

The chart is orientated for  
Aug. 15 at 10 p.m.  
Sep. 1 at 9 p.m.  
Sep. 15 at 8 p.m.

### Evening sky in September 2020

To use the chart, hold it up to the sky. Turn the chart so the direction you are looking is at the bottom of the chart. If you are looking to the south then have 'South horizon' at the lower edge. As the earth turns the sky appears to rotate clockwise around the south celestial pole (SCP on the chart). Stars rise in the east and set in the west, just like the sun. The sky makes a small extra clockwise rotation each night as we orbit the sun.

Three planets light up the early evening sky. Golden Jupiter is the 'evening star' appearing northeast of the zenith soon after sunset. Saturn appears to its right as the sky darkens. The lone bright star low in the west is Mercury, setting an hour after the sun at the beginning of the month; two hours after sunset at the end. Orange Mars rises around 10 pm at the beginning of the month; before 8 at the end. It is nearly as bright as Jupiter. Arcturus twinkles red and green as it sets in the northwest. Crux, the Southern Cross, and the Pointers are in the south-west. Canopus twinkles like a diamond near the southern horizon. Vega shines on the opposite horizon.

## The Evening Sky in September 2020

Golden **Jupiter** is the 'evening star' appearing northeast of overhead at dusk. To its right is fainter **Saturn**, appearing as the sky darkens. Low in the west is **Mercury** looking like a lone bright star. It slowly moves higher through September, setting an hour after the sun at the beginning of the month and more than two hours after sunset at the end. Orange **Mars**, nearly as bright as Jupiter, moves into the eastern evening sky through the month. At the beginning of the month it rises around 10 pm. By the end it appears around 8. The full moon will be near Mars on the 6th. It will be level with Mercury on the 19th and close to Jupiter on the 25th.

Jupiter and Saturn are always worth a look through a telescope. Jupiter's four 'Galilean' moons appear lined up on either side of the planet. Saturn looks oval in binoculars. More magnification separates the ring from the planet and may show Titan, Saturn's biggest Moon, four ring-diameters from Saturn. Jupiter is 690 million km away and Saturn 1410 million km away. Mars is 67 million km away, mid-month, nearly its closest this year. In a telescope it appears as a small disk with some dusky markings. The remnant of its south-pole frost cap might appear as a white spot on the edge of the disk.

**Canopus**, the brightest true star in the sky, skims along the southern skyline twinkling all colours as the air breaks up its white light. It is matched on the northern skyline by **Vega**. In the northwest is **Arcturus**, often twinkling red and green as it sets. Canopus is a truly bright star: 13 000 times the sun's brightness and 300 light years\* away. Vega is 52 times brighter than the sun and 25 light years away. From northern New Zealand the star **Deneb** can be seen near the north skyline. It is the brightest star in **Cygnus** the Swan. Deneb is around 1400 light years away and 50 000 times brighter than the Sun.

Orange **Antares** is northwest of the zenith. It marks the body of Scorpius. The Scorpion's tail hooks toward the zenith like a back-to-front question mark. It is the 'fish-hook of Maui' in Maori star lore. Antares is a red giant star: 600 light years away and 19 000 times brighter than the sun. It is a relatively cool 3000 C, hence its red-hot colour. Below or right of the Scorpion's tail is 'the teapot' made by the brightest stars of **Sagittarius**. It is upside down in our southern hemisphere view.

Midway down the southwest sky are 'The Pointers', Beta and **Alpha Centauri**. They point down to **Crux** the Southern Cross. Alpha Centauri is the third brightest star (but fainter than the bright planets.) It is also the closest of the naked eye stars, 4.3 light years away. Beta Centauri, along with most of the stars in Crux, is a blue-giant star hundreds of light years away.

