

**AUT**

A FUTURE IN  
**ASTRONOMY**





## WHAT COULD A CAREER IN ASTRONOMY BE LIKE?

Humans have always looked to the stars for inspiration, and astronomy and space research have provided many of the most amazing scientific discoveries that have become part of our knowledge about the universe.

Modern astronomy is a fundamental science with a strong grounding in physics, computer science and mathematics. High-performance computing and broadband networking play a significant role in processing and transferring astronomical data, as well as in generating images that astronomers utilise. This means that the skills gained in the study of astronomy are highly transferable to other industries, notably software development and data management.

The number of astronomy and radio astronomy related projects worldwide points to a Golden Age of space research. Massive developments like the Square Kilometre Array have necessitated a strong demand for highly skilled technicians, engineers and researchers in the field of astronomy, with specialised areas such as radio astronomy, astrophysics, astrometry, astrospectroscopy, space geodesy, big data and astronomical imaging, providing vast and fascinating global opportunities.

Are you intrigued by the cosmos and the wonder of what might be out there? Do you have a scientific and enquiring mind? Would you like to develop exceptional software and data analysis skills through the study of astronomy? Can you see yourself at the forefront of space research? If so, a career in astronomy could be great for you.





## OUTLOOK AND TRENDS

**Square Kilometre Array (SKA)** – is a radio telescope project that will be built in Australia and South Africa, and will be able to survey the sky more than 10,000 times faster than ever before. It will require very high performance central computing engines and long-haul links with a capacity greater than the current global internet traffic.

High Performance Computing technology design for the SKA is being investigated by AUT, in collaboration with international organisations and other New Zealand universities (Auckland, Massey and Otago) and companies (Compucon, GreenButton, OpenParallel, and others).

**Dynamic earth and space geodesy** – is the study of plate tectonic motion and irregularities in the Earth's rotation, and is being conducted in close collaboration with Geoscience Australia, GNS Science and Land Information NZ (LINZ). There are ongoing projects in collaboration with many research institutes around the world.

**Physics of the interstellar matter** – involves theoretical and observational study of highly-excited states of atoms (Rydberg atoms) and molecules (masers) in both ionised and molecular clouds in the Milky Way Galaxy and extragalactic radio sources. Part of this work is included in the GASKAP project of the Australian SKA Pathfinder and the long-baseline science of SKA.

### **Radio astronomy and Very Long Baseline**

**Interferometry (VLBI)** – the structure of our galaxy can only be deduced from studies of radio waves that enable us to penetrate the thick layers of dust and gas that block our view in the optical and other portions of the electromagnetic spectrum. Fundamental theories of physics can in many cases only be tested in the extremes that are impossible to achieve in the laboratory, but are common for deep space objects. The technique of VLBI is also essential in the development of geophysical models of Earth crustal movements and Earth rotational dynamics, providing a means of establishing the necessary fundamental frame of reference.

### **AUT involvement**

VLBI and its modern version, real-time e-VLBI, continues to provide engineering challenges, requiring very high speed data communications, high speed and massive data storage, advanced data processing methods, ultra precise timing systems and extremely sensitive receivers operating at radio frequencies. It provides an ideal vehicle for driving developments in the areas of high speed data communications, supercomputing and advanced microwave and RF design. To facilitate the development of these sciences and technologies in New Zealand, AUT has established an Institute for Radio Astronomy and Space Research (IRASR) and the Warkworth Radio Astronomical Observatory (WRAO). WRAO operates two modern world-class radio telescopes with 12 and 30 metre dishes in diameter.

## WORK SETTINGS

Specific employment areas include the following:

- Research organisations
- Planetariums
- Laboratories
- ICT sector
- Universities

Professionals in this field usually work regular office hours, but may have to work some evenings and weekends to meet astronomical observation requirements and project deadlines.



## CAREER ROLE EXAMPLES

**Astronomer** – engaged in the scientific study of the universe, which could involve research, teaching, and working on the technical aspects of astronomy and radio and/or optical astronomy equipment design and maintenance. This would almost always require a postgraduate qualification.

**Observatory technician/engineer** – designs, maintains and repairs all technical equipment in astronomical and radio astronomical observatories, including optical and radio telescopes, specialised apparatus and software systems.

**Planetarium lecturer** – involved in teaching diverse groups of people at planetariums, along with research and promotion of awareness of astronomy and related fields.

**Software engineer and developer** – designs and maintains various types of astronomical software systems, as well as writing software codes for new applications and products.

## SKILLS AND KNOWLEDGE

### Technical skills

- Well-developed knowledge of astronomy, radio astronomy, physics and mathematical modelling
- Excellent grasp of practical astrophysics
- Programming and software development skills
- Knowledge of statistical data analysis methods
- Expertise with big data and databases

### General skill requirements

- Ability to work in a team
- Excellent communicator, particularly in explaining complex ideas to clients or co-workers who may not understand technical terms
- Strong project management skills
- Hands-on practical aptitude
- Competent time management and organisation, especially the ability to prioritise
- Capable problem-solver

## PERSONAL QUALITIES

- Scientifically engaged with above average mathematical ability
- Logical, methodical and precise
- Flexible and quick to adapt to new projects or changing requirements
- Objective, enquiring and open to new ideas

## SALARY GUIDE

	Salary (per year)
Astronomer/technician	\$50,000 (starting)
	\$80,000 (intermediate)
	\$110,000 (senior)
Software developer	\$45,000 – \$60,000 (junior),
	\$60,000 – \$80,000 (intermediate),
	\$80,000–\$110,000 (senior)

Source – Hudson Salary Guide 2015

Salary range is indicative of the New Zealand job market at the time of publication (early 2016) and should only be used as a guideline.

