

Shared Sky Education Resource

In 2009 the world celebrates the International Year of Astronomy. This year marks the 400 year anniversary of Galileo's first observations of the universe through a telescope, as well as forty years since Neil Armstrong first stepped on the moon.

This education resource offers many curriculum links to mark these astronomical events. It provides opportunities to discuss significant developments in astronomy and explores the southern sky from different cultural perspectives, which reflect the complexities of Australia's histories.

The information and discussion points are suitable to use with middle years students (VELS levels 4–6) and for a range of learning areas across the curriculum, including the Arts, Science, History and English.

The discussion points may be used before, after or during your visit to the Shared Sky Exhibition (13 Mar – 2 Aug, 2009) at NGV Australia. It is suggested that teachers select relevant sections of the resource to suit their own curriculum requirements and the needs of their students.

The catalogue for Shared Sky is available for purchase from the NGV Bookshop or online at the NGV Shop.

For details on a range of School Programs, telephone (03) 8620 2340 (weekdays) or email education.

schoolprograms@ngv.vic.gov.au.

Shared stories of the Southern Cross

For thousands of years, people from cultures around the globe have questioned existence and humanity's relationship with the Earth, Sun, Moon and stars.

Through the prisms of science, religion and cultural lore, the night sky continues to offer a site for universal projections of ancient beliefs, nationhood and personal reflection.

Why do you think scientists believe that understanding the universe helps us to understand ourselves and our world?

What is the difference between astronomy and astrology?

Create a timeline of the history of astronomy.

Aboriginal and Torres Strait Islander peoples have observed the night sky for more than 40,000 years. Their knowledge of particular star clusters and constellations has been used for many purposes, including navigation, time keeping and as a means of telling Ancestral narratives for teaching and learning about cultural practices. The movement of stars across the sky has also been used as a calendar to mark the changing seasons and to indicate the availability of food. The stories associated with these star clusters and constellations ascribe specific meanings to the sky of the southern hemisphere. Many Aboriginal language groups hold their own beliefs and interpretations of star clusters observed in the night sky above their lands. Similarities are found in the interpretations of the Milky Way, the constellation of Orion, Pleiades and the Clouds of Magellan. However, there is wide variation in the stories concerning the Southern Cross.

What are the Clouds of Magellan?

Look at works of art by several Indigenous and non-Indigenous artists and compare their depictions and stories of the Milky Way, Orion and other constellations.

The Southern Cross is the best known star group in the southern hemisphere. In Melbourne, it can be seen all year round. It is the smallest of the eighty-eight constellations, but it is made up of some of the brightest stars. It is composed of four main stars, Acrux (Alpha), Mimosa (Beta), Gacrux (Gamma) and Delta. These stars depict the extremities of a Latin cross, although it is also considered to be a kite shape. There is a fifth star, Epsilon, which interferes with the regularity of the cross. Alpha and Beta Centauri, respectively the third and tenth brightest stars in the sky, act as pointers that guide the way to the top of the cross.

In hot Australian deserts, it is often better to walk longer distances through the night than during the day. Investigate how the Southern Cross can be used to find the South Celestial Pole and as a time-telling device.

The stars of the Southern Cross were known to the ancients and visible to equatorial cultures.

In the second century, Greek astronomer Claudius Ptolemy grouped these stars into the rear legs of the constellation of Centaurus. They were sighted in 1515 by Andrea Corsali while on board a Portuguese ship heading for the Indian Ocean and illustrated by Mollineaux of England in 1592. The stars of the Southern Cross were separated from Centaurus to become an independent constellation in 1679 when the French architect and cartographer Augustin Royer officially named them Crux.

Who was Claudius Ptolemy, and what were his major contributions to astronomy?

Use a planisphere to determine the path of the constellation of Centaurus as it travels across the sky in the southern hemisphere.

