- Physics of energy sources  
- Physics of life  
- Relativity and cosmology.

See pages 22-28 for module descriptions.
Physics MPhys
UCAS code: F303
Programme length: 4 years

This programme is intended for those considering a career as a professional physicist in fundamental research or industrial research and development. It covers a wider range of topics than the Physics BSc and provides more research experience. The Department has an excellent track record of securing PhD studentships and, as a consequence, our graduates have a good opportunity to study higher degrees spanning the whole of physics. The research-led teaching will provide a core of experience that will make you an excellent researcher and also prepare you to excel in many other professions.

Programme in detail
Core physics modules include: Newtonian dynamics; Wave phenomena; The material universe; Working with physics; Practical physics; Maths for physics; Electromagnetism; Condensed matter; Quantum and atomic physics, Nuclear physics and Particle physics.

You will also take mathematics, computing and experimental physics modules in support of these studies. There is an advanced computer modelling project in the third year. There may be opportunities to carry out a major project at an international laboratory such as TRIUMF in Vancouver, CERN in Geneva or the Diamond Light Source in Oxfordshire during the summer vacation between the third and fourth years for three months. These projects are fully paid and can form the basis of a more substantial final-year project at the cutting-edge of research.

Key modules
Year One
Core modules
- Foundations of modern physics
- Mathematics for physicists I
- Mathematics for physicists II
- Newtonian dynamics
- Practical physics I
- The material universe
- Wave phenomena
- Working with physics I.

Selected optional modules
- Working with medical physics I
- Working with nuclear science I.

Year Two
Core modules
- Condensed matter physics
- Electromagnetism
- Mathematics for physicists III
- Mathematics for physicists IV
- Nuclear and particle physics
- Practical physics II
- Quantum and atomic physics
- Working with physics II.

Year Three
Core modules
- Advanced electromagnetism
- Condensed matter physics
- Introduction to particle physics
- Modelling physics phenomena
- Nuclear physics
- Quantum mechanics and atomic physics
- Surface physics.

Selected optional modules
You can choose 15 credits from the following modules:
- Classical mechanics
- Communicating science
- Elements of stellar dynamics
- Materials physics
- Planetary physics
- Semiconductor applications
- Statistical and low temperature physics
- Statistics in data analysis
- Stellar astrophysics.

For up-to-date entry requirements and full module details see www.liverpool.ac.uk/study/undergraduate/courses
In addition to 15 credits from the following:
- Accelerators and radioisotopes in medicine
- Physics of energy sources
- Physics of life
- Physics of the radiative universe
- Relativity and cosmology.

**Year Four**

Core modules
- Advanced quantum physics
- Project (MPhys)
- Research skills.

Selected optional modules
You can choose 37.5 credits from the following modules not already taken:
- Accelerator physics
- Classical mechanics
- Communicating science
- Elements of stellar dynamics
- Galaxies
- Magnetic structure and function
- Materials physics
- Nanoscale physics and technology
- Planetary physics
- Semiconductor applications
- Statistical and low temperature physics
- Statistics in data analysis
- Stellar astrophysics.

In addition to 30 credits from the following modules not already taken:
- Advanced nuclear physics
- Advanced particle physics
- Chaos and dynamical systems
- Modelling of functional materials and interfaces
- Physics of energy sources
- Physics of life
- Physics of the radiative universe
- Radiation therapy applications
- Relativity
- Relativity and cosmology.

See pages 22-28 for module descriptions.

---

**Physics with Astronomy BSc (Hons)**

**UCAS code: F3F5**

**Programme length: 3 years**

A degree in Physics with Astronomy gives students a wide appreciation of the varied astronomical phenomena in the physical Universe. From the formation, evolution and deaths of stars – involving planetary systems, nucleosynthesis and supernovae – through structure of galaxies to the evolution of the Universe itself, the degree structure introduces the physics involved in the cosmos. At the end of Year Two the week-long field trip to the Teide Observatory in Tenerife introduces students to professional observatories. Delivered in conjunction with the Astrophysics Research Institute at Liverpool John Moores University, the three-year Physics and Astronomy degree will equip students with skills relevant for jobs in a wide range of careers, from education, research, finance and the city to industry.

**Programme in detail**

Core physics modules include: Newtonian dynamics; Wave phenomena; The material universe; Working with physics; Practical physics; Maths for physics; Electromagnetism; Condensed matter; Quantum and atomic physics; Nuclear physics and Particle physics.

There are modules on: Astronomy fundamentals; Astronomical techniques; Stellar astrophysics; Galaxies and Cosmology.

The two-metre Aperture Liverpool Telescope located in the Canaries, which is the largest robotically controlled telescope in the world, will provide you with unique access to observations from a major research facility when you undertake a research project in your final year.
**Key modules**

**Year One**  
Core modules  
- Foundations of modern physics  
- Mathematics for physicists I  
- Mathematics for physicists II  
- Newtonian dynamics  
- Practical physics I  
- The material universe  
- Wave phenomena  
- Working with physics I.

**Year Two**  
Core modules  
- Condensed matter physics  
- Electromagnetism  
- Mathematics for physicists III  
- Mathematics for physicists IV  
- Nuclear and particle physics  
- Practical astrophysics  
- Quantum and atomic physics  
- Working with physics II.

**Year Three**  
Core modules  
- Advanced observational astronomy  
- Galaxies  
- Introduction to particle physics  
- Nuclear physics  
- Quantum mechanics and atomic physics  
- Relativity and cosmology  
- Stellar astrophysics.

Selected optional modules  
You can choose 15 credits from the following modules:  
- Group physics project  
- Project (BSc)  
- Undergraduate ambassadors project.