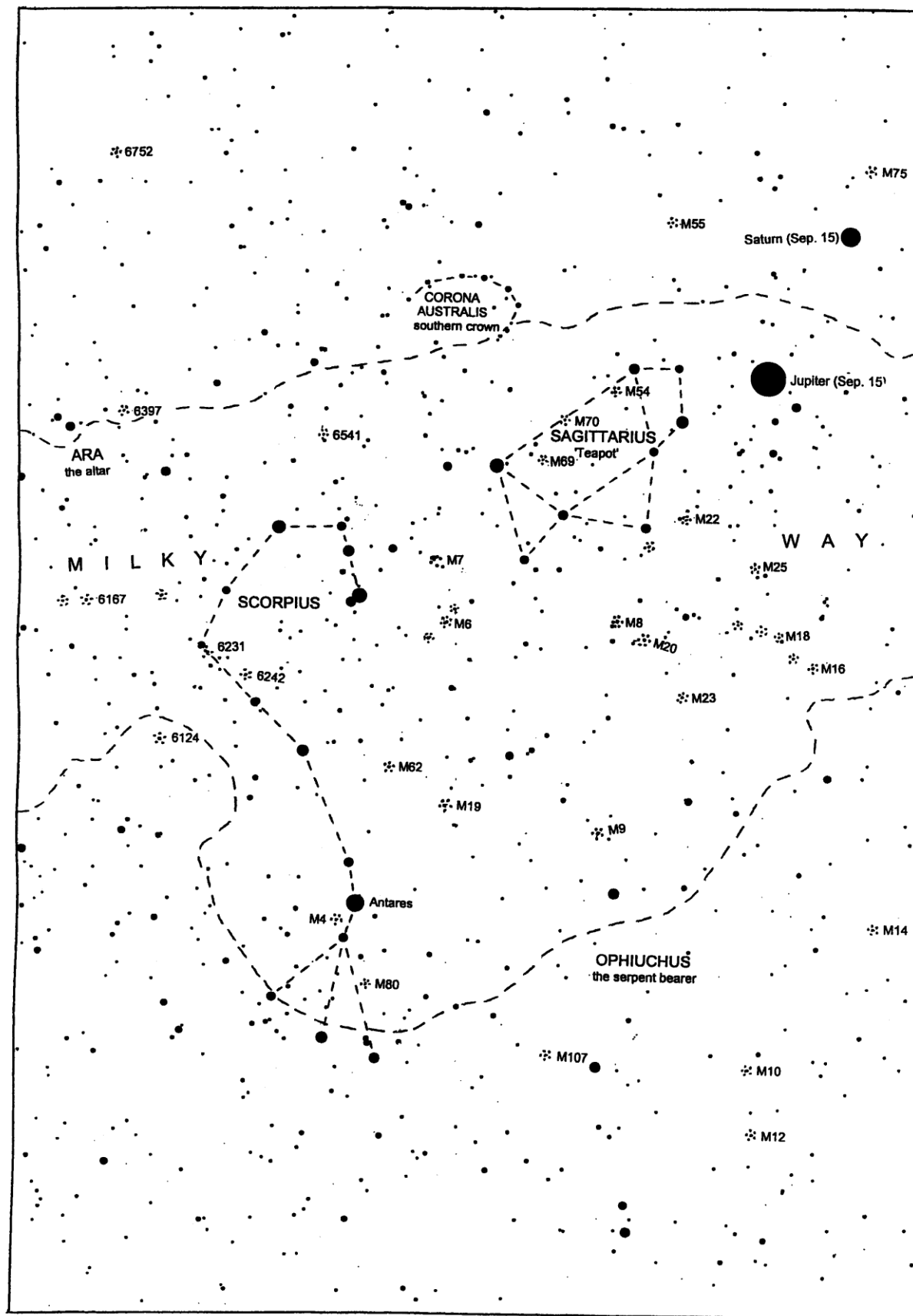
The **Milky Way** spans the sky from north to south. It is brightest and broadest overhead in Scorpius and Sagittarius. In a dark sky it can be traced down past the Pointers and Crux into the southwest. To the northeast it passes **Altair**, meeting the skyline right of **Vega**. The Milky Way is our edgewise view of the galaxy, the pancake of billions of stars of which the sun is just one. The thick hub of the galaxy, 27 000 light years away, is in Sagittarius. The actual centre is hidden by dust clouds in space. Binoculars show many clusters of stars and some glowing gas clouds in the Milky Way.

The Large and Small Clouds of Magellan, **LMC** and **SMC**, look like two misty patches of light in the south sky. They are easily seen by eye on a dark moonless night. They are galaxies like our Milky Way but much smaller. The LMC is about 160 000 light years away; the SMC about 200 000 light years away.

On moonless evenings in a dark sky the **Zodiacal Light** is visible in the west. It is a faint broad column of light surrounding Mercury and extending upward toward Libra. It is sunlight reflecting off meteoric dust in the plane of the solar system. The dust may have come from a big comet, long ago.

Brilliant **Venus** is the brightest 'star', by far, in the dawn sky. It rises around 5 a.m. Venus is bright enough to see in daylight. At 10 a.m. it is due north and about 30° above the north horizon.

