School of PHYSICS

University of BRISTOL

Physics with a Preliminary Year of Study

BSc Honours (four years)

Is Physics with a Preliminary year for you?

We welcome students with a broad range of background and experiences, including:

- those with qualifications that do not meet the expected requirements for direct entry into Year 1 (such as A-levels in subjects other than physics and maths; qualifications at GSCE, BTEC, or Access to HE programme);
- those returning to education after some time away;
- those returning to study after a period of work in relevant science and technology based areas without traditional academic qualifications;
- mature students seeking to follow a new career path with updated knowledge and skills in physics.

Dr Anthony Laing, Senior Lecturer, School of Physics, Bristol

'I arrived in Bristol aged 25, with no A-levels, and no formal training in science, and enrolled onto Bristol's physics with a preliminary year course.

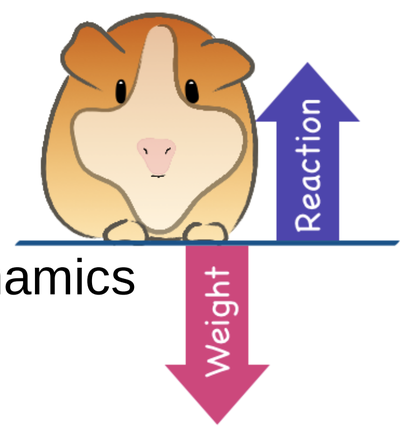
Eighteen years later, I now lead a group that researches quantum technologies and has published results in Nature and Science. In the last two years I've been invited to more than 20 conferences around the world to speak about my work. I lead the photonics activity in the UK's national programme for quantum computing.'

About the course

The preliminary year is designed to give you a solid basis in physics and mathematics and to help you develop essential study and problems solving skills allowing you to progress on to the Year-1 of the BSc Physics degree. The preliminary year study includes:

Foundations of Physics:

- Mechanics
- Waves and Optics
- Electromagnetism
- Structure of matter & Thermodynamics
- Atomic & Nuclear Physics



Laboratory work:

During the preliminary year, an important part of your learning will be practical work that will enhance your understanding of physics and develop your experimental skills.

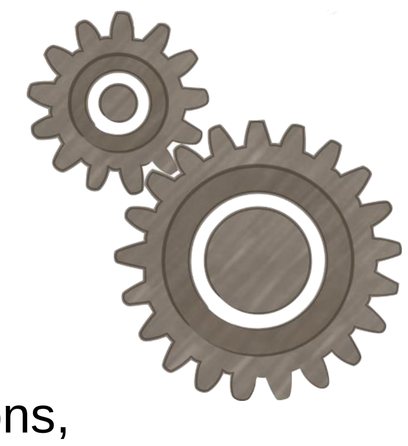
You will learn how to:

- Conduct experiments and collect data
- Analyse the results of experimental measurements using graphs and errors analysis
- Write scientific reports

Foundations of Mathematics:

- Introductions to basic algebra, trigonometry, differentiation and integrals of simple functions

•Integral calculus, differential equations, vectors and matrices.



Essential scientific skills:

You will develop highly valuable skills for independent study, scientific communication and problem solving. Through group work and independent study you will:

- work on different types of investigative assignments that will include independent study and critical analysis;
- develop oral and written communication of science;
- conduct the analysis of different problems using mathematics to describe the physical world;
- develop basic programming and data analysis skills;
- analyse the results of experimental measurements using specialized data analysis software.

Support during your studies

During the preliminary year you will be supported by an academic personal tutor who will guide and follow your academic and personal development.

Through your weekly meetings you will discuss physics problems and develop close relationships with a small group of your fellow students.

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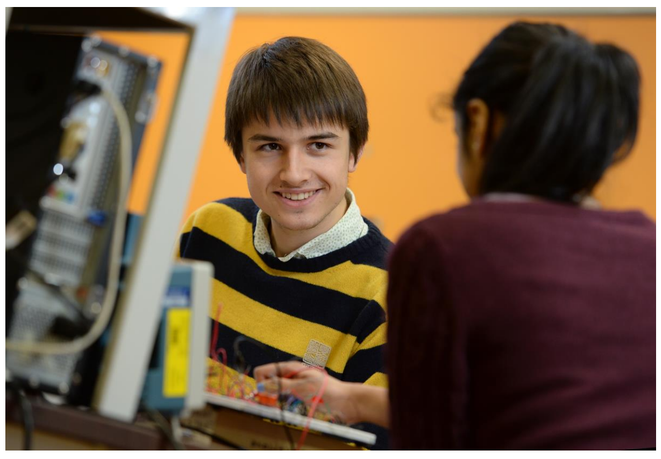
First year physics