In addition to 15 credits from the following:  
- Accelerators and radioisotopes in medicine  
- Advanced electromagnetism  
- Communicating science  
- Condensed matter physics  
- Materials physics  
- Observational astronomy  
- Physics of energy sources  
- Physics of life  
- Planetary physics  
- Semiconductor applications  
- Stellar atmosphere  
- Surface physics.

See pages 22-28 for module descriptions.

**Astrophysics MPhys**  
**UCAS code: F521**  
**Programme length: 4 years**

An Astrophysics degree has the unique potential to provide students with an understanding of the most up-to-date discoveries in the Universe. During the programme, students will be introduced to all aspects of physics and astronomy from quantum mechanics to cosmology. In Year Two, there is a week-long field trip to the Teide Observatory in Tenerife, where students make astronomical measurements at a professional observatory. Offered in conjunction with the Astrophysics Research Institute at Liverpool John Moores University, this four-year degree will equip students with skills relevant for further study of the universe at postgraduate research level as well as for jobs in a wide range of careers.

**Programme in detail**  
Core physics modules include: Newtonian dynamics; Wave phenomena; The material universe; Working with physics; Practical physics; Maths for physics; Electromagnetism; Condensed matter; Quantum and atomic physics; Nuclear physics and Particle physics.

There are also modules on: Astronomy fundamentals; Astronomical techniques; Stellar astrophysics; Galaxies and Cosmology. Advanced modules include: Computational astrophysics; Communication of astrophysical ideas; Chaos theory and Dynamical astronomy.

The two-metre Aperture Liverpool Telescope sited on La Palma in the Canaries, which is the largest robotically controlled telescope in the world, will provide you with unique access to observations from a major research facility when you undertake a research project in your final year.

For up-to-date entry requirements and full module details see www.liverpool.ac.uk/study/undergraduate/courses
Key modules

Year One
Core modules
- Foundations of modern physics
- Mathematics for physicists I
- Mathematics for physicists II
- Newtonian dynamics
- Practical physics I
- The material universe
- Wave phenomena
- Working with physics I.

Year Two
Core modules
- Condensed matter physics
- Electromagnetism
- Mathematics for physicists III
- Mathematics for physicists IV
- Nuclear and particle physics
- Practical astrophysics
- Quantum and atomic physics
- Working with physics II.

Year Three
Core modules
- Advanced observational astronomy
- Galaxies
- Introduction to particle physics
- Nuclear physics
- Quantum mechanics and atomic physics
- Relativity and cosmology
- Stellar astrophysics.

Selected optional modules
You can choose 30 credits from the following modules:
- Accelerators and radioisotopes in medicine
- Advanced electromagnetism
- Classical mechanics
- Communicating science
- Condensed matter physics
- Elements of stellar dynamics
- Materials physics
- Observational astronomy
- Physics of energy sources
- Physics of life
- Physics of the radiative universe
- Planetary physics
- Semiconductor applications
- Statistical and low temperature physics
- Statistics in data analysis
- Stellar atmosphere
- Surface physics
- The interstellar medium.

Year Four
Core modules
- Communication of astrophysical ideas
- Computational astrophysics
- Project (MPhys)
- The interstellar medium.

Selected optional modules
Students can choose 30 credits from the following modules not already taken:
- Accelerator physics
- Advanced quantum physics
- Classical mechanics
- Communication of astrophysical ideas
- Elements of stellar dynamics
- Magnetic structure and function
- Materials physics
- Nanoscale physics and technology
- Planetary physics
- Research skills
- Semiconductor applications
- Statistical and low temperature physics
- Statistics in data analysis
- Stellar populations
- Surface physics.

In addition to 15 credits from the following modules not already taken:
- Advanced electromagnetism
- Advanced nuclear physics
- Advanced particle physics
- Chaos and dynamical systems
- Condensed matter physics
- Physics of energy sources
- Physics of life
- Physics of the radiative universe
- Radiation therapy applications
- Relativity
- Stellar atmosphere
- Surface physics.

See pages 22-28 for module descriptions.
Physics research is helping us to live longer, healthier lives. It is helping us to develop new cures for disease and new ways to quickly diagnose health problems. For example, particle beams and detectors used in physics research have led to the development of proton cancer therapies and new diagnostic imaging technologies. Combining the study of physics and selected topics in medical applications, this programme provides skills such as numeracy, problem solving, reasoning and communication that are attractive to the general employer, and it is an excellent preparation for a career in medical physics.

Programme in detail
Core physics modules include: Newtonian dynamics; Wave phenomena; The material universe; Working with physics; Practical physics; Maths for physics; Electromagnetism; Condensed matter; Quantum and atomic physics; Nuclear physics and Particle physics.

You will also take mathematics, computing and experimental physics modules in support of these studies.

There is a project on a medical physics topic in Year Three with involvement from the local hospitals and medical research centres. Staff from these institutions will also be involved with teaching.

Key modules
Year One
Core modules
- Foundations of modern physics
- Mathematics for physicists I
- Mathematics for physicists II
- Newtonian dynamics
- Practical physics I
- The material universe
- Wave phenomena
- Working with medical physics I.

Year Two
Core modules
- Accelerators and radioisotopes in medicine
- Condensed matter physics
- Electromagnetism
- Mathematics for physicists III
- Nuclear and particle physics
- Practical physics II
- Quantum and atomic physics
- Working with physics II.

Year Three
Core modules
- Communicating science
- Medical physics project
- Radiation physics advanced practical
- Radiation therapy applications.

Selected optional modules
You can choose 30 credits from the following modules:
- Materials physics
- Nuclear physics
- Quantum mechanics and atomic physics
- Semiconductor applications
- Statistical and low temperature physics
- Stellar astrophysics
- Surface physics.

