The School of Engineering, Computer and Mathematical Sciences at AUT offers undergraduate and postgraduate study in astronomy.

Modern astronomy as a discipline encompasses a vast range of mathematical and computer science applications and complements the existing majors within the Bachelor of Mathematical Sciences/Bachelor of Science. The objectives of the astronomy major are to ensure that you have a good grasp and understanding of both the basics and current trends in astronomy and astrophysics. As a student of the Astronomy major you will be introduced to the specialisations of AUT’s Institute for Radio Astronomy and Space Research, which include radio astronomy, astrophysics and space geodesy. You have the opportunity to use the AUT Warkworth Radio Astronomical Observatory – the only New Zealand radio astronomical observatory. You will develop practical skills in modern astronomy and radio astronomy that will enable you to work in optical and radio astronomical observatories and research institutions worldwide. The statistical, mathematical and computational skills you develop through this major are readily transportable to many other fields of work, including finance, economics or engineering. People with these skills are always in demand. Postgraduate study in a specialist subject in astronomy, astrophysics or radio astronomy is also an option.
ASTRONOMY MAJOR PAPERS

**ASTR500 Introductory Astronomy**
Introduces you to the wonders of the Universe and equips you with the basic concepts and principles of astronomy. Describes and explains cosmic cycles and ‘rhythms’, the origin of matter and time, formation of galaxies, stars and the Earth. An introduction to the history of astronomy and Māori cosmology will provide an appreciation of the contemporary place of astronomy and a framework for understanding how the modern body of astronomy knowledge has developed.

**PHYS500 Physics I**
Topics covered include particle kinematics, Newtonian dynamics, work and energy, gravitation, collisions and momentum, torque and angular momentum, rigid-body statics and dynamics, harmonic oscillations, mechanical waves, sound waves, thermal processes, laws of thermodynamics and entropy.

**ASTR600 Computational Spherical Astronomy**
This paper covers some of the most fundamental topics that astronomers can’t do without. They include the basics of observational and positional astronomy such as coordinate systems and their transformations, parallax, precession and aberration, sidereal time, time-keeping and calendar, the basics of celestial mechanics such as Kepler’s laws, two-body orbital motion and binary star orbits. Computational aspects of these topics are emphasised.

**PHYS600 Physics II**
Topics covered include electrostatics, magnetostatics, DC and AC circuits, time-varying fields, Maxwell’s equations, electromagnetic waves, geometric optics, interference and diffraction, the quantum nature of particles and light, atomic and nuclear phenomena.

**ASTR601 Astrophysics**
The paper examines the fundamental concepts and principles of astrophysics. Students develop problem-solving skills in radiative processes, stellar structures and evolution, physics of the Solar System, galactic structure and evolution, and cosmology.
**ASTR700 Practical Astrophysics**

The principles and practice of observational astronomy and astrophysics are covered with a focus on the design and synthesis of instruments for specific observational programmes. Topics include telescopes (optical and radio), multi-wavelength radiation detectors, gravitational and neutrino detectors, methods of CCD photometry and astrometry, principles and methods of spectroscopy and astronomical data analysis techniques, polarimetry, magnetometry and solar observational techniques.

**ASTR701 Radio Astronomy**

Provides an understanding of the principles and practice of radio astronomy starting from a review of the radio astronomical Universe: the Sun and planets, gaseous nebulae, pulsars, masers, radio galaxies and quasars and cosmic microwave background radiation. Topics include radio spectroscopy, the design of radio telescopes and the application of interferometric techniques to the analysis of synthesis imaging. Students have access to the AUT Warkworth Radio Astronomical Observatory and learn about the principles and operation of radio telescopes.

**ASTR702 Frontiers of Astronomy**

Examines different aspects of modern astronomy and astrophysics by surveying topics that are at the cutting edge of current research. Topics include microarcsecond astrometry, numerical and quantum cosmology, microlensing, exoplanets, active galactic nuclei and relativistic jets, X-ray and γ-ray astronomy, dark matter and dark energy, pulsars and magnetars, SETI, optical and radio telescopes of the future.

**ASTR703 Research Project in Astronomy**

As a final-year student, you can undertake an individual research project in a specialist area of astronomy, under the supervision of a member of staff. This 30-credit paper will allow you to explore in depth a research topic or area, design scientific and/or computational experiments, and submit a project report detailing your findings. All the astronomy resources of AUT will be made available to you as a project student. It may also be possible for you to use internationally available astronomy resources, subject to agreement.
RESOURCES

Astronomical observational resources at AUT include two large (12-metre and 30-metre) world-class radio telescopes and an optical telescope. Students have access to online resources in astronomy and to international virtual observatories. Auckland’s Stardome Observatory and Planetarium welcome AUT astronomy students making use of their facilities.

LEARNING OUTCOMES

• A sound understanding of the main body of knowledge in astronomy, astrophysics and radio astronomy
• Sound practical (observational) skills in astronomy, astrophysics and radio astronomy
• A sound knowledge of the theoretical basis for applications involving mathematics and computing in astronomy and radio astronomy
• The ability to understand, develop and implement effective models and algorithmic solutions to solve problems in astronomy and radio astronomy
• The ability to select appropriate statistical, mathematical and computational techniques to carry out astronomical and radio astronomical data acquisition and analysis.
MORE INFORMATION

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