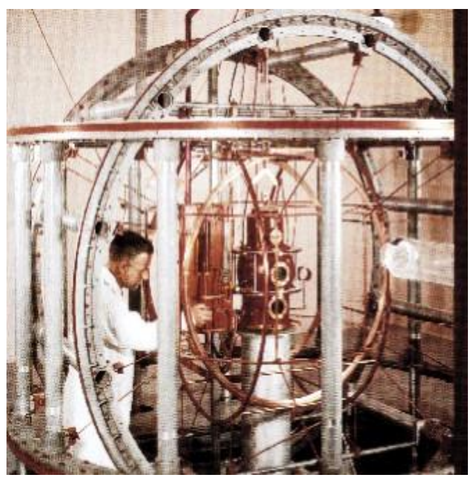
In your first year you will likely spend at least two thirds of your time studying physics and mathematics, building and developing your existing knowledge.



The undergraduate teaching laboratory is where you start to see how physics really works, learning how to take laboratory notes, what makes for good and poor data, and how to interpret and quantify the uncertainty of your results.

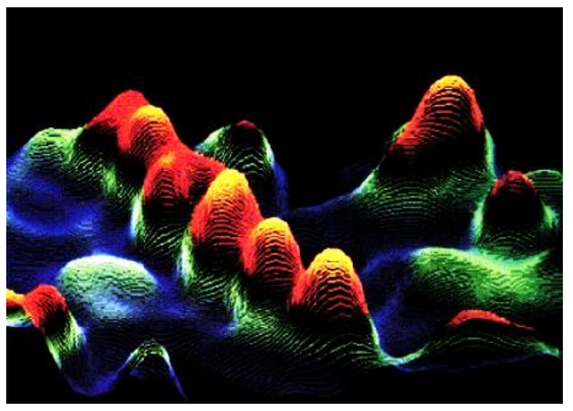
Experiments in the laboratory include making a working radio, measuring the speed of light and determining the charge on an electron.

Here are some key concepts you will learn in first year core physics lecture units:

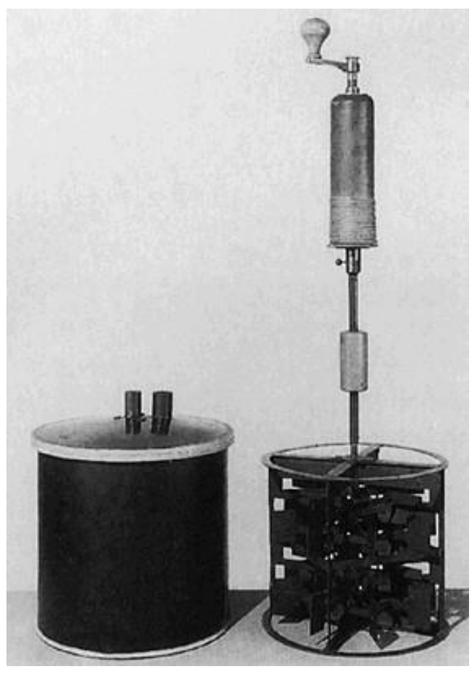


Mechanics: Involves developing a mathematical treatment of the interactions of particles and solid bodies, solving problems such as how long a snooker ball will slip before it starts to roll, or how fast you must swing a bucket of water over your head to avoid getting wet.

Fields: You will understand how Helmholtz coils are used to cancel the Earth's magnetic field so we can study the magnetic properties of matter in the absence of an external field.



Special Relativity: In this module you'll start to learn about Einstein's theory of relativity and resolve apparent paradoxes such as how observers on a moving train and on a station platform can disagree about whether the train fits inside a tunnel.



Oscillations and Waves: You will discover how imaginary numbers can be used to describe the propagation of waves and the behaviour of AC circuits.

Properties of Matter: You'll investigate how Joule used the equipment shown here to measure the mechanical equivalent of heat, and learn about the multitude of states of matter and how substances transform from one state to another.

For most first year physics students, a third of the credit for the year comes from open units. These can be chosen from any school in the University providing they fit your timetable. Physics offers open units in Astrophysics and Communicating Science; other options available include units in Mathematics, Philosophy, Chemistry and Languages.

