

# HEROES OF AUSTRALIAN ASTRONOMY

Every day, Australian scientists are hard at work. They are heroes because their research contributes to scientific knowledge and can improve the ways we live. In the field of astronomy, Australian scientists are working to discover more about the universe, how it formed and how it is changing.

## What is astronomy?

Astronomy is the study of outer space and all the stars, planets and other structures in it. Astronomers use huge telescopes to see millions of kilometres into space, discover new objects and find clues about what makes up the universe.

## What have Australian scientists achieved in this field?

Australian scientists have played important roles in astronomy for many decades. In the 1800s, they mapped the southern skies, and from the late 1940s Australian astronomers became world leaders in **radio astronomy**. Their discoveries showed radio astronomy was very useful for studying deep outer space. Australian radio astronomers made many discoveries about the Sun, the Milky Way, **quasars** and **pulsars**.

Today, Australian astronomers are world leaders in large-scale **surveys** of the sky that show how the universe is changing and how **galaxies** form.

## Did you know?

Images of the first Moon landing relayed by the Parkes Radio Telescope were so much better than those from United States telescopes that the Parkes footage was shown around the world.



Australian astronomers at the Parkes Radio Telescope, New South Wales, watch the first Moon walk, part of the *Apollo 11* mission in 1969.

## Who are the Australian astronomers profiled in this book?

Brian Schmidt, Bryan Gaensler, Rachel Webster and Matthew Colless are Australian heroes working in the field of astronomy today. Their work has made great contributions to astronomy, and they have each received prizes or held important positions. You can read about their lives and discoveries in their profiles. Explanations of the science related to their work are included in special 'Science behind it' boxes.

AUSTRALIAN ASTRONOMER	WHAT IS THEIR WORK ABOUT?	WHAT QUESTIONS HAVE THEY ASKED IN THEIR RESEARCH?	WHAT IS THE SCIENCE BEHIND THEIR RESEARCH?
<b>BRIAN SCHMIDT</b>  PAGE 8	How the universe has been expanding since it formed	Is the universe getting bigger at a steady rate? What is the force making it expand faster?	The expanding universe (page 10) Looking into the past (page 11)
<b>BRYAN GAENSLER</b>  PAGE 14	The part <b>magnetic fields</b> play in shaping the universe	How do magnetic fields form in space? Are magnetic fields in space getting stronger?	Magnetic fields (page 15) <b>Neutron stars</b> and magnetars (page 17)
<b>RACHEL WEBSTER</b>  PAGE 20	The structure of quasars Making a map of the sky by looking for hydrogen gas The birth of the first stars	What makes up a quasar? How does the universe look when you study traces of the gas hydrogen? How did the first stars form?	Gravitational lensing (page 21) Quasars (page 23) The 'dark ages' (page 25)
<b>MATTHEW COLLESS</b>  PAGE 26	The large-scale structure of the universe	Where are the universe's galaxies and clusters? Where is <b>dark matter</b> , the matter that we can't see?	Redshift (page 28)

## Other Australian scientists in the field

There are many other notable Australian scientists in the field of astronomy. The achievements of some of them are outlined in the timeline on pages 6 and 7.



# A TIMELINE OF AUSTRALIAN ACHIEVEMENTS IN ASTRONOMY

Discoveries made by scientists today are only possible because of discoveries made in the past. This timeline outlines some important Australian achievements in the field of astronomy over time.

## FROM 60 000 YEARS AGO

Indigenous Australians observe the night sky and use it to tell the seasons. For example, when the constellation Pleiades appeared at dawn, the Pitjantjatjara people of central Australia knew winter had come.

**1768**

**James Cook** travels from England to Tahiti, aboard the HMS *Endeavour*, to observe the planet Venus moving across the face of the Sun, before exploring Australia's eastern coast in 1770.



**1788**

**William Dawes** arrives with the First Fleet and establishes Australia's first **observatory**, at Point Maskelyne (Sydney Cove).

