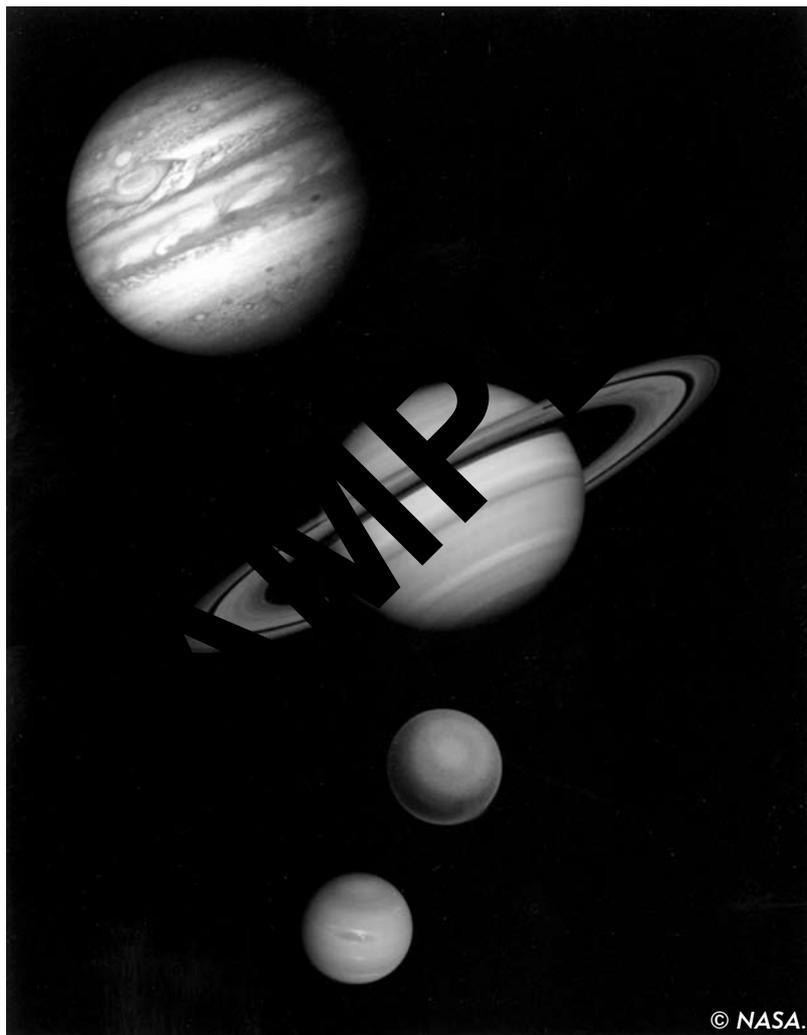


# Super Space

by Jane Bourke



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**SAMPLE**

# The Universe



Supernova Explosion © NASA.

**The universe includes everything; all the matter, light, energy, space and time that exists. It includes our solar system and the galaxy in which it is contained. The solar system is only a small part of the universe. There are probably other solar systems just like ours with planets that revolve around a Sun. The stars we see in the night sky are distant Suns from other galaxies inside the universe.**

No-one knows for sure exactly how big the universe is. Scientists have been able to see objects that are at least 13 billion light-years from Earth. One light-year is equal to 9,460,550,000,000 miles. 12 billion light-years is a long way.

For thousands of years, people thought that the solar system and the universe were the same thing. They thought that stars were just tiny glowing space bodies. It was not until the time of Nicolas Copernicus' theories that people understood that the tiny stars were probably as large as our Sun but just millions of light years away. The Sun is just a typical star.

## How Did the Universe Begin?

No-one is certain how the universe came to be, however, several astronomers and scientists

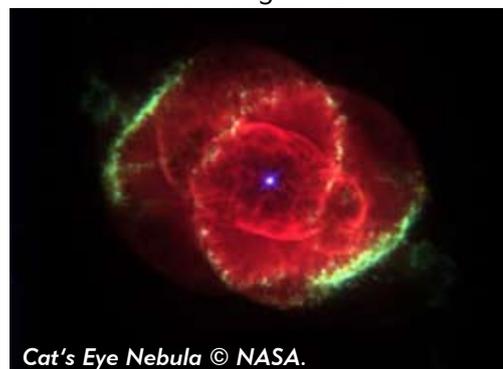
have devoted their whole lives to finding out. New technology, such as improved telescopes and spectroscopes (instruments which examine light and radiation), have led to amazing and significant discoveries about the universe.