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Third year physics

The final year for BSc students and penultimate year for MSci students offers a wide range of topics. Core units in Semiconductors and Magnetism, Quantum Physics and Electrons in Crystals are complemented by optional units. Depending on your degree programme, you may be able to choose from:

- **Condensed Matter**
- **Nanophysics**
- **Biophysics**
- **Galaxies**
- **High Energy Astrophysics**
- **Stellar Structure and Evolution**
- **Methods of Theoretical Physics**
- **Modern Optics**
- **Air, Water, Fire, Earth**
- **Particle Physics.**

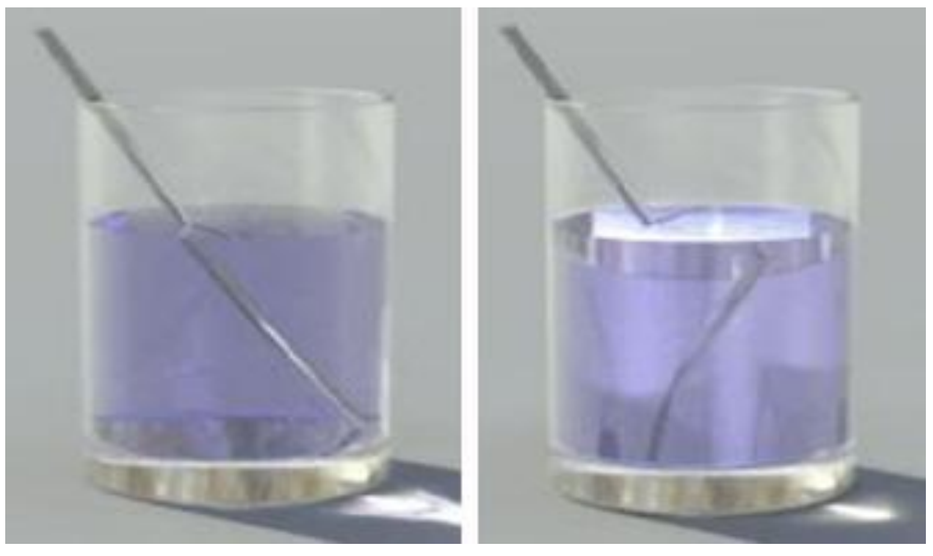
Practical and transferable skills are also nurtured and developed further:

BSc students

- You can carry out an experimental or theoretical project, join a group project with an industrial partner, write a dissertation on your chosen topic, or spend time in a local school

- You have the option of a unit in which each student leads the discussion of a topic from a recent issue of Physics World magazine

- In addition to optional physics units you may choose a language unit, depending on your language skills and availability.



The effects of nanostructured materials on refraction.

MSci students

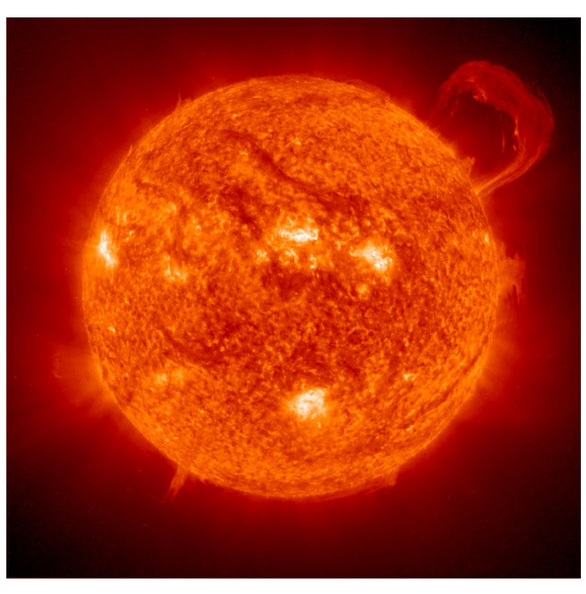


Image of the Sun - Solar and Heliospheric Observatory, ESA/NASA.

- Experimental work is carried out in the third year teaching laboratory as well as some research-group laboratories.

- Computer-package training develops your skills in programming, and in manipulating and presenting scientific data.

- In your Group Work unit you may research a physics topic, and work together to produce a written report and oral presentation.

