

# PHYSICS & ASTRONOMY

USQ FACULTY OF SCIENCES

## SCIENTIFIC SKILLS + FUNDAMENTAL UNDERSTANDING

Discover the science that underpins our future – study physics

*Study a science with wide application & lasting value in a world of changing technology.*

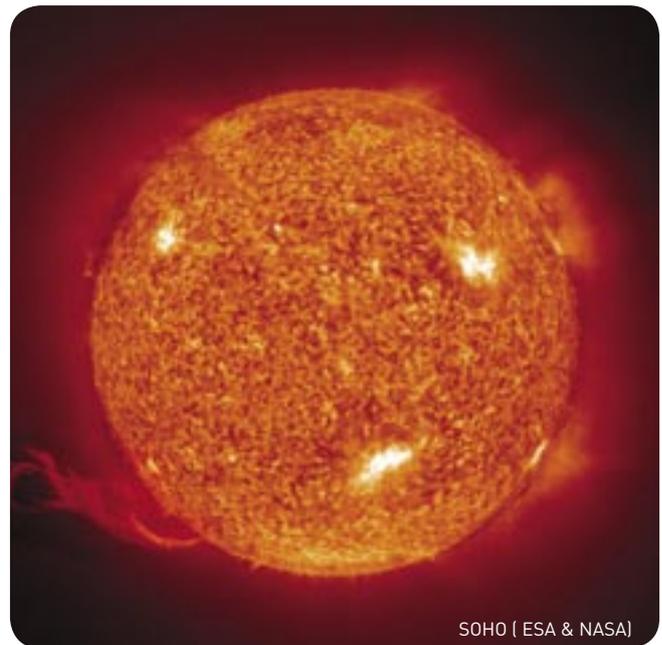
*Enhance your qualifications by combining physics with engineering, education or other studies.*

*Learn about the earth, sun & universe, and our origins & future.*

*Do your studies on-campus or by distance education, full-time or part-time.*

*Physics & astronomy options at USQ include:*

- Bachelor of Science (Physics)
- Graduate Certificate in Physics
- Graduate Certificate in Astronomy
- Postgraduate Diploma of Science
- Honours, MSc, MPhil and PhD programs
- Combined degrees that add a Physics BSc to engineering, education, computing, business or the arts
- Elective or single-subject enrolment courses in physics or astronomy



### FOR MORE INFORMATION

Email: [Studysci@usq.edu.au](mailto:Studysci@usq.edu.au)

Phone: 1800 640 678

Web: [www.usq.edu.au/biophysci](http://www.usq.edu.au/biophysci)



# PHYSICS & ASTRONOMY

## WHY STUDY PHYSICS?

*Physics is the science of matter and energy, space and time. It is the most fundamental science, and the enabling discipline underpinning much of our technology. Physics & astronomy are closely related disciplines, with astronomers using physical principles to understand the universe. Studying physics is important in a world undergoing rapid technological change, and requiring innovative problem-solving. This is because physics studies develop critical thinking skills and the understanding of fundamental scientific principles of wide application and lasting value.*

## USQ offers Physics Qualifications in the following

### Undergraduate Programs

- Bachelor of Science (Physics)
- Bachelor of Science (Honours)
- Bachelor of Engineering and Bachelor of Science
- Bachelor of Information Technology and Bachelor of Science
- Bachelor of Science and Bachelor of Business
- Bachelor of Arts and Bachelor of Science
- Bachelor of Science and Bachelor of Education (Senior and Middle Schooling)

### Graduate Programs by Coursework

- Graduate Certificate in Physics
- Graduate Certificate in Astronomy

### Postgraduate Research Programs

- Master of Science
- Postgraduate Diploma of Science
- Master of Philosophy
- Doctor of Philosophy

## Careers in Physics

An undergraduate physics degree is the foundation for a career in science or industry, and undertaking postgraduate studies in physics can be a pathway to a career in scientific research. An undergraduate physics degree also can be completed as part of combined degree studies, a combination of physics with engineering, education, computing, business, or the arts, providing an added professional qualification that can strengthen and widen career options. In particular, Bachelor of Engineering students can add to their qualifications a BSc in physics

that comprehensively addresses and extends the Engineers Australia engineering enabling competencies in physics, with only one extra year of full-time study compared to a standard engineering degree. Education students taking a Bachelor of Science in physics combined with appropriate education studies obtain qualifications in extremely strong demand.

## Bachelor of Science (Physics)

The BSc (Physics) is a program that aims to cover the major areas of physics, and includes study of solar science and technology. Theory and practical work are covered using online material and the creative use of teaching kits, Residential Schools and USQ facilities for online solar radiation measurements and astronomical observations.