\*A **light year (l.y.)** is the distance that light travels in one year: nearly 10 million million km or  $10^{13}$  km. Sunlight takes eight minutes to get here; moonlight about one second. Sunlight reaches Neptune, the outermost major planet, in four hours. It takes sunlight four years to reach the nearest star, Alpha Centauri.



### The Sky North of Overhead at Evening in September 2020

The chart shows the sky north and west of the zenith at nightfall. Jupiter is a beacon for the region. It is the brightest 'star' in the evening sky. Saturn is beside it. The Milky Way is here bright and broad as we look toward the centre of the galaxy. Many star clusters and a few nebulae (glowing clouds) are seen, some obvious to the naked eye. Those visible in binoculars or small telescopes are indicated with asterisks.

Chart produced by Guide 8 software; [www.projectpluto.com](http://www.projectpluto.com). Labels added by Alan Gilmore, University of Canterbury's Mt John Observatory, P.O. Box 56, Lake Tekapo 7945, New Zealand. [www.canterbury.ac.nz](http://www.canterbury.ac.nz)

## Interesting Objects North and West of Overhead in September 2020

**Jupiter**, northeast of overhead at dusk, is the brightest 'star' in the evening sky. **Saturn** is the 'star' just to the right of Jupiter. Jupiter is moving eastward faster than Saturn so the gap between the two is closing. By the end of the year they will be in the same telescope view.

**Antares** is the orange star west of overhead. It is a bit fainter than Saturn and marks the body of **Scorpius**. In the evening around this time of year the Scorpion has its tail curled around the zenith and its head down into the western sky. The sting is the near-vertical line of bright stars pointing toward Antares. In Maori star lore the tail is the 'fish hook of Maui'.

Antares is a 'red giant' star. It is 600 light years away (l.y.), 19 000 times brighter than the sun, and big enough to fill Earth's orbit. Its mass or weight is about 12 times that of the sun, so most of the star is very thin gas spread around a hot dense core. Red giants are the last stage in the evolution of stars. The dense core of the star has shrunk and heated while the outer regions of the star have expanded to a very spread-out red-hot gas.

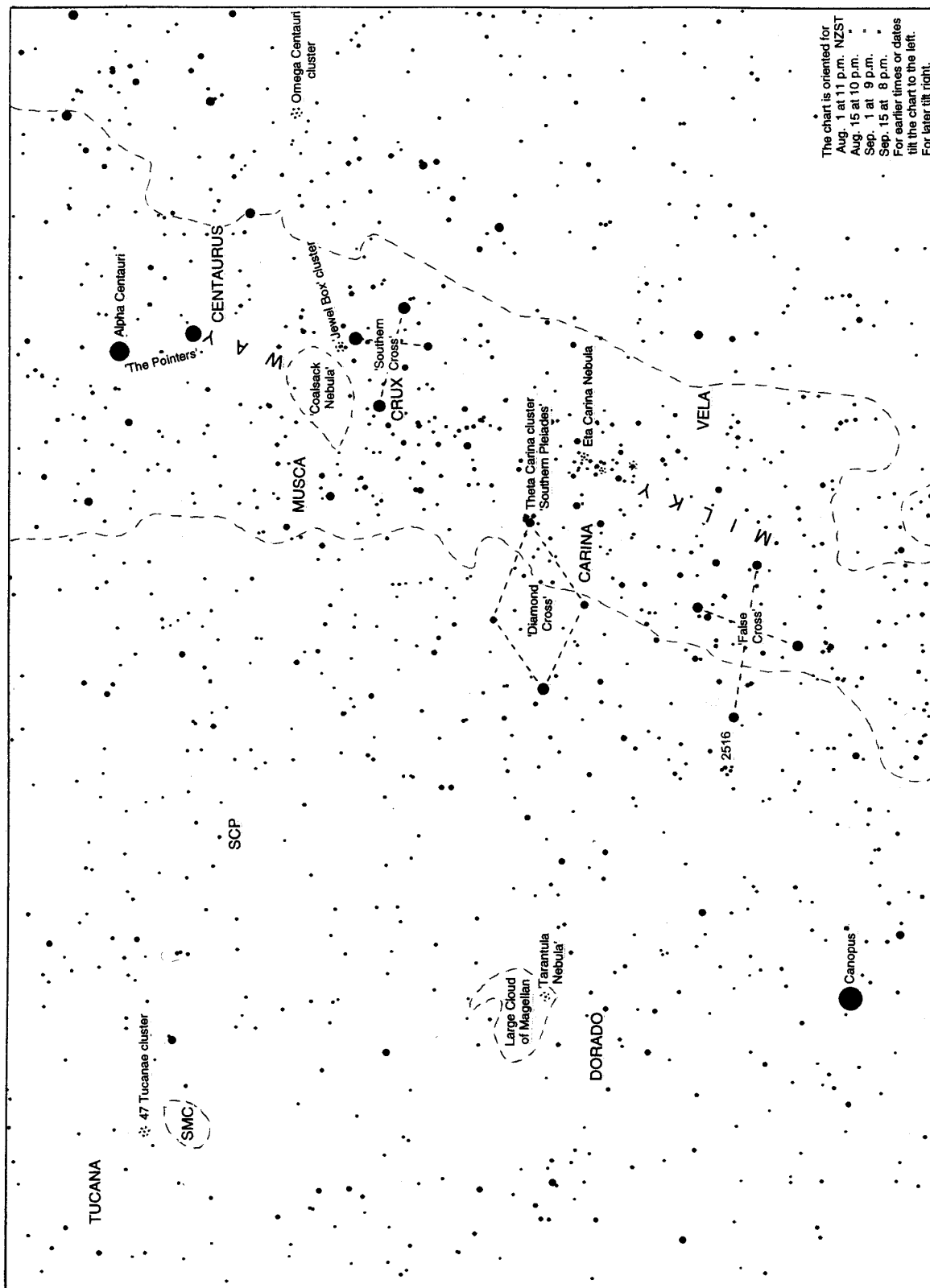
At the right-angle bend in the Scorpion's tail is a large and bright cluster of stars, NGC **6231**, looking like a small comet. It is around 6000 l.y. away. Its brightest stars are 60 000 times brighter than the sun. The cluster is about 8 light years across, similar in size to the Pleiades/Matariki cluster in our summer evening sky. Were it as close as the Pleiades (440 l.y.) then its brightest stars would be as bright as Sirius. Below and right of the Scorpion's sting is **M7** a cluster obvious to the eye and nicely seen in binoculars. M7 is about 800 l.y. away and around 260 million years old. Old star clusters have fewer bright stars because bright stars use up their energy supply quickly and disappear.

