

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 2009

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.

Golden Jupiter is northeast of overhead in the evening, setting in the southwest around dawn. Mercury is prominent low in the western sky at dusk at the beginning of the month. It fades and sinks lower, disappearing mid month. Orange Antares, the Scorpion's heart, is west of the zenith. The Scorpion's tail, a.k.a. the fish-hook of Maui, curls toward the zenith. Crux, the Southern Cross, and the Pointers are in the south-west. Canopus is near the south horizon, moving up into the eastern sky. Vega shines on the opposite horizon. The Milky Way spans the sky from north to south. Arcturus twinkles red and green as it sets in the northwest.

Chart produced by Guide 8 software; www.projectpluto.com. Labels and text added by Alan Gilmore, Mt John Observatory of the University of Canterbury, P.O. Box 56, Lake Tekapo 7945, New Zealand. www.canterbury.ac.nz

The Evening Sky in September 2009

Jupiter is northeast of overhead at dusk. It is by far the brightest 'star' in the sky and shines with a steady golden light. Binoculars will show the disk of Jupiter. A small telescope easily shows its four big moons and the parallel stripes in Jupiter's clouds. Jupiter is the biggest planet by far, as heavy as all the other planets combined. It is nearly 12 times wider than the earth at the equator and 320 times Earth's mass. It spins once in 10 hours, stretching it at the equator. It is around 620 million km from us now.

This year we are looking edge-on to the orbits of Jupiter's moons. So the moons frequently hide (occult) each other and their shadows cross over (eclipse) each other. These events last only a few minutes. Evening events visible from NZ: Sept.1, satellite 1 Io occults satellite 2 Europa starting at 8:47; Sept. 5, 1 occults 2 at 9:10, then 1 eclipses 2 at 10:21; Sept. 12, 1 occults 2 starting at 11:33.

Mercury ends its best evening sky appearance of the year. At the beginning of September it sets due west two hours after sunset. It sinks lower in the twilight through the first half of the month as it passes between the Earth and the sun. A telescope magnifying 100x will show Mercury as a thinning crescent. It is 120 million km from us on Sept. 1, closing to 97 million km mid month. Mercury is the smallest of the eight planets: just over a quarter of Earth's diameter and one-eighteenth Earth's mass.

Canopus, the second brightest star, is near the south skyline at dusk. It swings upward into the southeast sky through the morning hours. Canopus is a truly bright star: 13 000 times the sun's brightness and 300 light years* away. On the opposite horizon is **Vega**, one of the brightest northern stars. It is due north at dusk and sets in the late evening. **Arcturus**, the brightest northern star, sets in the northwest at dusk. It often twinkles red and green as the air splits up its orange light.

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. It is also the closest of the naked eye stars, 4.3 light years away. And it is a binary star: two sun-like stars orbiting each other in 80 years. A telescope magnifying 50x will split the pair. Beta Centauri, along with most of the stars in Crux, is a blue-giant star hundreds of light years away.