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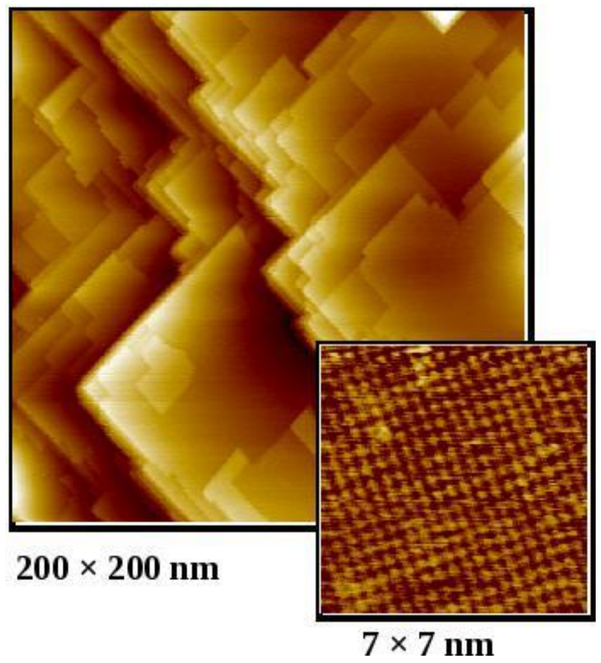
Fourth year physics

The final year of your MSci programmes offers the opportunity to study a wide variety of topics at a high level. Throughout your degree you will be taught by enthusiastic experts keen to impart their knowledge; in the final year your options will reflect research activities in the School.

Research project

All students carry out a major research project which constitutes half of your final year mark. You will work alone or in a pair, under the supervision of a member of academic staff. Projects may be in experimental, theoretical or computational, and are located within research groups in the School. Students learn about the challenges of real research in physics and further develop practical, report writing and computational skills.



The surface of a copper sample is restructured along rectangular patterns by a chloride solution.

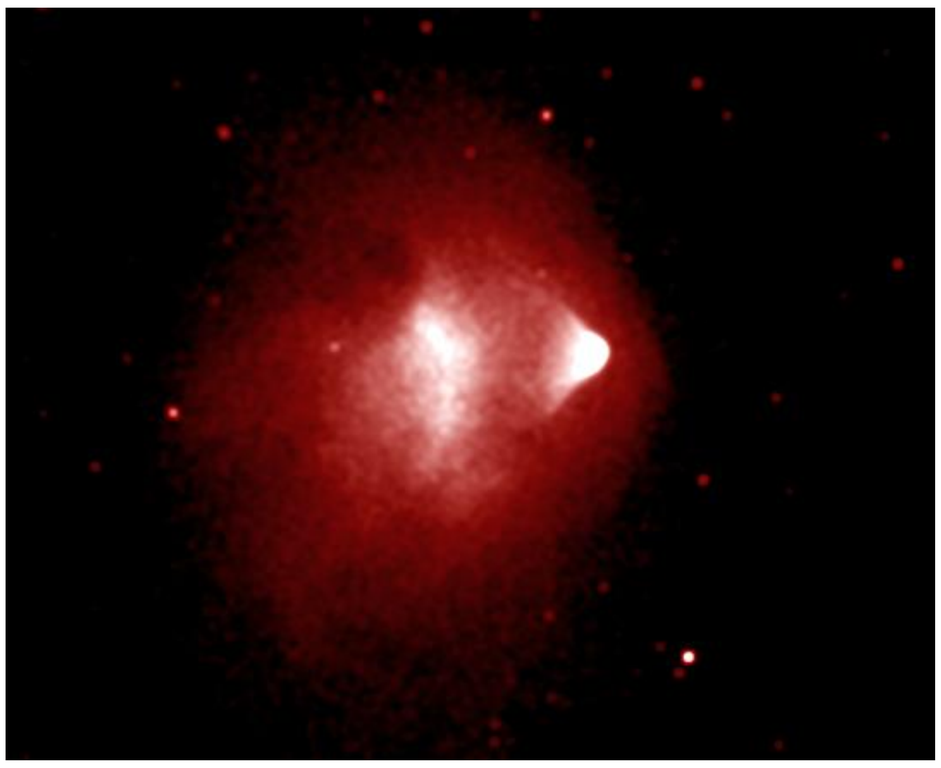
Lecture courses

Students must take five units from a range of options currently including:

- **Magnetism and Superconductivity**
- **Theoretical Particle Physics**
- **Advanced Quantum Physics**
- **General Relativity and Cosmology**
- **Semiconductor Physics**
- **Foundation of Modern Physics**
- **Advanced Nanophysics**
- **The Physics of Gas and Plasma in the Universe**
- **Relativistic Field Theory**
- **Surface Physics**
- **Advanced Computational Physics.**

Current topics in physics and student seminar

Options include the study of a topic of current research interest in physics; you may present individual seminars on this topic to a group of students and expert members of staff, or write a detailed report based on your study.