Below the sting and fainter than M7 is **M6**, the 'butterfly cluster'. M6 is around 1600 l.y. away and is half the age of M7. Other clusters worth a look in binoculars are **M21**, **M23**, NGC **6167**, and NGC **6193**. The 'M' objects were listed by the 18<sup>th</sup> Century French astronomer Charles Messier. He hunted comets, so made a catalogue of fuzzy objects that could be mistaken for comets. The NGC (New General Catalogue) objects shown are bright enough to have been seen by Messier but are too far south to be seen from Paris where Messier worked.

On a line left of Jupiter and Saturn is the glowing gas cloud **M8**, the 'Lagoon Nebula'. It is a star-forming region where gas and dust have recently gathered into new stars. ('Recently' = the past two million years or so.) Ultraviolet light from very hot stars is lighting up the leftover gas, making it glow. On colour photos it appears pink due to hydrogen atoms glowing in the UV light. Below M8 is **M20**, the Trifid Nebula, a small glowing patch in binoculars, also a pink hydrogen region in photos. Right alongside it is a blue reflection nebula where starlight is scattered by dust. Other nearby nebulae are **M16** and **M17**.

Globular clusters, spherical clusters of ancient stars, are found throughout the region. The brightest is **M4** beside Antares. It is also one of the closest at 7000 l.y. away. In binoculars and small telescopes 'globs' appear as round fuzzy spots. Others marked on the chart are **M9**, **M10**, **M12**, **M14**, **M19**, **M22**, **M55**, **M54**, **M62**, **M80** and NGC **6541**. The concentration of globular clusters in this area was an early clue that the centre of the galaxy lay in this direction.

This part of the Milky Way is broad and bright as we are looking to the centre of the galaxy. The actual centre, 27 000 light years away, is hidden from our view by intervening dust clouds. The nearer clouds make gaps and slots along the Milky Way. The hub of the galaxy is a great sphere of stars, called the 'central bulge'. Some of the central bulge is glimpsed in gaps between the dust clouds. At the very centre of the galaxy is a black hole with four million times the sun's mass but only the size of our solar system. Infra-red telescopes, peering through the dust, show stars orbiting the invisible black hole at high speed. By plotting the movements of these stars over the past two decades, astronomers have been able to deduce the mass of the central black hole and its distance. All big galaxies have a massive black hole at their centre.