## The Big Bang Theory

This popular theory attempts to explain the beginnings of the universe. According to this theory, a huge explosion occurred at least ten billion years ago which sent matter flying in all directions. This theory was first put forward in 1927 by Belgian priest, Georges Lemaître. Then in 1929, American astronomer, Edwin Hubble found evidence to support this idea through his study of the movement of the galaxies.

## The Red Shift

The red shift is an observable change in the light rays from an object - the light appears redder when an object is moving away. By observing the amount of red shift, astronomers can work out the speed at which objects are moving away. The measurement of the red shift has provided evidence that the universe is expanding. Hubble suggested that the red shift could be used to estimate the distance of the galaxies from Earth. Hubble's discovery has led astronomers to believe that galaxies are rapidly moving away from one another as in an explosion. These findings have led many modern scientists and astronomers to the conclusion that the universe is increasing in size.



Cat's Eye Nebula © NASA.

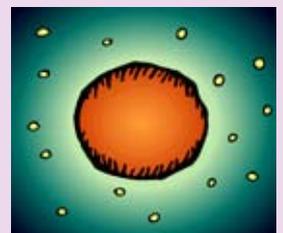


## BECOME A STAR CHILD:

Want to know all about astrophysics?

Explore the fascinating links at the website below:

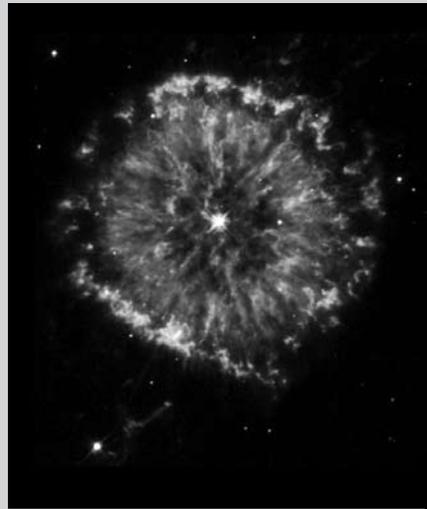
► [starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html](http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html)



# A Star is Born

**Stars are huge. It is hard to even envisage just how big they are.**

When we look at the Sun, it really only appears to be the size of a ball as it is so far away. There are over ten billion trillion stars in the universe and some of them are so huge that they would take up the whole distance between the Earth and the Sun. These massive stars look like tiny pinpricks in the sky because they are so far away. Even the Sun, which is 100 times bigger than Earth, appears to be the size of a basket ball because of its distance from us.