In addition to 30 credits from the following:
- Advanced electromagnetism
- Condensed matter physics
- Introduction to particle physics
- Physics of energy sources
- Physics of life
- Relativity and cosmology.

See pages 22-28 for module descriptions.
Physics with Nuclear Science BSc (Hons)
UCAS code: F390
Programme length: 3 years

This programme offers the study of physics and selected topics in nuclear science and provides an excellent preparation for a career in nuclear related industries. There are links with many parts of the nuclear industry including those involved with decommissioning and homeland security. Staff from these institutions will be involved in the project work. The programme comprises modules in common with the Physics programme (including Mathematics support).

Programme in detail
Core physics modules include: Newtonian dynamics; Wave phenomena; The material universe; Working with physics; Practical physics; Maths for physics; Electromagnetism, Condensed matter; Quantum and atomic physics; Nuclear physics and Particle physics.

You will also take modules on: Nuclear physics; Thermodynamics; Nuclear energy; Nuclei; Molecules and solids and Statistics related to nuclear science.

You will also take mathematics, computing and experimental physics modules in support of these studies. There is a project on a nuclear science topic in Year Three with involvement from industry. Other modules from the Physics F300 programme may also be taken.

Key modules
Year One
Core modules
- Foundations of modern physics
- Mathematics for physicists I
- Mathematics for physicists II
- Newtonian dynamics
- Practical physics I
- The material universe
- Wave phenomena
- Working with nuclear science I.

Year Two
Core modules
- Accelerators and radioisotopes in medicine
- Condensed matter physics
- Electromagnetism
- Mathematics for physicists III
- Nuclear and particle physics
- Practical physics II
- Quantum and atomic physics
- Working with physics II.

Year Three
Core modules
- Communicating science
- Nuclear physics
- Nuclear science project
- Physics of energy sources
- Radiation physics advanced practical
- Statistics in data analysis.

Selected optional modules
You can choose 37.5 credits from the following modules:
- Advanced electromagnetism
- Condensed matter physics
- Introduction to particle physics
- Materials physics
- Physics of life
- Quantum mechanics and atomic physics
- Relativity and cosmology
- Semiconductor applications
- Statistical and low temperature physics
- Stellar astrophysics
- Surface physics.

See pages 22-28 for module descriptions.
Physics with Radiation Protection BSc (Hons)
UCAS code: F351
Programme length: 3 years

This programme offers the study of physics and selected topics in radiation protection. The programme provides an excellent preparation for a career in the industries requiring radiation protection professionals. There are links with many parts of the nuclear industry including those involved with decommissioning and homeland security, plus the health service, government bodies, and emergency services. Staff from these institutions will be involved in the project work. The programme comprises modules in common with the Physics (F300) programme (including Mathematics support).

Programme in detail
Core physics modules include: Newtonian dynamics; Wave phenomena; The material universe; Working with physics; Practical physics; Maths for physics; Electromagnetism; Condensed matter; Quantum and atomic physics; Nuclear physics and Particle physics.

You will take modules on: Radiation protection of people; Radiation protection of the environment; Radioactive source security; Thermodynamics; Nuclear power; Nuclear and particle physics and Statistics related to radiation protection.

You will also take mathematics, computing and experimental physics modules in support of these studies. There is a project on a radiation protection topic in Year Three with involvement from industry.

In addition, there will be a three-month industrial placement scheduled to take place between Year Two and Year Three.

Key modules
Year One
Core modules
- Foundations of modern physics
- Mathematics for physicists I
- Mathematics for physicists II
- Newtonian dynamics
- Practical physics I
- The material universe
- Wave phenomena
- Working with radiation protection I.

Year Two
Core modules
- Accelerators and radioisotopes in medicine
- Condensed matter physics
- Electromagnetism
- Mathematics for physicists III
- Nuclear and particle physics
- Practical physics II
- Quantum and atomic physics
- Working with radiation protection II.

Year Three
Core modules
- Communicating science
- Nuclear physics
- Radiation metrology and dosimetry
- Radiation physics advanced practical
- Radiation protection project
- Statistics in data analysis.

Selected optional modules
You choose 22.5 credits from the following modules:
- Condensed matter physics
- Introduction to particle physics
- Physics of life
- Radiation therapy applications
- Radioactive source security.

See pages 22-28 for module descriptions.
Physics for New Technology BSc (Hons)
UCAS code: F352
Programme length: 3 years

This degree offers a programme in physics with particular emphasis in Year Three on applied topics. The area of engineering provides a module in the management of research and development. This covers managing the process of technological innovation, new product innovation and managing the translation of innovation into manufacture.

There are also extensive opportunities to work on projects of direct relevance to industry. The programme is intended for students who are less interested in the mathematical aspects of physics.

Programme in detail
Core physics modules include: Newtonian dynamics; Wave phenomena; The material universe; Working with physics; Practical physics, Maths for physics; Electromagnetism, Condensed matter; Quantum and atomic physics; Nuclear physics and Particle physics.

You will also take modules in: Electronic instrumentation; Materials and semiconductor physics; Nuclear energy; Environmental radiation and Industrial studies.

There is a two-module project running through both semesters in the final year. This involves computer interfacing to a system that is planned, designed and built by students.

Key modules
Year One
Core modules
- Foundations of modern physics
- Mathematics for physicists I
- Mathematics for physicists II
- Newtonian dynamics
- Practical physics I
- The material universe
- Wave phenomena
- Working with physics I.

Selected optional modules
- Working with medical physics I
- Working with nuclear science I.

Year Two
Core modules
- Condensed matter physics
- Electromagnetism
- Mathematics for physicists III
- Mathematics for physicists IV
- Nuclear and particle physics
- Practical physics II
- Quantum and atomic physics
- Working with physics II.