**1946-50**

**Joseph Pawsey, Lindsay McCready and Ruby Payne-Scott** are amongst the world's first **radio astronomers**. They study the Sun's surface.



**1861**

**John Tebbutt** is the first person to observe the 'Great Comet of 1861', which is later named after him. In his career, Tebbutt publishes many more astronomical reports.

**1828**

**James Dunlop** publishes *A Catalogue of Nebulae and Clusters of Stars in the Southern Hemisphere Observed in New South Wales*, which describes many objects in the sky for the first time.

**1947-48**

**John Bolton and Gordon Stanley** discover points in the sky that send out **radio waves**.

**1953**

**John Bolton** locates the centre of the Milky Way.

**1954-57**

Large, cross-shaped radio telescopes are built in New South Wales to study sources of radio waves.



**1969**

Scientists at the Parkes Radio Telescope relay signals from *Apollo 11* as it makes the first Moon landing. The story of the Parkes Radio Telescope and the first Moon landing was later told in the film 'The Dish' (2000).



**FROM 1967**

Australian radio astronomers discover many **pulsars**.

**1963**

**Donald Matthewson and Douglas Milne** find the Milky Way has a **magnetic field** that runs along its arms.

**1962-63**

The Parkes Radio Telescope begins operation and is used to discover many distant **quasars**.

**1957**

**Frank Kerr** helps discover the Milky Way has a spiral structure and arms.

**1970**

**Kenneth Freeman** is part of a team that shows there is **dark matter** in spiral galaxies.

**1978**

The Anglo-Australian Telescope makes the first image of a **neutron star**.

**1983**

**Ron Ekers** leads a team that makes an image of the Milky Way's centre.

**1989**

**Rachel Webster** observes the new technique of microlensing. From 1997 to 2003 she leads a **survey** that discovers many new galaxies.

**1989-99**

**Jeremy Mould** is in a team that find that the universe is about 14 billion years old, using the Hubble Space Telescope. He is awarded the Gruber Prize in Cosmology in 2009 for this work.



**2010**

Building starts on the Australian Square Kilometre Array Pathfinder, for Australia and New Zealand's bid to be home to a massive international telescope, the Square Kilometre Array.

**2006-10**

The WiggleZ Dark Energy Survey, led by **Warrick Couch**, investigates dark energy.

**2005**

**Bryan Gaensler** and his team publish a detailed map of magnetic fields in a small galaxy called the Large Magellanic Cloud.

**2003**

**Naomi McClure-Griffiths** and her team discover the Milky Way has another arm.



**2002**

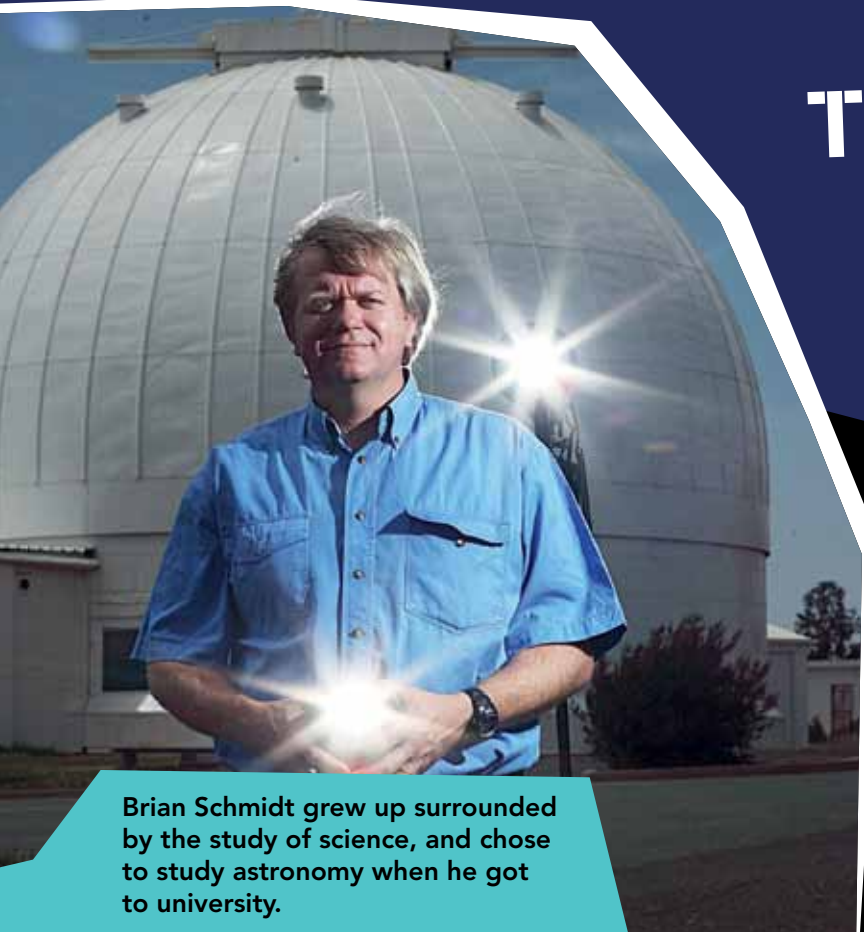
**Matthew Colless** and his team publish the most detailed map ever made of our part of the universe.