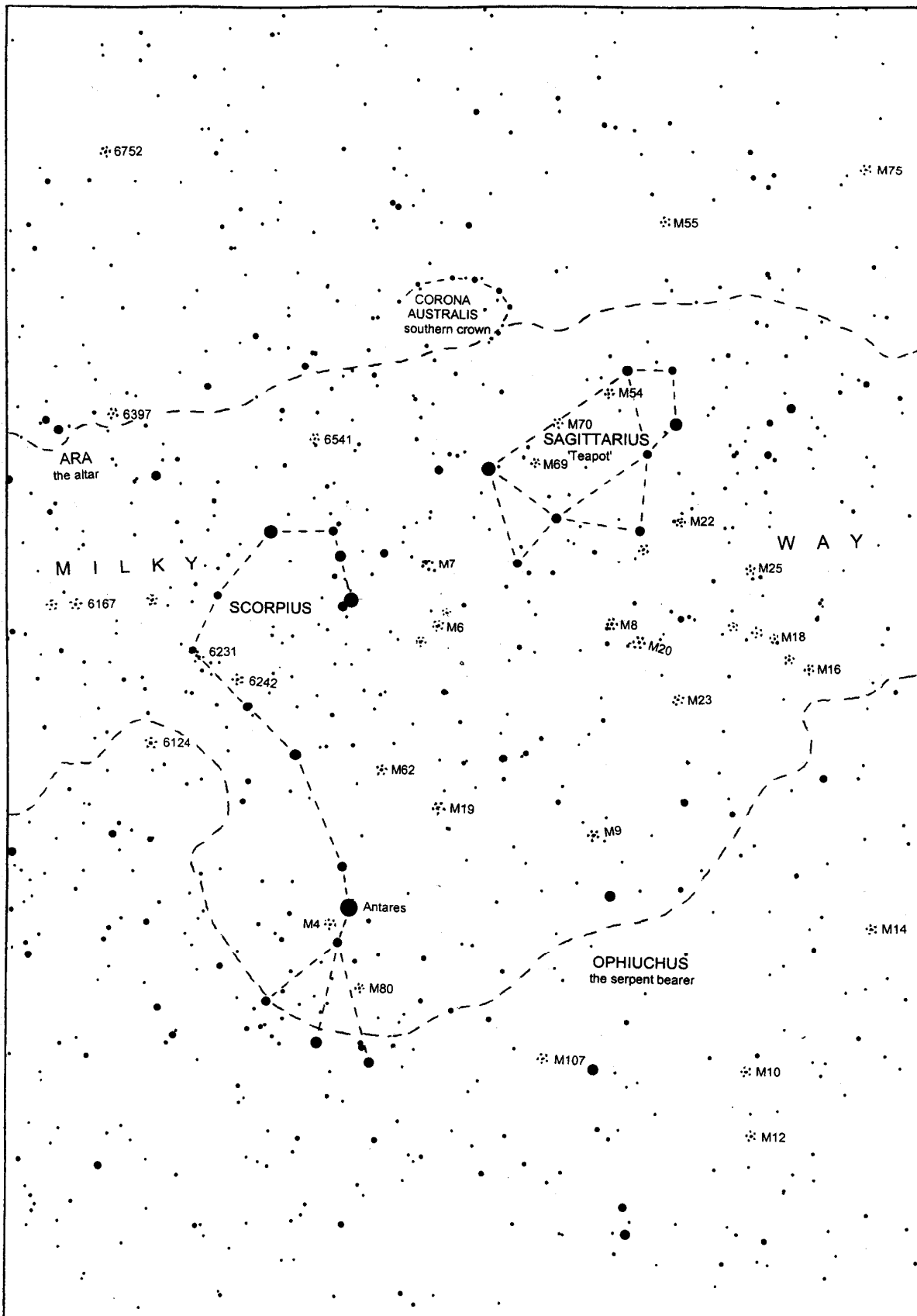
West of overhead the orange star **Antares** marks the heart of the Scorpion. The Scorpion's tail hooks toward the zenith like a back-to-front question mark, the 'fish-hook of Maui' in Maori star lore. Antares is a red giant star: 600 light years away and 19 000 times brighter than the sun. Above **Scorpius** is 'the teapot' made by the brightest stars of **Sagittarius**. It is upside down in our southern hemisphere view.

The **Milky Way** 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 south. To the north it passes west (left) of Jupiter and crosses 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, 30 000 light years away, is in Sagittarius. The actual centre is hidden by dust clouds in space. The nearer clouds appear as gaps and slots in the Milky Way. A scan along the Milky Way with binoculars shows many clusters of stars and some glowing gas clouds, particularly in the **Carina** region below Crux, and in Scorpius and Sagittarius.

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.

Mars (not shown) rises in the northeast morning sky around 3 a.m. Its brightness and reddish colour are similar to two nearby stars: Betelgeuse, above Mars, and Aldebaran above and well left. Brilliant Venus is low in the northeast dawn sky, rising after 5 a.m.

*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 four years to reach the nearest star, Alpha Centauri.



The Sky West of Overhead at Evening in September

The chart shows the sky west of the zenith at nightfall. The Milky Way is here bright and broad as we look toward the centre of the galaxy. Many star clusters and a few nebulae are seen, some obvious to the naked eye. Those visible in binoculars or small telescopes are indicated with asterisks. They are described on the other side of this page.

Chart produced by Guide 8 software; 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

Interesting Objects West of Overhead in September

Orange **Antares** is the brightest star in the region. It marks the heart of **Scorpius** the Scorpion. The Scorpion is head-down, tail-up in the evening sky now. It sets in the southwest soon after midnight. Antares and the tail make a back-to-front question mark. In Maori star lore the tail is the fish-hook of Maui.

Antares is a red-giant star: 600 light years* away, 19 000 times brighter than the sun, and big enough to fill Earth's orbit. Its mass or weight is about 20 times that of the sun, so the star is mostly extremely thin gas spread around a hot dense core. Red giant star is the last stage in the life of a star. The hot dense core of the star is wringing the last of the thermo-nuclear energy from helium to form heavier elements. For massive stars like Antares a core of iron (gas!) is finally formed. This leads to a collapse of the core into a neutron star or a black hole. In the resulting explosion -- a supernova -- chemical elements heavier than iron are made. The rich amount of heavy elements on earth shows that we are made of the matter that has been processed in two supernova explosions since the beginning of the universe.

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. Some of the central bulge of the galaxy is glimpsed in gaps between the clouds, making brighter areas of Milky Way in this region. The dust is from old stars giving off clouds of gas rich in carbon (forming soot, roughly speaking) and silicon (making fine sand).