Selected optional modules
- You can choose 37.5 credits from the following modules:
  - Accelerators and radioisotopes in medicine
  - Advanced electromagnetism
  - Communicating science
  - Physics of life
  - Relativity and cosmology
  - Stellar astrophysics
  - Surface physics.

See pages 22-28 for module descriptions.
Physics with Education MPhys  
UCAS code: N/A. Students can apply at the end of Year Two  
Programme length: 4 years

The University of Liverpool is one of the first universities in the UK to offer undergraduate students the opportunity to complete a Master in Physics with Education (with recommendation for Qualified Teacher Status (QTS)) degree programme, satisfying the criteria to become a physics teacher. This unique degree programme is part of a joint degree enabling students to qualify with the necessary skills, experience and qualifications to teach in England and Wales after their graduation. We pride ourselves on the flexibility we offer with our degree programmes and any physics undergraduates interested in doing this degree only need to apply if they want to do the MPhys degree with Education by the end of Year Two.

Registered students will receive a generous bursary from the NCTL (National College of Teaching and Learning), currently £9,000 per year for Year Three and Four (to be confirmed at the opt-in stage). Physics with Education is a joint programme with education components provided by Liverpool John Moores University.

Physical Sciences entry route leading to BSc (Hons) (4-year route including a Foundation Year at Carmel College)  
UCAS code: F308  
Programme length: 4 (1+3) years

This programme offers a four-year route to the BSc (Hons) degree programmes offered by the Department of Physics. You follow the Foundation Year at Carmel College, St Helens, about nine miles away from the main University campus. It offers small class sizes and high academic standards. You then opt to follow any of the Physics programmes.

Programme in detail
At Carmel College, you will take three foundation modules chosen from physics, mathematics, chemistry, biology or geography, depending on which degree route you want to follow. In your second year, you will attend the University of Liverpool and take the same modules as other students on your chosen programme. Please contact Carmen Nunez for full details E: degree@carmel.ac.uk or T: +44 (0)1744 452 213

For up-to-date entry requirements and full module details see www.liverpool.ac.uk/study/undergraduate/courses
Degrees offered with other departments

Geophysics (Physics) BSc (Hons)  
UCAS code: F656  
Programme length: 3 years

This programme provides training in the principles and practice of geophysics with an emphasis on pure and practical physics. High level training is given in geophysics with supporting physics, providing classical physics training to second year university level, and including university training in geology and mathematics. The programme is particularly strong for careers in geophysical data analysis, and research areas related to global geophysics and planetary science.

Transferring on to a physics degree is possible up to the end of Year One.

This degree is recognised by the Institute of Physics.

For more information download the Earth, Ocean and Ecological Sciences brochure from www.liverpool.ac.uk/study/undergraduate/courses/publications

Geology and Geophysics MESc (Hons)  
UCAS code: F641  
Programme length: 4 years

This four-year degree delivers advanced and rigorous training in both geophysics and geology, including a high proportion of field-based work, and fundamental training in physics and mathematics. Graduates benefit from a wide range of careers in geosciences, allowing (for example) flexible career paths between geology and geophysics in a large company. Transferring on to a geology degree is possible up to the end of Year One. This degree is accredited by the Geological Society of London, satisfying the requirements of Fellowship and Chartered Geologist status.

For more information download the Earth, Ocean and Ecological Sciences brochure from www.liverpool.ac.uk/study/undergraduate/courses/publications

Geophysics (Geology) BSc (Hons)  
UCAS code: F640  
Programme length: 3 years

This degree provides high-level training in geophysics with supporting geology, and including fundamental university training in physics and mathematics. This programme is particularly strong for careers in interpretation and processing of geophysical data, and research areas related to geological applications.

Transferring on to a geology degree is possible up to the end of Year One.

This degree is accredited by the Geological Society of London, satisfying the requirements of Fellowship and Chartered Geologist status.

For more information download the Earth, Ocean and Ecological Sciences brochure from www.liverpool.ac.uk/study/undergraduate/courses/publications

Geophysics (North America)  
MESc (Hons)  
UCAS code: F660  
Programme length: 4 years

The first two years of this four-year degree are shared with the F640 programme whilst the final two years provide more advanced training. Your Year Three will be spent at a sister department in North America or Australia, where you will have the opportunity to experience a different culture and learning environment, along with access to diverse subject areas. Current links include the University of Georgia; the University of Illinois at Urbana-Champaign; McGill University, Montreal, Canada; Toronto University in Canada and Monash University in Melbourne, Australia. The number of places available on this degree programme is limited.

If you apply, but don’t achieve the required grades, you will be offered a place on either F641 or F640, provided you obtain the required grades for those programmes.
This degree is accredited by the Geological Society of London, satisfying the requirements of Fellowship and Chartered Geologist status.

For more information download the Earth, Ocean and Ecological Sciences brochure from www.liverpool.ac.uk/study/undergraduate/courses/publications

**Mathematical Physics MMath**  
UCAS code: FGH1  
Programme length: 4 years

**Physics and Mathematics BSc (Joint Hons)**  
UCAS code: FG31  
Programme length: 3 years

**Theoretical Physics MPhys**  
UCAS code: F344  
Programme length: 4 years

Physics and mathematics degrees are highly prized and our graduates have excellent career opportunities in industrial research and development, computing, business, finance and teaching.

We offer one three-year BSc degree and two four-year degrees, MMath or MPhys, combining these two intimately related disciplines. These programmes provide strong mathematical training and mathematical techniques to help you to deal with new ideas that often seem counterintuitive, such as string theory, black holes, superconductors and chaos theory.