Popular choices in other schools include:

- **Earth Sciences**

- Seismology, Geophysical Fluid Dynamics

- **Mathematics**

- Quantum Information Theory, Quantum Chaos

- **Philosophy**

- Philosophical Foundations of Physics.

Left: X-ray image of the plasma atmosphere in colliding galaxy clusters, revealing shock and cold fronts (credit: NASA).

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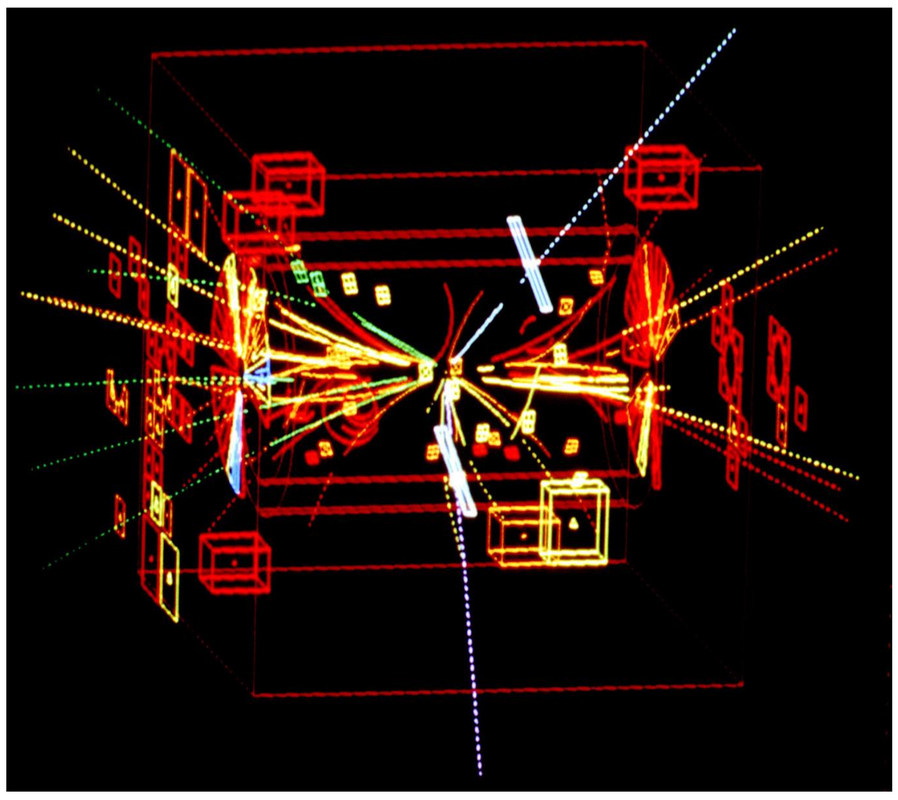
Second year physics

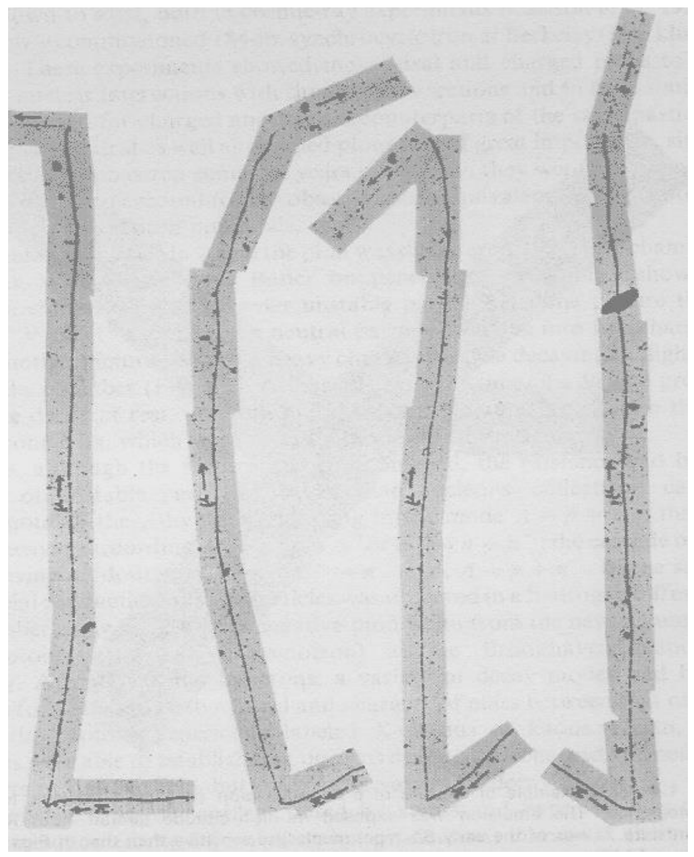
The second year is the heart of your physics course. By the end of the year you will have covered most of the core physics subjects that the Institute of Physics regards as essential for a physics degree. Concentrating on this core knowledge in the second year gives you maximum flexibility in the third and fourth year.