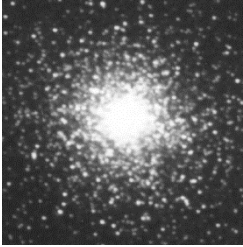
The chart is oriented for  
 Aug. 1 at 11 p.m. NZST  
 Aug. 15 at 10 p.m.  
 Sep. 1 at 9 p.m.  
 Sep. 15 at 8 p.m.  
 For earlier times or dates  
 tilt the chart to the left.  
 For later tilt right.

**Southern Evening Sky in September**  
 The chart shows the southern and southwest sky. Interesting star clusters and nebulae are indicated with asterisks. They are described on the other side of this page.

Chart produced by Guide 8 software: [www.projectpluto.com](http://www.projectpluto.com). Labels added by Alan Gilmore, University of Canterbury's Mt John Observatory  
 P.O. Box 56, Lake Tekapo 7945, New Zealand. [www.canterbury.ac.nz](http://www.canterbury.ac.nz)

## Interesting Objects in the Southern Sky

**Large & Small Clouds of Magellan (LMC & SMC)** appear as two luminous patches, easily seen by eye in a dark sky. They are two galaxies like the Milky Way but much smaller. Each is made of billions of stars. The Large Cloud contains many clusters of young luminous stars seen as patches of light in binoculars and telescopes. The LMC is about 160 000 light years away and the SMC 200 000 l.y away, both very close by for galaxies. (1 light year is about 10 000 billion km,  $10^{13}$  km.)



**47 Tucanae**, looks like a faint fuzzy star on the edge of the SMC. It is a globular cluster, a ball of millions of stars. A telescope is needed to see a peppering of stars around the edge of the cluster. Though it appears on the edge of the SMC it is one-tenth the distance, 15 000 light years away, and is has no connection to the Small Cloud. Globular clusters are mostly very old, 10 billion years or more; at least twice the age of the sun. **Omega Centauri**, right of the Pointers, is a similar cluster around 17 000 light years away.



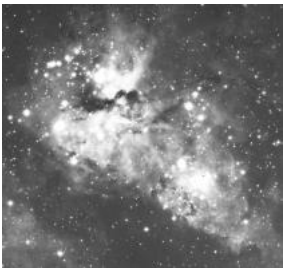
**Tarantula nebula** is a glowing gas cloud in the LMC. The gas glows in the ultra-violet light from a cluster of very hot stars at centre of the nebula. The cloud is about 800 light years across. It is easily seen in binoculars and can be seen by eye on moonless nights. This nebula is one of the brightest known. If it was as close as the Orion nebula (in The Pot's handle in the summer sky) then it would be as bright as the full moon.

**Canopus** is the second brightest star. It is 14 000 times brighter than the sun and 300 light years away. Sirius, in the eastern dawn sky, is the brightest star in the sky. The planets Venus and Jupiter are brighter.

**Alpha Centauri**, the brighter Pointer, is the closest naked-eye star, 4.3 light-years away. Alpha Centauri is a binary star: two stars about the same size as the sun orbiting around each other in 80 years. The pair appear close together now so are not easily split in a telescope. (A very faint and slightly closer star, Proxima Centauri, orbits a quarter of a light-year, or 15 000 Sun-Earth distances, from the Alpha pair.)

**Coalsack nebula** is a cloud of dust and gas about 600 light years away, dimming the more distant stars in the Milky Way. Many similar 'dark nebulae' can be seen, appearing as slots and holes in the Milky Way. These clouds of dust and gas eventually coalesce into clusters of stars.

**The Jewel Box** is a compact cluster of young luminous stars about 6400 light years away. The cluster formed about 16 million years ago. It is best seen in a telescope. To the eye it looks like a faint star.



**Eta Carinae nebula** is a glowing gas cloud about 8000 light years away. The golden star in the cloud, visible in binoculars, is Eta Carinae. (Eta is the Greek 'e'.) It is estimated to be to be 80 times heavier than the sun and four million times brighter but is dimmed by dust clouds around it. It is expected to explode as a supernova any time in the next few thousand years. Many star clusters are found in this part of the sky.

The **Southern Pleiades** is a newish name for a cluster of stars at one point of the 'Diamond Cross'. It is formally the **Theta Carinae cluster**, after its brightest star but is also known as the 'Five of Diamonds' cluster, the reason obvious when it is seen in a telescope. It is much fainter and smaller than the real Pleiades in Taurus but a nice sight in binoculars. The cluster is about 500 light years away and is around 30 million years old.

**NGC 2516**, right of the False Cross, looks to the eye like a tailless comet. It is a nice sight in binoculars. The cluster is about 1200 light years away and 110 million years old.