There are no Greek or Roman legends associated with the Southern Cross, however, many Indigenous stories relate to this group of stars and the dark nebula beside it, known as the Coalsack. On Groote Eylandt, an island situated in the Gulf of Carpentaria in the Northern Territory, the stars of the Southern Cross are known as two fishermen and their cooking fires. To the Ngarrindjeri people of South Australia, the dark shape of the cross is the stingray, Nunamara, and the pointers are the sharks, Ngarakani, which chase the stingray across the sky. The Boorong people of north-west Victoria see Bunya, the ringtail possum, as he hides in a tree after running from Tchingal, the evil emu who terrorised people. The silhouette



of Tchingal is seen in the shadowy expanse of the Coalsack, next to the Southern Cross. For the Kulin people, a federation of five distinct but strongly related communities around Melbourne, the Southern Cross represents Bundjil, who takes the form of an eagle, the creator of people, land, law and language.

Mankokkarrng (The Southern Cross), 1948, is a work on paper by an unknown artist from Oenpelli in Arnhem Land and depicts the constellation in a kite-like configuration. The four large stars are the eyes of the Nangurgal, a group of Star men from the Ancestral period. The Nangurgal went hunting with their sons, who are represented by the smaller stars, and caught a large, non-venomous snake. After they cooked it and ate their meal, the Nangurgal's eyes glowed so brightly

they could be seen by people on Earth. The crescent shape of the snake represents the Milky Way and an adjacent star is the gunark, or fire, on which the snake was cooked.

Unknown
active in Australia (1940s)
Mankokkarrng (The Southern Cross) 1948
earth pigments on paper on cardboard
National Gallery of Victoria, Melbourne
Presented by the Commonwealth Government,
1956



The Southern Cross has been incorporated into the flags of several nations situated in the South Pacific. On the Australian flag, the stars reflect the nation's geographical location and a government based on freedom and democracy. For many, these stars are a familiar and comforting sight, but for those new to this land they can be foreign and unnerving. Ludwig Hirschfeld Mack was born in 1893 in Frankfurt. He fled from Germany to England in 1936 to escape the rise of Nazism. In 1940, he was deported to

Australia as an 'enemy alien' and spent two years in internment camps in New South Wales and Victoria, at Hay, Orange and Tatura. During this time, he made a number of woodcuts that illustrated his life in detention. When creating these works he used the same printing techniques, which he taught art students at the Weimar Bauhaus. One of his most poignant images is the solitary, unidentified figure in *Desolation, Internment camp, Orange N.S.W., 1941*. The blackness that envelops the stars of Southern Cross enhances the sense

of isolation and adversity experienced by the figure enclosed within the fence. A poem written by the artist conveys his despair at being exiled from his homeland.