For more information download the Mathematical Sciences brochure from www.liverpool.ac.uk/study/undergraduate/courses/publications

**Ocean Sciences BSc (Hons)**  
UCAS code: F700  
Programme length: 3 years

**Ocean Sciences MOSci (Hons)**  
UCAS code: F710  
Programme length: 4 years

The ocean plays a central role in the Earth’s climate system by regulating the transfer of heat and carbon over the globe. The effect of the ocean can only be fully understood by addressing the fundamental physical and chemical processes operating in our environment. This degree route offers three distinct pathways in oceanography, physics or chemistry, combined with an understanding of the ocean and climate system.

Each pathway has its own mix of modules from the School of Environmental Sciences and School of Physical Sciences. Scientists from the National Oceanography Centre in Liverpool provide guest lectures and supervision of projects. The four-year master’s programme, F710, will provide you with the high-level skills and knowledge required to work in a research environment and address the challenges in ocean science. There is a strong emphasis on numerical skills, hands-on laboratory and fieldwork at sea and independent study. You will have the opportunity to work with scientists from the National Oceanography Centre (Liverpool), who are international leaders in sea level science and shelf sea physics.

For more information download the Earth, Ocean and Ecological Sciences brochure from www.liverpool.ac.uk/study/undergraduate/courses/publications
# Core and selected optional modules overview

## Year One

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundations of modern physics</td>
<td>2</td>
<td>15</td>
<td>This module will introduce the theory of special relativity and its experimental proofs. It will also introduce the concepts and the experimental foundations of quantum theory.</td>
</tr>
<tr>
<td>Mathematics for physicists I</td>
<td>1</td>
<td>15</td>
<td>Provides a foundation for the mathematics required by physical scientists.</td>
</tr>
<tr>
<td>Mathematics for physicists II</td>
<td>2</td>
<td>15</td>
<td>Consolidates and extends the understanding of mathematics required for the physical sciences.</td>
</tr>
<tr>
<td>Newtonian dynamics</td>
<td>1</td>
<td>15</td>
<td>This module covers the fundamental concepts and principles of classical mechanics together with an introduction to the study of fluids. The use of elementary vector algebra in the context of mechanics is also introduced.</td>
</tr>
<tr>
<td>Practical physics I</td>
<td>1 and 2</td>
<td>15</td>
<td>A thorough grounding in the fundamental practices and techniques carried out in a physics laboratory. This module will highlight the analytical methods used by radiation protection professionals including half-life assessment, energy determination, and alpha/beta counting.</td>
</tr>
<tr>
<td>The material universe</td>
<td>1</td>
<td>15</td>
<td>Covers thermal physics and the laws of thermodynamics together with the kinetic theory of gases, the equation of state, Van der Waals equation, and the basis of statistical mechanics.</td>
</tr>
<tr>
<td>Wave phenomena</td>
<td>2</td>
<td>15</td>
<td>An introduction to the fundamental concepts of wave phenomena which will highlight the many diverse areas of physics in which an understanding of waves is crucial. The module will cover reflection, transmission, and superposition of waves leading to the concepts of interference and diffraction. In addition, it will address lenses, optical instruments, and the basic principles of lasers.</td>
</tr>
<tr>
<td>Working with medical physics I</td>
<td>1 and 2</td>
<td>15</td>
<td>Develop the ability to use spreadsheets and mathematical packages to calculate and graph mathematical equations using examples from medical physics.</td>
</tr>
<tr>
<td>Working with nuclear science I</td>
<td>1 and 2</td>
<td>15</td>
<td>Develop the ability to use spreadsheets and mathematical packages to calculate and graph mathematical equations using examples from nuclear physics.</td>
</tr>
<tr>
<td>Working with physics I</td>
<td>1 and 2</td>
<td>15</td>
<td>Introduces how to use spreadsheets and mathematical packages to calculate and graph mathematical equations.</td>
</tr>
<tr>
<td>Working with radiation protection I</td>
<td>1 and 2</td>
<td>15</td>
<td>An introduction to the concepts and practice of protecting people (workers, public and patients) from ionising radiation. The module will review the relevant legislation and examine the principles of justification, optimisation and dose limitation. In addition, it will cover shielding, distance and time as external radiation control measures, together with internal radiation hazards and how to mitigate them.</td>
</tr>
</tbody>
</table>

**Please note:** modules may not be available across all programmes, please check programme specific module lists on pages 08-20.
## Core and selected optional modules overview