**1998**

**Brian Schmidt** and his team discover that the expansion of the universe is speeding up. In 2011, he shares a **Nobel Prize** for this discovery.



# BRIAN SCHMIDT



## The future of the universe

**B**rian Schmidt is an astronomer who received a **Nobel Prize** for his research into how the universe is changing. Astronomers have long known that everything that makes up the universe is moving further apart. However, no one expected Brian's discovery that the universe is moving apart faster and faster!

Brian Schmidt grew up surrounded by the study of science, and chose to study astronomy when he got to university.

### fact file

**Born:** 24 February 1967

**Schooling:** (Helena, Montana, United States) Hawthorn Elementary; (Anchorage, Alaska, United States) Bartlett High School

**Selected achievements:**

Pawsey Medal, Australian Academy of Science, 2000

*The Bulletin's* Scientist of the Year, 2004

Shaw Prize in Astronomy (shared), 2006

Gruber Prize for Cosmology (shared), 2007

Nobel Prize for **Physics** (shared), 2011

### Growing up with science

Brian Paul Schmidt was born and grew up in the United States. He became an Australian citizen in 1999. As a boy, Brian was interested in all types of science. His dad was a **biologist**, and Brian often helped him collect insects on field trips together. From the age of eight, Brian became keen on observing the night sky.

During high school in Anchorage, Alaska, Brian had great science teachers. They helped and encouraged him to do his best. At the end of high school, he got some good career advice: 'do something that you would like to do for free'. He realised that for him this meant studying astronomy.

### Brian's PhD and move to Australia

Brian studied astronomy at the University of Arizona, graduating in 1989. Next, he went to Harvard University to study for his **PhD**. Brian used very sensitive telescopes to study exploding stars, called **supernovae**. While at Harvard, he met and married an Australian economist. Not long after Brian finished his PhD, they moved to Canberra and he began work at the Australian National University.

### The big question: will our universe keep expanding?

In 1994, Brian began to consider whether he could use a particular type of supernovae, called Type Ia supernovae, to study the past and the future of the universe. He decided to compare the movement of distant supernovae with the movement of closer objects. He would find out whether objects were moving faster, the same, or slower in the past. Brian would use the results to answer a question astronomers had been asking for decades: will the universe keep moving apart forever?

### Did you know?

Supernovae are very bright, so astronomers can observe them even when they are billions of **light years** away. Some supernovae are so bright they can be seen in daylight.

Most supernovae occur when a large star has burnt up its fuel. In this image, colours have been added to show the huge amounts of energy and matter released into space when a star explodes and becomes a supernova.