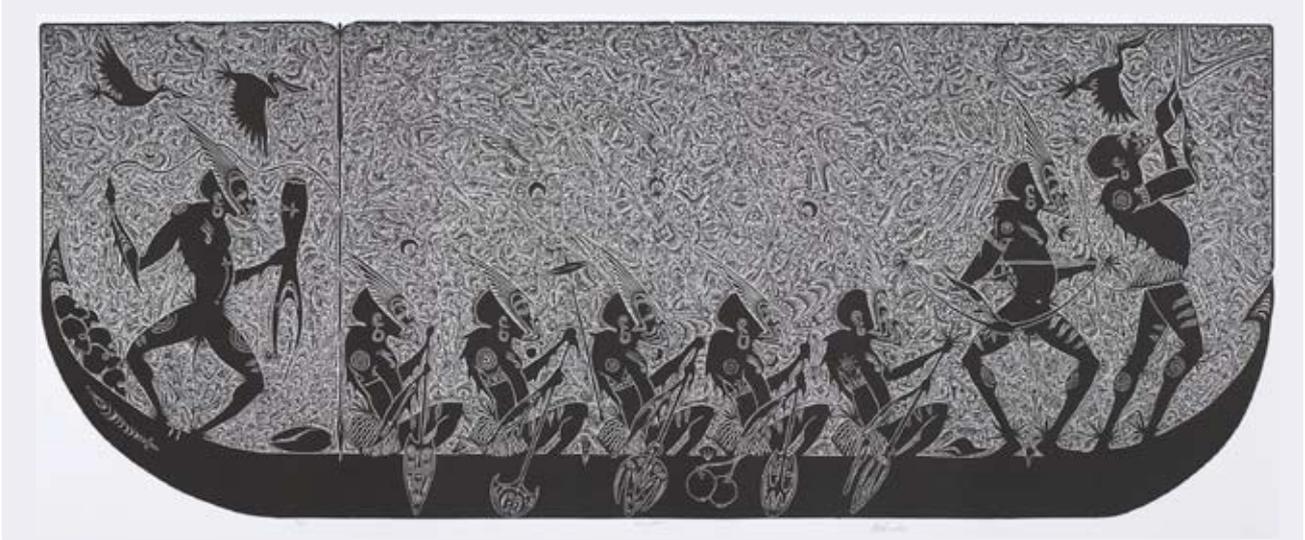
**Closed in,
enclosed in the walls
Under pressure,
oh seize your strength
Hardly a ray of
silver remains
Hope stays out in
France's fields
Look outwards,
O poor soul, abandoned
in distant never
Ending horizons where
You see a distant circle**

Ludwig Hirschfeld Mack in Roger Butler (ed.), *The Europeans: Émigré artists in Australia 1930–1960*, National Gallery of Australia, Canberra, 1997, p. 89.

One of the five finalists for the design of the Australian flag in 1901 was fourteen-year-old Ivor Evans. He used the four stars of the Southern Cross to represent the four moral virtues of justice, prudence, temperance and fortitude, as portrayed by the Italian poet Dante.

Locate Dante's writing about these virtues and explain why Evans used them in his concept for the design of the Australian flag.

Ludwig Hirschfeld Mack
born Germany 1893,
arrived Australia 1940, died 1965.
Desolation: Internment camp, Orange N.S.W. 1941
National Gallery of Victoria, Melbourne, Gift of Mrs Franz
Philipp, 1971, © Estate of Ludwig Hirschfeld Mack



Torres Strait Islanders are great navigators of the sea and customarily used the stars as constant guides on their voyages. In his large-scale linocut, *Zugubal*, 2006, Alick Tipoti has depicted a group of Zugubal navigating by the stars. The Zugubal are Spirit beings, superhuman in their strength and deeds and are represented in the bright stars of Orion and Pleiades which follow the rotation of Thagai around the south celestial pole. The four black crescent moons mark the star cluster of the great Zugub leaders, Thagai and his brother Kang as they move across the sky on an annual cycle. The Southern Cross sits at the end of the spear in Thagai's left hand, and in his right hand is the constellation of Corvus, the crow. The body and tail of Scorpius make up part of the canoe near where Kang sits and Sagittarius forms the anchor.

Locate a range of works of art by both Indigenous and non-Indigenous artists depicting the Southern Cross. Identify what the Southern Cross represents in these works of art.

What is the difference between a woodcut and a linocut?

Alick Tipoti
 Kala lagaw ya born 1975
Zugubal 2006
 linocut, ed. 9/35
 81.0 x 199.7 cm irreg. (block); 106.5 x 220.0 cm irreg. (sheet)
 National Gallery of Victoria, Melbourne
 Purchased, Victorian Foundation for Living Australian Artists, 2008
 © Alick Tipoti courtesy of The Australian Print Network

History of Astronomy

During ancient times, the night sky was the dwelling place of the gods. Ancient Egyptian paintings and stories describe space as a great dome, pierced with holes through which the sparkling lights of the stars shine. Drawings of the cosmos on ancient Sumerian clay tablets indicate that people 5,000 years ago were looking at the night sky as we do today. Roman and Aztec civilisations saw celestial phenomena in the night sky as portents of significant terrestrial events. Spiritual leaders offered interpretations of these occurrences in an attempt to give meaning to the mysteries of life on Earth.