## Program Structure

The BSc (Physics) includes the following core courses: *Physics Concepts; Physics & Instrumentation; Electromagnetics; Astrophysics; Optical Physics; Atomic Physics; Quantum & Solid State Physics; Advanced Topics in Physics.*

Electives include: *Astronomy 1 & 2, Remote Sensing & Meteorology, Introductory Climatology, and Environmental Studies.*

## Entry Requirements

Applicants who have completed Year 12 at a Queensland secondary school or equivalent are eligible for consideration under the standard admission requirements. In addition, applicants should have:

- four semesters of English attaining a minimum of Sound Achievement
- four semesters of Mathematics B attaining a minimum of Sound Achievement
- one of Biology, Chemistry, or Physics is desirable, but not essential

Applicants who do not have formal qualifications but age and previous experience demonstrate there is a reasonable chance of success may apply via alternative entry.

## Bachelor of Science (Honours)

The Bachelor of Science (Honours) program can be undertaken in physics and is available to graduates who have performed at a high level in the undergraduate program at USQ or other universities. It allows students to expand their knowledge in physics & astronomy and gain experience in the conduct of high-level scientific research. Successful completion of the Honours year qualifies students for entry into postgraduate programs including Masters and PhD studies.

## Graduate Programs by Coursework

Physics & astronomy staff at USQ are active in pure and applied solar research, and teach courses and supervise research in related areas. Our coursework programs provide formal instruction to enhance professional skills and knowledge in physics or astronomy. USQ has advanced solar radiation and environmental measurement facilities, and an astronomical observatory capable of remote & robotic observing. These facilities support student research in areas relevant to topical issues in public health, the environment, and climate change.

### Graduate Certificate in Physics (GradCertPhys)

This is a one-year part-time professional program consisting of 4 units of study: Remote Sensing & Meteorology (PHY1102); Physics Concepts (PHY1104); Electromagnetic Concepts (PHY2205); Advanced Topics in Physics (PHY3302)

### Entry Requirements

A student entering this program must have an approved Bachelors degree from an Australian University or equivalent, and the equivalent of either high school Mathematics C, or MAT1102 Algebra and Calculus I.

### Graduate Certificate in Astronomy (GradCertAstr)

This is a one-year part-time professional program consisting of 4 units of study: Astronomy 1 (PHY1101); Astronomy 2 (PHY1107); Astrophysics (PHY2204); Science Project (SCI3301)

### Entry Requirements

To be eligible for a place in this program, applicants must have a three-year degree from an Australian or other recognized University or equivalent.



## Postgraduate Research Programs

Research programs leading to Postgraduate Diploma of Science (PGDSc), Master of Science (MSc), Master of Philosophy (MPhil) and Doctor of Philosophy (PhD) are available to students with appropriate qualifications. These programs provide opportunities for motivated and highly qualified students to undertake advanced study to produce a research-based dissertation. Students develop the appropriate research skills and specialist knowledge that will enhance their career prospects.

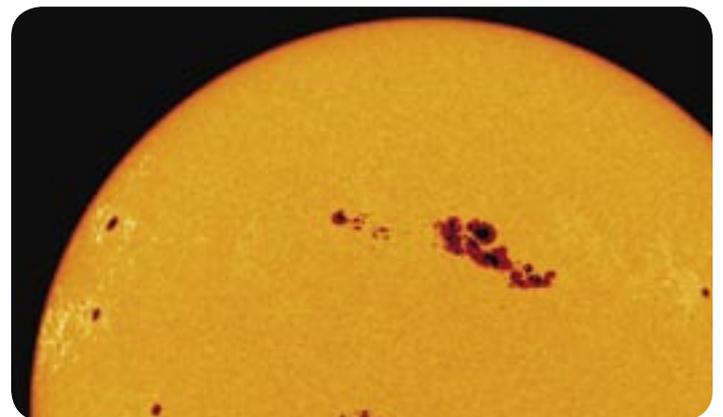
### Program Durations

- PGDSc: Minimum period of one year (full-time) and two years (part-time)
- MPhil: Minimum period of one year (full-time) and two years (part-time)
- MSc: Minimum period of two years (full-time) and four years (part-time)
- PhD: Minimum period of three years (full-time) and five years (part-time)

### Entry Requirements

Entry requirements differ between these postgraduate programs and prospective candidates should consult the University Handbook for details. As the programs are based on supervision by a principal and an associate supervisor, it is essential that intending candidates clarify their topic of research and seek an academic staff member able to provide supervision. Details of Staff and their Research Interests can be found at <http://www.usq.edu.au/sciences/biophysci/research/interests.htm>

Application forms and advice on procedures for enrolment may be obtained from the Office of Research and Higher Degrees.