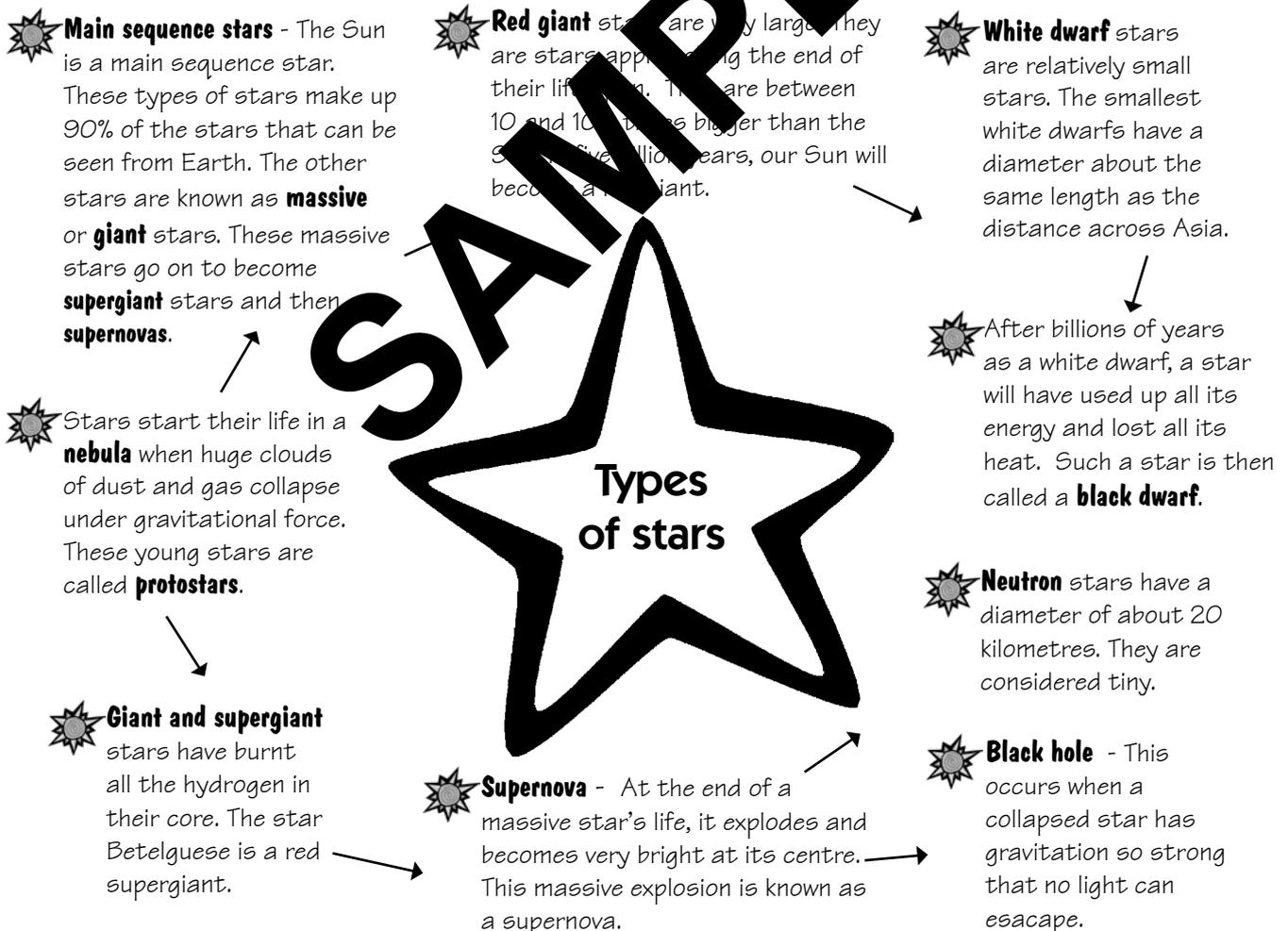


The Glowing Eye - otherwise known as planetary nebula NGC-6751. © NASA.

The stars are there all the time, however the sunlight prevents us from seeing them during the day.

*Alpha Centauri*, the nearest star to our solar system, is more than 40 million kilometres away. Using today's technology, it would take about a million years to fly to it!

Like the Sun, stars are made up of helium and hydrogen gases. Only the brightest stars in the universe can be seen from Earth. Scientists estimate that about 6000 stars are visible from Earth without a telescope. Large telescopes are able to see over 600 000 stars.



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## Jupiter

- Jupiter is the largest planet in the solar system and is the fifth planet from the Sun.
- It has a diameter 11 times larger than Earth.
- Jupiter spins faster than any other planet, rotating once every 9 hours and 55 minutes. This means a day consists of about 10 hours on Jupiter.
- The surface of Jupiter is covered by thick clouds and astronomers believe Jupiter is made of gases (90% hydrogen, 10% helium) and liquid, rather than solid rock.