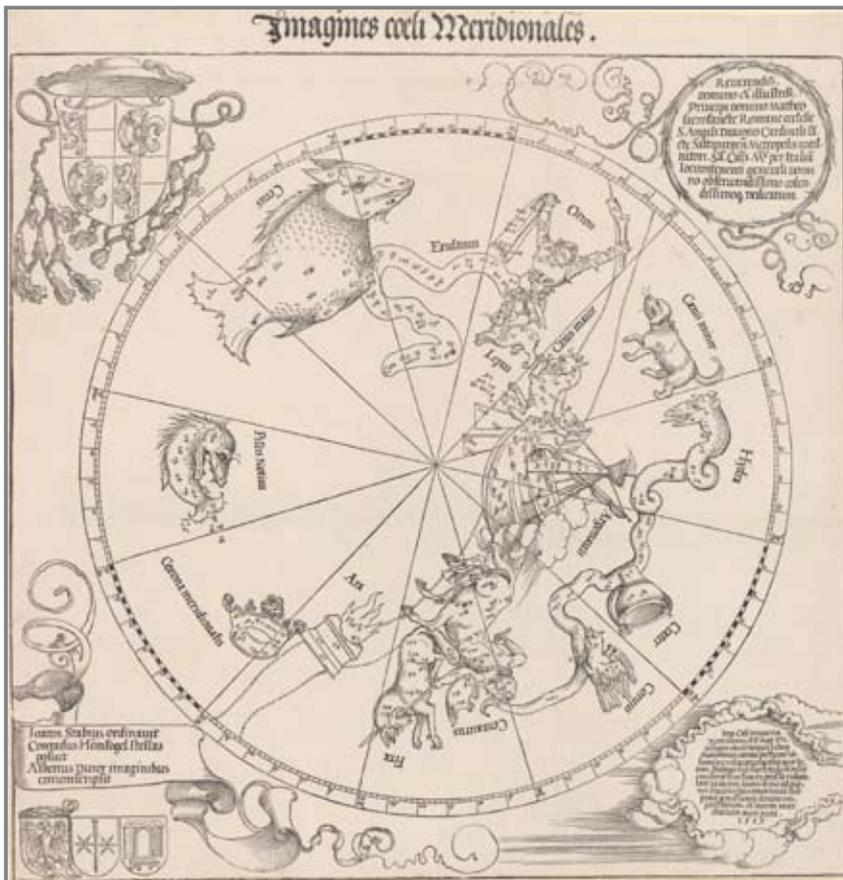
The patterns of the stars were imagined as groupings of animals, people and objects. These spiritual and mythological characters were the custodians of the sky, unlocking secrets through stories. The constellation of Orion, which can be viewed in both the southern and northern hemispheres, was integral to Greek mythology. Orion was the great hunter, son of Neptune, who boasted so loudly of his hunting prowess that Gaia, the Earth goddess, sent a huge scorpion to kill him. In Ancient Egyptian culture, Orion was Osiris, god of light. The Chinese consider the stars of Orion as Tsan, the Chinese Warrior. For the Maori, they delineate a great canoe that moves in celestial space. In Australia, the Yolngu people of Arnhem Land interpret the stars of Orion as *Djulpan*, the canoe that carried two brothers as they fished. These stories helped people remember the positions of the stars as they changed with the seasons and, for nomadic people, trace their movements through the landscape.

Investigate the Ancient Egyptian story of the god Shu and goddess Nut.

Compare western stories about constellations with those from Chinese astronomy. Cultures from around the globe have stories associated with the constellation of Orion.

Make a planisphere and use it to track the path of Orion through the northern and southern hemisphere sky.