Our **Mathematical Physics** course provides the tools you need to tackle physics at degree level.

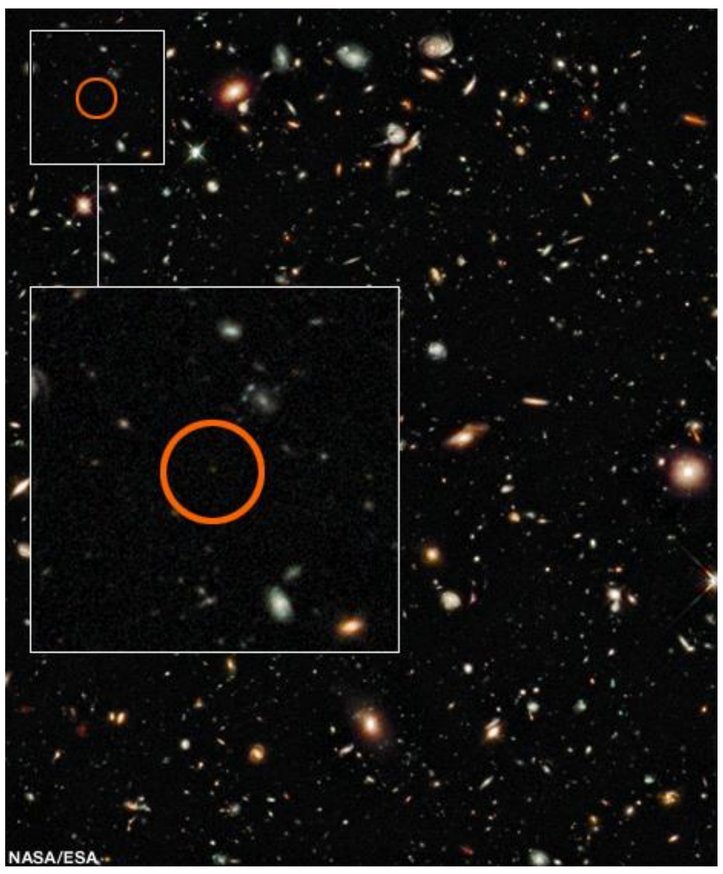
In **Classical Physics** you will study electromagnetism, thermal physics and mechanics. These build on and add to knowledge gained from the first year courses, giving you a thorough grounding in the classical strands of physics.

Left: The discovery of the Z boson at CERN – a topic covered in the second year Quantum Physics course.



The **Quantum Physics** unit introduces you to key topics in modern physics. This starts from the basic ideas of quantum physics and leads through to understanding the fundamentals of atomic physics. You will study the physics of matter on the smallest scales, at the limits of our current knowledge, in courses on **Nuclear and Particle Physics**.

Right: Measurements by Bristol Physicist Cecil Powell, who won the Nobel Prize for the discovery of the pion.



One of the most distant galaxies ever seen was discovered by a team which included Bristol astrophysicists.

At the opposite end of the size scale, and addressing some of the same problems as particle physics, you will study **Cosmology** - looking at how the entire Universe evolves from the Big Bang through to the distant future.

The second year teaching laboratory builds on and extends the skills learnt in the first year. There are fewer experiments but more time spent on each, and they are more open-ended. You present one experiment in a small group as if at a conference.

As part of the practical skills development in the second year, you also study computational physics to give you your first programming skills, or develop those that you already have.