## Saturn

- Saturn is the second largest planet and is characterised by its remarkable rings. These rings were thought to be unique in the solar system until 1977, when faint rings were discovered around Uranus and shortly after, they were also identified around Jupiter and Neptune. The rings are made of billions of chunks of ice. Originally the rings were thought to be one solid ring.
- Galileo, the Italian astronomer was the first to view Saturn with a telescope. Saturn is rather flat in shape and is not a perfect sphere. Its diameter through the equator is 10% longer than its diameter through the poles.
- It takes 29.5 Earth years for Saturn to make one revolution around the Sun and Saturn spins around on its axis once every 10 hours and 39 minutes.



## Uranus

Uranus was the first planet to be discovered in modern times. It is the most distant planet that can be seen without a telescope.

Uranus is the third largest planet in diameter, however Neptune is larger in mass. This planet is basically a large sphere of gas and liquids.

- It takes 84 years for Uranus to orbit the Sun. Unlike other planets, Uranus is tilted on its axis at 98°. This means that it lies almost flat in its plane or orbit.

## Neptune

- Like Pluto, Neptune cannot be seen without a telescope. Studies have shown that Neptune is made up mainly of hydrogen, helium, water, and silicates. Although silicates are the minerals that make up most of Earth's rocky crust, Neptune does not have a solid surface like Earth. The planet is covered with thick clouds.
- Neptune orbits the Sun once every 167 years. It spins around on its axis (tilted at 30°) once every 16 hours and 7 minutes.



# Eye on the Skies

The Hubble Space Telescope (HST) is a reflecting telescope built as an orbiting observatory. It is controlled by radio commands from NASA's Goddard Space Flight Centre, which is located in Maryland in the United States. During its lifetime, this telescope has become one of the most important science projects ever.

## The Specs

<b>Launched:</b>	April 24, 1990, by NASA's space shuttle Discovery (STS-31).
<b>Repaired:</b>	In 1993 when it was discovered that there were errors in the telescope's original optics.
<b>Mission schedule:</b>	The mission is expected to end in 2010.
<b>Orbit:</b>	Orbits Earth at a distance of 610 kilometres above the surface, escaping the effects of Earth's atmosphere.
<b>Orbit shape:</b>	Circular.
<b>Orbit distance:</b>	593 kilometres.
<b>Orbital time:</b>	Approximately 96 minutes.



Hubble Space Telescope, © NASA.



Everything you ever need to know about the Hubble Space Telescope  
[www.hubblesite.org/](http://www.hubblesite.org/)

For the best Hubble images, be sure to visit this website:  
[www.seds.org/hst/hst.html](http://www.seds.org/hst/hst.html)

## Hubble Discoveries

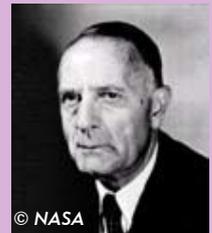
The HST has delivered many amazing images to astronomers and scientists since it was first sent into space. It has paved the way for certain ideas and theories about astronomy and space exploration.

Some significant discoveries:

- ☆ Finding evidence for massive black holes: The discovery was based on observations of Galaxy M87, which is about 50 million light years away from Earth. A light year is the distance that light travels in a year which is about 9.46 trillion kilometres.
- ☆ Astronomers have collected images of Pluto, and of a satellite of Pluto called Charon.
- ☆ HST provided evidence that at least half the young stars in the Great Nebula are surrounded by disks of dust and gas that may one day form planets. The Great Nebula is a cloud of dust particles and gas in the Orion constellation.
- ☆ The expansion of the universe has been measured.
- ☆ HST found proof that gamma-ray bursts occur in galaxies. These spectacular but powerful explosions are equal to all of the Sun's energy generated over its ten-billion-year lifetime!

and now....astronomers are currently searching for stars like our Sun, that have planets revolving around them.

## Who was Edwin Hubble?



© NASA

Edwin P. Hubble (1889 - 1953) was an American astronomer and was the first person to explain that the universe contains star systems other than our galaxy, the Milky Way. He identified certain stars in the Andromeda Nebula as being of the same type as some stars in the Milky Way. However, he proved that the stars in Andromeda were not in the range of our galaxy and that Andromeda must be a separate galaxy. He also discovered that the universe is expanding.