As a result of significant technological advances, in the areas of astronomy and space exploration, long held beliefs and theories are challenged and contested. The *Shared Sky* exhibition brings together fragmentary glimpses of the evolution of astronomy and ancient interpretations of the night sky. Today, it can be difficult to appreciate the way the world and space were understood in the past. Our understanding of the cosmos has been greatly shaped by technological advances and discoveries since the Renaissance. Up until the end of the sixteenth century, religion and science understood that all the stars and planets orbited around Earth, with man at its centre.



Albrecht Dürer

Germany 1471–1528

Celestial map of the southern sky (Imagines coeli meridionales) 1515

woodcut, 2nd state of 2

National Gallery of Victoria, Melbourne

Felton Bequest, 1956

Albrecht Dürer's Celestial map of the southern sky, 1515, gives us insights into the artistic and scientific ideas of that time.

Following the Islamic tradition of visualising the stars from an aerial perspective, the constellations are reversed so they appear to be seen from space rather than from Earth. The oldest visual record of western constellations is a second-century Roman sculpture, the Farnese Atlas, that depicts the god Atlas holding up the universe. Rather than placing the stars in their correct positions, medieval illustrators distorted them to create 'pleasing' visuals. Dürer, by contrast, used the accumulated observations of astronomers, philosophers and mathematicians such as Al-Sufi, Ptolemy and Johannes Stabius (1450–1522). Dürer promotes humanist ideals by combining classical elegance and proportion with these astronomical observations. Dürer's maps became the blueprint for many artists and astronomers until the late seventeenth century.

Using the newly invented telescope, the astronomer Galileo Galilei (1564–1642) made careful observations of the sky that began to challenge established teachings and religious beliefs, especially those of the Roman Catholic Church. Galileo did not invent the telescope, but he exploited this new technology, pushing its capabilities to magnify objects from two to three times to an extraordinary factor of thirty-three. This challenged the long held belief that the Earth was at the centre of the universe. Following the investigations of Nicolas Copernicus (1473–1543), Galileo risked his freedom to assert the idea of a sun-centred, or heliocentric, cosmology.

For many centuries, science and religion have debated how the universe was created. Recent scientific discoveries seem to question biblical interpretations. What are the main issues and ideas surrounding this debate?

Why were the earliest depictions of the constellations made using a 'god-like' view?

Research the story of Atlas.

Locate a copy of Dürer's Celestial map of the northern sky (Imagines coeli septentrionales), 1515. Discuss the differences between his depictions of the northern and southern hemispheres.

Who was Abdur Rahman Al-Sufi and what was his contribution to astronomy?

Compare representations of the human form by Dürer and other Renaissance artists. Why were they interested in capturing the human form so naturalistically?

Describe the difference between a Ptolemaic and a heliocentric system.

Celestial bodies have been used throughout history to aid navigation and to facilitate the exploration of distant lands. European people used the stars to investigate lands, such as the Americas, and the fabled great southern land of *Terra australis incognita*. Over centuries, explorers and sailors relied on their mathematical skills and their knowledge of the movement of the stars to calculate their shifting position while at sea. This is called celestial navigation. Explorers used a number of instruments, such as the astrolabe, to measure the position of sun and stars to work out how far they were from the equator and the prime meridian.

Astronomers have known for hundreds of years that Earth orbits elliptically around the Sun. How can this be proven from observations on Earth?

Define the following terms: stellar cartography, stellography

What does celestial mean?

**What is an astrolabe?
Investigate other instruments used for celestial navigation.**

What is the prime meridian?

What is the difference between a star and a planet?

In 1961, the Soviet Union launched Sputnik 1 initiating the space race between two significant global powers. Then in 1969, NASA's Apollo 11 spacecraft was the first manned mission to land on the Moon. Since this momentous occasion, we have witnessed more advances in space investigation and exploration. The launch of the Hubble telescope in 1990 changed the way we view space and our planet within the universe. The telescope captured the frail light emitted from galaxies in the deep space billions of light years away.