### Year Two

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accelerators and radioisotopes in medicine</strong></td>
<td>2</td>
<td>15</td>
<td>This module deals with the uses of accelerators and isotopes in medical applications, such as PET, SPECT, X-ray imaging, brachytherapy, IMRT and heavy ion radiotherapy. It will cover the interaction of radiation with materials, acceleration of charged particles, types of accelerators, production of radioisotopes, properties of some common medical isotopes.</td>
</tr>
<tr>
<td><strong>Condensed matter physics</strong></td>
<td>1</td>
<td>15</td>
<td>Condensed matter refers to both liquids and solids and all kinds of other forms of matter in between those two extremes. While the module will touch on liquids, the emphasis will be on crystalline solids, including some nanomaterials.</td>
</tr>
<tr>
<td><strong>Electromagnetism</strong></td>
<td>1</td>
<td>15</td>
<td>This module will cover electrostatics, magnetostatics, circuit analysis, electromagnetism and Maxwell's equations. This will lead on to electromagnetic waves and the concepts of field theories in physics using electromagnetism as an example.</td>
</tr>
<tr>
<td><strong>Mathematics for physicists III</strong></td>
<td>1</td>
<td>15</td>
<td>Reinforces students’ prior knowledge of mathematical techniques and introduces new mathematical techniques for physics modules.</td>
</tr>
<tr>
<td><strong>Mathematics for physicists IV</strong></td>
<td>2</td>
<td>15</td>
<td>Builds on Mathematics for physicists III.</td>
</tr>
<tr>
<td><strong>Nuclear and particle physics</strong></td>
<td>2</td>
<td>15</td>
<td>This module covers the basic principles that determine nuclear size, mass and decay modes. It will introduce the basics of Rutherford, electron and neutron scattering as well as giving examples of the applications of nuclear physics. In addition, it will address elementary particles and their interactions, and provide a basic treatment of relativistic 4-vectors.</td>
</tr>
<tr>
<td><strong>Practical astrophysics</strong></td>
<td>1 and 2</td>
<td>15</td>
<td>Develop techniques in setting up and calibrating equipment; become familiar with equipment used in later modules; learn how to take reliable and reproducible data and develop an understanding of various techniques of data gathering and analysis in modern astrophysics.</td>
</tr>
<tr>
<td><strong>Practical physics II</strong></td>
<td>1 and 2</td>
<td>15</td>
<td>This lab-based module will cover the setting up and calibration of radiation monitoring equipment. This will involve taking reliable and reproducible data, calculating experimental results and their associated errors, and using computer software for simulation and data analysis.</td>
</tr>
<tr>
<td><strong>Quantum and atomic physics</strong></td>
<td>2</td>
<td>15</td>
<td>This module will introduce the concepts of quantum theory. It will cover the Schrodinger equation as applied to particle flux and to bound states, and demonstrate how quantum ideas provide an understanding of atomic structure.</td>
</tr>
<tr>
<td><strong>Working with physics II</strong></td>
<td>1 and 2</td>
<td>15</td>
<td>Develop essential research skills and learn how to use programming techniques to solve problems in physics, nuclear physics, astrophysics and/or medical applications of physics.</td>
</tr>
<tr>
<td><strong>Working with radiation protection II</strong></td>
<td>1 and 2</td>
<td>15</td>
<td>An introduction to the concepts and practice of protecting our environment from discharges of radioactive waste. The module will review the relevant legislation and the UK environmental permitting regime. It will cover ‘Best Available Techniques’ and deal with some simple environmental impact assessments to illustrate how discharges can affect flora and fauna (notably humans).</td>
</tr>
</tbody>
</table>

**Please note:** modules may not be available across all programmes, please check programme specific module lists on pages 08-20.
# Core and selected optional modules overview

## Year Three/Four

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accelerator physics</td>
<td>2</td>
<td>7.5</td>
<td>Covers the functional principles of different types of particle accelerators that are used, the generate ion and electron beams, as well as the layout and the design of simple ion and electron optics. The application of accelerators in a variety of scenarios is also addressed.</td>
</tr>
<tr>
<td>Accelerators and radioisotopes in medicine</td>
<td>2</td>
<td>15</td>
<td>This module deals with the uses of accelerators and isotopes in medical applications, such as PET, SPECT, X-ray imaging, brachytherapy, IMRT and heavy ion radiotherapy. It will cover the interaction of radiation with materials, acceleration of charged particles, types of accelerators, production of radioisotopes, properties of some common medical isotopes.</td>
</tr>
<tr>
<td>Advanced electromagnetism</td>
<td>2</td>
<td>15</td>
<td>Builds on Year One and Two modules on electricity, magnetism and waves.</td>
</tr>
<tr>
<td>Advanced nuclear physics</td>
<td>2</td>
<td>7.5</td>
<td>Offers an insight into current ideas about the description of atomic nuclei and nuclear matter.</td>
</tr>
<tr>
<td>Advanced observational astronomy</td>
<td>2</td>
<td>15</td>
<td>Introduces the experimental techniques which enable astrophysicists to use the full range of the electromagnetic spectrum to study the physics of astronomical objects.</td>
</tr>
<tr>
<td>Advanced particle physics</td>
<td>2</td>
<td>7.5</td>
<td>Gives the student a deeper understanding of the standard model of particle physics and the basic extensions.</td>
</tr>
<tr>
<td>Advanced practical physics</td>
<td>1</td>
<td>15</td>
<td>Gives further training in laboratory techniques, in the use of computer packages for modelling and analysis, and in the use of modern instruments.</td>
</tr>
<tr>
<td>Advanced quantum physics</td>
<td>1</td>
<td>15</td>
<td>Provides breadth and depth in the understanding of the commonly used aspects of quantum mechanics.</td>
</tr>
<tr>
<td>Chaos and dynamical systems</td>
<td>2</td>
<td>15</td>
<td>Develop expertise in dynamical systems in general and study particular systems in detail.</td>
</tr>
<tr>
<td>Classical mechanics</td>
<td>1</td>
<td>15</td>
<td>Provides an awareness of the physical principles that can be applied to understand important features of classical (ie non-quantum) mechanical systems.</td>
</tr>
<tr>
<td>Communicating science</td>
<td>1</td>
<td>7.5</td>
<td>This module covers some of the key factors in successful communication of science via an appreciation of the needs of different audiences. A variety of written and oral media are addressed enabling students to communicate with confidence on radiation and radiation protection matters.</td>
</tr>
</tbody>
</table>