## DESCRIPTION OF SOME COURSES IN THE BACHELOR OF SCIENCE (PHYSICS) & GRADUATE CERTIFICATES

### ASTRONOMY 1 (PHY1101)

The course provides a general introduction to observational astronomy and planetary science. A range of topics is covered, so that the diverse nature of the subject can be appreciated. The course also offers students an opportunity to practice astronomical observation. The course includes study of the following topics: The Universe; The Sky; The History of Astronomy; The Scientific Method; Observatories; The Solar System; The Terrestrial Planets; the Jovian Planets; Interplanetary Bodies; Extrasolar Planets. This course is a companion subject to PHY1107 Astronomy 2, which provides an introduction to the Sun and stars, galaxies and cosmology.

### PHYSICS CONCEPTS (PHY1104)

Physics is a fundamental science and is concerned with the basic principles of science and technology. This introductory course provides students with an understanding of basic physics principles. The use of physics concepts for problem solving and exercises, based on real-life applications, is provided.

### PHYSICS AND INSTRUMENTATION (PHY1911)

Physics is the science dealing with natural laws and processes. Its universal principles are fundamental to science, engineering and technology. The principles remain useful despite technological change, and sometimes underpin major advances in technology. This course provides instruction in physics, emphasising the practical role of applied physics. Key physical concepts are discussed and examples given of how physics is of practical benefit, including the role of physics in instrumentation and measurement. The course content includes discussion of topics in the following areas of physics: mechanics, thermodynamics, electromagnetism, optics and modern physics. This calculus-based course builds on concepts introduced in PHY1104 Physics Concepts and prepares students for second level physics studies.

### OPTICAL PHYSICS (PHY2202)

This laboratory-based course builds upon the theory developed in first year Physics. The focus of the course is on wave optics and electromagnetic theory. Some of the topics covered include: interference, coherence, diffraction, light scattering, polarization, Fourier optics and applications of lasers.

### ASTROPHYSICS (PHY2204)

Astrophysics combines astronomy and physics to provide an in-depth understanding of our universe. Astrophysics is an extremely active area of physics research and deals with such profound scientific issues as the Big Bang, dark matter, dark energy, the origins and fate of the Sun and planet Earth, and the search for planets and life beyond the Solar System. This course on astrophysics includes both theory and observation, and addresses selected key concepts in planetary science and stellar, galactic & extragalactic astronomy. The topics in this course are addressed through problem-solving and some astronomical observation using a robotic telescope remotely accessible over the web.

### QUANTUM AND SOLID STATE PHYSICS (PHY3301)

The first part of this course discusses topics necessary for the student to gain an understanding of the experimental foundations of quantum physics along with the necessary theory to explain the behaviour of atoms and sub-atomic particles and how this relates directly to larger scale phenomena and applications. The second section of this course examines the properties of matter in the solid state and seeks to understand them in terms of the concepts of physics that students will have encountered in their previous studies. A series of practical exercises are undertaken to demonstrate some of the principles involved.

### REMOTE SENSING & METEOROLOGY (PHY1102)

This course provides a basic understanding of remote sensing and meteorology which is necessary in evaluating global change in the world environment. No prior knowledge of mathematics or physics is required. Concepts covered in the course include the physics of data acquisition, image processing, remote sensing applications, physics of the atmosphere, synoptic and sub-synoptic-scale processes.

### ASTRONOMY 2 (PHY1107)

This course provides an introduction to such topics as the sun and stars, black holes, galaxies, the universe, cosmology and the Big Bang, with an opportunity for astronomical observation. The course content includes the following: the sun, the stars, star-birth, stellar evolution, neutron stars, black holes, our galaxy, galaxies, quasars, cosmology, the early universe and the search for extraterrestrial life.

### ELECTROMAGNETICS (PHY2201)

This laboratory-based course builds upon a previous knowledge of both first-year physics and mathematics to consolidate a rigorous understanding of both circuit and electromagnetic theory. Some of the topics covered include A.C. Circuits, microwave applications and Maxwell's equations.

### ATOMIC PHYSICS (PHY 2203)

This course discusses topics necessary for the student to gain an understanding of the fundamental building blocks of matter. The concepts studied are related to the structure and properties of both the atom and the nucleus. A range of current applications are discussed in order to clarify and support the theories. A series of compulsory practical exercises are undertaken to demonstrate the principles involved.

### ELECTROMAGNETIC CONCEPTS (PHY2205)

This course builds upon a concurrent knowledge of both physics and mathematics to consolidate an understanding of electromagnetic theory, geometrical and wave optics for Scientists, Engineers and Science Teachers. Attendance at residential school is not required for this course. Some of the topics covered include Maxwell's equations, A.C. circuits, lens design, optical systems, light scattering, polarization, Fourier optics and applications of microwaves and lasers.

### ADVANCED TOPICS IN PHYSICS (PHY3302)

The topics to be covered are Cloud Physics and UV Radiation Physics. Each topic builds on some of the material in previous courses and provides examples of in-depth applications. Cloud Physics will discuss cloud monitoring and influence of Clouds on UV. The UV radiation section will include topics on solar UV, Spectroradiometry, broad band metres and UV dosimetry.