In 20 July 1969, the astronaut Neil Armstrong was the first man to walk on the Moon. He famously declared, 'One small step for man, one giant leap for mankind'. What is the significance of this statement?

**What is the Hubble telescope?
Investigate some of the discoveries made by the Hubble.**

Why are we looking back in time when we look into space?

How is distance measured in space?

**Micky Allan**

born Australia 1944

Six galaxies 1988

National Gallery of Victoria, Melbourne

Purchased from Admission Funds, 1988

© Micky Allan/Licensed by VISCOPY, Australia

Micky Allan visualises deep space in *Six galaxies*, 1988. Using pastels, Allan's drawing technique creates subtle tonal variations and the grid imitates the arrangement of nebula and galaxies reproduced in colonial astronomical lithographs. The size and ordered placement of the galaxies contrasts with the random splatters throughout the composition bringing together ideas of order and chaos, the scientific and the spiritual. Describing her work, Allan states:

I wanted to honour the forces and rhythm of nature, their constant flow of transformation and change and the mysterious order deep within apparent chaos, with which I felt in dialogue, co-creating my life.

Micky Allan in Christina Balcombe Davidson, On a clear day, 2005, www.mickyallan.com/Articles/OnaClearDay.html (4/09/08)

Further Activities

The Pleiades

The Pleiades star cluster, also known as the Seven Sisters and Messier 45, is a prominent sight in the northern hemisphere in winter and in the southern hemisphere in summer. The visibility of these stars in the night sky has ensured Pleiades has a special place in many cultures, both ancient and modern.

Below is a table of various interpretations of the stories associated with seven stars of Pleiades even though today only six stars can be seen with the naked eye.

Determine the phases of this star cluster as it moves through the sky of the southern hemisphere.

Compare and contrast the stories associated with Pleiades from different cultural groups. Why do you think some similarities occur?

Culture

Interpretation

Greece

The Seven Sisters were said to be the daughters of Atlas and Pleione, named Alcyone, Electra, Celaeno, Maia, Sterope, Merope and Taygete. They were the virgin companions of Artemis and the objects of Orion's affection. The Greek story tells us that when Orion, the beautiful hunter, pursued them they prayed to the Gods for rescue. The gods answered their prayer by changing them into doves and later into stars.

Russia, Czech Republic and Hungary

This constellation is interpreted as a hen and six chicks.

Pawnee of North America

These and other Native American groups speak of the Seven Brothers of Unity. These people saw the stars as gods who interacted with humans.

Torres Strait Islands

Known as the shark constellation, Pleiades used for navigation and provides knowledge about the seasons for growing fruits and vegetables

Egypt

Representation of the goddess *Net* or *Neith*, the divine mother.

Maori New Zealand

Known as *Matariki*. The Maori New Year is marked by the rise of *Matariki* and the sighting of the next new moon. *Matariki* has two meanings, both referring to a tiny constellation of stars; *Mata Riki* (Tiny Eyes) and *Mata Ariki* (Eyes of God).

Japan

Known as *Subaru*. This star group has also given their name to the car manufacturer whose logo incorporates six stars.

Chinese

Known as *Mao*, the hairy head of the white tiger of the west.

East Africa – Swahili language

Called *Kilimia* which means digging stars.

South Africa

Called *Khuseti* and known as the stars of rain.

Arnhem Land

Tjilulpana or canoe stars covers a large area of the evening sky during the wet season from December to March. Every night during that time the men, *Tjilulpana*, paddle their canoe along the river, the Milky Way, fishing as they go. The men are represented by three stars (the belt of Orion) and the Pleiades as their wives. The fish they have caught are the constellation of the Hyades.

Warakurna, Western Australia

This narrative is about seven women who transformed into stars in an attempt to escape the unwelcome attention of a lustful man/men. The three bright stars of Orion represent the men consigned to forever chase the sisters in the cold night sky.