**Please note:** modules may not be available across all programmes, please check programme specific module lists on pages 08-20.
<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication of astrophysical ideas</td>
<td>1 and 2</td>
<td>15</td>
<td>Develop the ability of the student to communicate results and ideas in astrophysics at a range of technical levels, dealing with the objective criticism of existing articles, videos, papers and lecture/seminar presentations, as well as the creation of new material.</td>
</tr>
<tr>
<td>Computational astrophysics</td>
<td>2</td>
<td>15</td>
<td>Provides practical experience of using computational techniques extensively employed by researchers in the physical sciences.</td>
</tr>
<tr>
<td>Condensed matter physics</td>
<td>2</td>
<td>7.5</td>
<td>Develops concepts introduced in Year One and Year Two modules which relate to solids.</td>
</tr>
<tr>
<td>Elements of stellar dynamics</td>
<td>1</td>
<td>7.5</td>
<td>Provides a basic understanding of the dynamics of systems containing millions and billions of point-like gravitating bodies: stars in stellar clusters and galaxies.</td>
</tr>
<tr>
<td>Galaxies</td>
<td>1</td>
<td>15</td>
<td>Provides a broad overview of these complex yet fundamental systems which interact at one end with the physics of stars and the interstellar medium and at the other with cosmology and the nature of large-scale structures in the Universe.</td>
</tr>
<tr>
<td>Group physics project</td>
<td>2</td>
<td>15</td>
<td>Students will work in a group on a research project.</td>
</tr>
<tr>
<td>Introduction to particle physics</td>
<td>2</td>
<td>7.5</td>
<td>Develop an understanding of the modern view of particles, their interactions and the Standard Model.</td>
</tr>
<tr>
<td>Magnetic structure and function</td>
<td>1</td>
<td>7.5</td>
<td>Develop an understanding of the phenomena and fundamental mechanisms of magnetism in condensed matter.</td>
</tr>
<tr>
<td>Management of design</td>
<td>2</td>
<td>7.5</td>
<td>Stimulates awareness of and interest in engineering project management.</td>
</tr>
<tr>
<td>Materials physics</td>
<td>1</td>
<td>7.5</td>
<td>Looks at the properties and methods of preparation of a range of materials of scientific and technological importance.</td>
</tr>
<tr>
<td>Medical physics project</td>
<td>1 and 2</td>
<td>30</td>
<td>Gives students experience of working independently on an original problem related to medical physics.</td>
</tr>
<tr>
<td>Modelling of functional materials and interfaces</td>
<td>2</td>
<td>7.5</td>
<td>Provides an introduction to modern computational chemistry methods and concepts for functional materials and interfaces. These methods will include primarily density functional theory methods for electronic structure but also an orientation towards wave function methods and classical molecular dynamics methods combined with force fields.</td>
</tr>
<tr>
<td>Modelling physics phenomena</td>
<td>2</td>
<td>15</td>
<td>Gives students experience of working independently and in small groups on an original problem.</td>
</tr>
<tr>
<td>Nanoscale physics and technology</td>
<td>1</td>
<td>15</td>
<td>Introduces the emerging fields of nanoscale physics and nanotechnology.</td>
</tr>
<tr>
<td>Nuclear physics</td>
<td>1</td>
<td>7.5</td>
<td>This module will take a detailed look at the bulk properties of nuclei, nuclear, instability, and nuclear interactions, together with nuclear structure models and electromagnetic nuclear properties</td>
</tr>
</tbody>
</table>

Please note: modules may not be available across all programmes, please check programme specific module lists on pages 08-20.
### Core and selected optional modules overview

**Year Three/Four (continued)**

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nuclear science project</strong></td>
<td>1 and 2</td>
<td>30</td>
<td>Gives students experience of working independently on an original problem related to nuclear science.</td>
</tr>
<tr>
<td><strong>Observational astronomy</strong></td>
<td>1</td>
<td>15</td>
<td>The one week astrophysics field trip to the Teide Observatory, Tenerife provides practice in the planning and execution of a programme of astronomical observations. A follow up project will be undertaken to analyse the observations.</td>
</tr>
<tr>
<td><strong>Physics for new technology project</strong></td>
<td>1 and 2</td>
<td>30</td>
<td>An opportunity to conceive, plan, propose and execute a project involving computing and technology.</td>
</tr>
<tr>
<td><strong>Physics of energy sources</strong></td>
<td>2</td>
<td>15</td>
<td>Develop an ability which allows educated and well informed opinions to be formed by the next generation of physicists on a wide range of issues in the context of the future energy needs of man.</td>
</tr>
<tr>
<td><strong>Physics of life</strong></td>
<td>2</td>
<td>7.5</td>
<td>Will explain the constraints on the physical forces which are necessary for life to evolve in the Universe. The module will describe the characteristics of life on earth, and cover the physical techniques used in the study biological systems. Topics include the molecular basis of life, the genetic code and the chirality of life, thermodynamic considerations and self-organisation in chemical systems.</td>
</tr>
<tr>
<td><strong>Physics of the radiative universe</strong></td>
<td>2</td>
<td>15</td>
<td>This module looks at some of the many ways that matter radiation interact, in relativistic and non-relativistic physical contexts.</td>
</tr>
<tr>
<td><strong>Planetary physics</strong></td>
<td>1</td>
<td>7.5</td>
<td>Provides a background in geophysics and solar system planetary science towards the understanding of exoplanet system research. Introduces methods of exoplanet detection, and current physical understanding of exoplanet systems.</td>
</tr>
<tr>
<td><strong>Project (BSc)</strong></td>
<td>2</td>
<td>15</td>
<td>Gives students experience of working independently on an original problem.</td>
</tr>
<tr>
<td><strong>Project (MPhys)</strong></td>
<td>1 and 2</td>
<td>30</td>
<td>Gives students experience of working independently on an original problem.</td>
</tr>
<tr>
<td><strong>Quantum mechanics and atomic physics</strong></td>
<td>1</td>
<td>15</td>
<td>Develop an understanding of the role of wave functions, operators, eigenvalue equations, symmetries, compatibility/non-compatibility of observables and perturbation theory in quantum mechanical theory.</td>
</tr>
</tbody>
</table>