## THE AUT APPROACH

AUT's Warkworth Observatory, which is linked to New Zealand's most powerful super computers, has two large professional radio telescopes – the only radio telescopes in the country. It enables AUT's Institute for Radio Astronomy and Space Research (IRASR) to receive and process enormous amounts of data from deep space, used for cutting-edge research in astrophysics and earth science.

AUT is part of a global astronomy network that conduct cutting edge space research, and has close ties to organisations like NASA (National American Space Administration), SpaceX, CSIRO (Commonwealth Scientific and Industrial Research Organisation), ESA (European Space Agency) and others.

Final-year students conduct a research project that may involve a placement in an employer organisation like those mentioned above. This project involves an investigation into a scientific problem where skills in experimental design, literature searching, the collection, treatment, interpretation and reporting of results would be necessary.

## FURTHER STUDY OPTIONS

For those wanting more specialised study, postgraduatelevel programmes include Graduate Certificate and Graduate Diploma in Science, Master of Science, Master of Mathematical Sciences, Master of Philosophy, and Doctor of Philosophy in Astronomy.

Research areas include astrophysics, radio astronomy, interstellar matter, stellar atmospheres, statistical and atomic physics, spectroscopy and space geodesy.

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## KRUPA NAYAK

Licensing Analyst, Accordo Group Ltd

Bachelor of Mathematical Sciences in Astronomy and Applied Mathematics

"Growing up I was always fascinated with the night sky. I was curious about how stars were formed as well as how we came to be here. I loved mathematics and physics at school, and when I heard AUT was offering a new degree in Astronomy I decided to try it.

We learned a lot about the cosmos and stars of course, but it was also about dealing with large amounts of data – using software to separate it, categorize it, and analyse it.

After graduating I took up a Licensing Analyst position at Accordo, which is a software license compliance company. This means that I analyse software license ownership on behalf of some global software giants. My job focuses on reconciliation analysis which involves matching installation data with true ownership, creating customized reports, analysing customer license contracts and creating recommendations on how to reconcile licensing entitlements. This is a complex role and involves heavy calculations, especially with respect to server virtualization. Every day presents new challenges but I feel like I'm learning a lot about data management and accuracy.

The Astronomy program at AUT has equipped me with numeracy and data analysis skills for my current role and both have helped show me that there is real continuity between this field and data and software, which are huge industries. I want to continue to develop in this role as I feel my current job is giving me concrete skills that will be transferable to a career in Astronomy research. I'm passionate about Cosmology and I would potentially return to study at postgraduate level."

## EMPLOYER COMMENT

Study of software licensing is not offered at university, so we require graduates for our license analytics team who have solid technical backgrounds. Those who thrive in this role are people who, like Krupa, have already demonstrated excellence in a complex, data-driven field.

In this role, it's important to be able to review and analyse large amounts of data, learn about and understand a wide variety of different IT environments, perform calculations based on complex licensing rules, use several different software tools to validate information, and draw it all together appropriately in a customer-facing report.

Attention to detail, a thirst for continuous learning and a penchant for excellence are also key success drivers for this team.

**Joanna Smith**

People and Capability Manager, Accordo Group



## USEFUL WEBSITES

**Institute for Radio Astronomy and Space Research**

[www.irasr.aut.ac.nz](http://www.irasr.aut.ac.nz)

**GNS Science**

[www.gns.cri.nz](http://www.gns.cri.nz)

**Land Information New Zealand (LINZ)**

[www.linz.govt.nz](http://www.linz.govt.nz)

**National American Space Administration**

[www.nasa.gov](http://www.nasa.gov)

**SpaceX**

[www.spacex.com](http://www.spacex.com)


## FURTHER INFORMATION

For further information about astronomy and the Bachelor of Science or Bachelor of Mathematical Sciences please visit: [www.aut.ac.nz/astronomy](http://www.aut.ac.nz/astronomy)

### FUTURE STUDENTS

Contact the Future Student Advisory team for more information: [www.aut.ac.nz/enquire](http://www.aut.ac.nz/enquire)


[futurestudents@aut.ac.nz](mailto:futurestudents@aut.ac.nz)

 @AUTFutureStudents

### CURRENT AUT STUDENTS

Contact the Student Hub Advisors team for more information: 0800 AUT UNI (0800 288 864)

[www.aut.ac.nz/enquire](http://www.aut.ac.nz/enquire) | [studenthub@aut.ac.nz](mailto:studenthub@aut.ac.nz)

 @AUTEmployabilityandCareers

### EMPLOYABILITY & CAREERS

For other Future Career Sheets visit:

[www.aut.ac.nz/careersheets](http://www.aut.ac.nz/careersheets)


For employability and career support, AUT students can book an appointment through


<https://elab.aut.ac.nz/>


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The information contained in this career sheet is correct at time of printing, August 2019.