**Please note:** modules may not be available across all programmes, please check programme specific module lists on pages 08-20.
<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiation metrology and dosimetry</td>
<td>2</td>
<td>15</td>
<td>The module begins with a review of radiation dose quantities and units before progressing to cover radiation dosimetry and its requirements — both practical and legal. It will include the use of a range of radiation measuring instruments in a variety of applications, together with a closer look at radiation measurements and their meanings.</td>
</tr>
<tr>
<td>Radiation physics advanced practical</td>
<td>1</td>
<td>7.5</td>
<td>Gives further training in laboratory techniques, in the use of computer packages for modelling and analysis, and in the use of modern instruments. Students will refine their skills in performing radiation physics experiments and researching an aspect of radiation protection complementary to material met in lectures and tutorials.</td>
</tr>
<tr>
<td>Radiation protection project</td>
<td>1 and 2</td>
<td>7.5</td>
<td>This module allows students to explore in more depth and to expand upon an aspect of practical radiation protection. Some introductory programming, modelling and/or instrumentation exercises are used to allow the student to become familiar with the systems available. There will also be a literature survey and report on the topic of the project. Project topics may include: spillage accidents, decommissioning, management of sealed sources and HASS, X-ray survey techniques, accelerator installations, etc.</td>
</tr>
<tr>
<td>Radiation therapy applications</td>
<td>2</td>
<td>15</td>
<td>This module will cover the basic physics principles of radiation therapy. It will address the interactions of different types of radiations with biological materials, together with beam modelling for radiotherapy treatments, and treatment planning. In addition, it will describe Monte Carlo modelling in radiobiology.</td>
</tr>
</tbody>
</table>

Please note: modules may not be available across all programmes, please check programme specific module lists on pages 08-20.
## Core and selected optional modules overview

### Year Three/Four

<table>
<thead>
<tr>
<th>Module title</th>
<th>Semester</th>
<th>Credit</th>
<th>Module description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Radioactive source security</strong></td>
<td>2</td>
<td>7.5</td>
<td>An introduction to radiological/nuclear security concepts and practice both in the UK and overseas. This includes a review of radiological and nuclear terrorism, and its prevention. Students will study previous acts of terrorism or breaches in security to assess where errors were made and what lessons can be learned.</td>
</tr>
<tr>
<td><strong>Relativity</strong></td>
<td>2</td>
<td>15</td>
<td>Looks at the physical principles behind special and general relativity and their main consequences.</td>
</tr>
<tr>
<td><strong>Relativity and cosmology</strong></td>
<td>2</td>
<td>15</td>
<td>Introduces the ideas of general relativity and demonstrate its relevance to modern astrophysics.</td>
</tr>
<tr>
<td><strong>Research skills</strong></td>
<td>1</td>
<td>7.5</td>
<td>Performing literature searches; planning research projects; explaining research projects to both expert and non-expert audiences; planning and organising the work as a team.</td>
</tr>
<tr>
<td><strong>Semiconductor applications</strong></td>
<td>1</td>
<td>7.5</td>
<td>Develop the physics concepts describing semiconductors in sufficient details for the purpose of understanding the construction and operation of common semiconductor devices.</td>
</tr>
<tr>
<td><strong>Statistical and low temperature physics</strong></td>
<td>1</td>
<td>15</td>
<td>Builds on material presented in earlier thermal physics and quantum mechanics courses.</td>
</tr>
<tr>
<td><strong>Statistics in data analysis</strong></td>
<td>1</td>
<td>15</td>
<td>This module deals with experimental errors and probability distributions. It covers the use of statistical methods in data analysis, and applies statistical analysis to data from a range of radiation protection sources. The use of statistical information to assess the validity of a hypothesis or experimental measurement is also addressed.</td>
</tr>
<tr>
<td><strong>Stellar astrophysics</strong></td>
<td>1</td>
<td>15</td>
<td>Provides an understanding of the physical processes which determine all aspects of the structure and evolution stars, from their birth to their death.</td>
</tr>
<tr>
<td><strong>Stellar atmosphere</strong></td>
<td>2</td>
<td>7.5</td>
<td>Provides an understanding of the properties of stellar spectra, of the effect of expanding atmospheres and of the relevance for supernovae.</td>
</tr>
<tr>
<td><strong>Stellar populations</strong></td>
<td>2</td>
<td>15</td>
<td>Develop knowledge of stellar evolution and techniques to investigate the evolution of stellar population in the universe.</td>
</tr>
<tr>
<td><strong>Surface physics</strong></td>
<td>2</td>
<td>7.5</td>
<td>Describes the properties of surfaces; conveys an understanding of the physical properties of Surfaces and provides knowledge and understanding of a range of surface characterisation techniques.</td>
</tr>
<tr>
<td><strong>The interstellar medium</strong></td>
<td>1</td>
<td>15</td>
<td>Builds upon the student’s appreciation of the role which the interstellar medium (ISM) plays in topics such as stellar evolution (star-forming regions to supernova remnants) and galaxy evolution.</td>
</tr>
<tr>
<td><strong>Undergraduate ambassadors project</strong></td>
<td>2</td>
<td>15</td>
<td>Provides students with opportunity to learn to communicate physics at different levels.</td>
</tr>
</tbody>
</table>

Please note: modules are provided for information only and may change. Timetabling restrictions may apply.
Find out more
www.liverpool.ac.uk/study

Accommodation: www.liverpool.ac.uk/accommodation
Fees and student finance: www.liverpool.ac.uk/money
Life in Liverpool: www.liverpool.ac.uk/study/undergraduate/welcome-to-liverpool
Student Welfare Advice and Guidance: www.liverpool.ac.uk/studentsupport
Undergraduate enquiries and applications: T: +44 (0)151 794 5927
@livuniphyssci

Physics
The University of Liverpool
The Oliver Lodge Laboratory
Liverpool
L69 7ZE
T: +44 (0)151 794 3378
E: physics@liverpool.ac.uk
www.liverpool.ac.uk/physics

Information provided is correct at time of going to press and is subject to change.