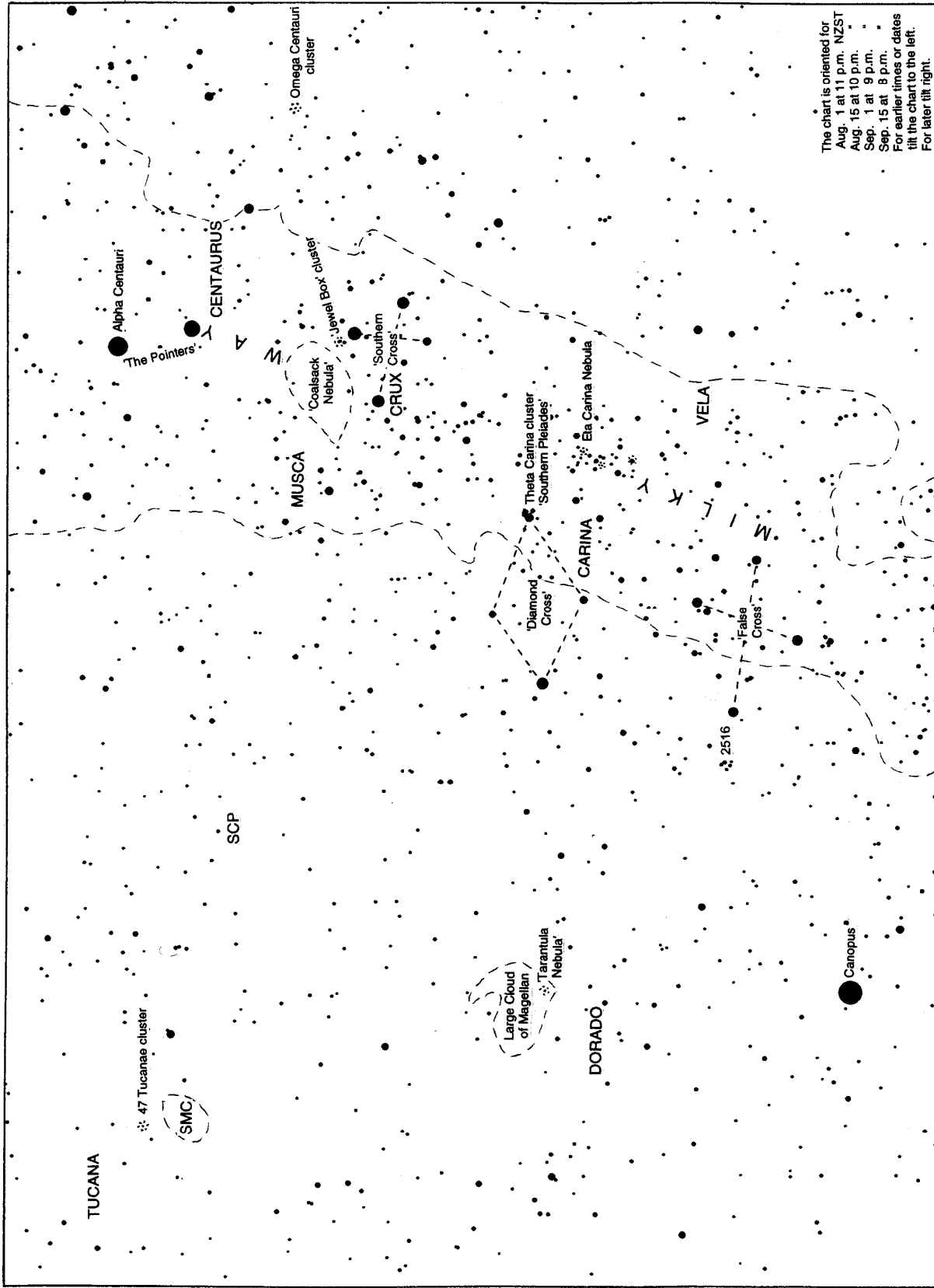
On the chart the direction to the centre of the galaxy is below the Teapot's spout and left of M8. Infrared telescopes, peering through the dust between us and the centre, show stars orbiting the invisible black hole at high speed. From the speed and orbits of these stars it is found that the central black hole is four million times heavier than the sun. Infra-red and x-ray 'flares' are seen from the region, as clouds of matter fall into the black hole. These confirm that the black hole is smaller than Earth's orbit, ruling out the possibility that the four million solar masses are just a dense cluster of stars.

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. 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 220 million years old. Below M7 and fainter is **M6**, the 'butterfly cluster', around 1600 l.y. away. Other clusters worth a look in binoculars are **M23**, NGC **6167**, and NGC **6193**. The 'M' objects were listed by the 18th Century French astronomer Charles Messier (1730-1817). He hunted comets, so catalogued fuzzy objects that could be mistaken for comets. The NGC (New General Catalogue) objects were too far south to be seen from Paris.

Below Sagittarius's 'Teapot' is the glowing gas cloud **M8**, commonly called the Lagoon Nebula from the dark lane of dust that crosses it. The gas is glowing in ultra-violet light from very hot stars. These stars have formed within the cloud in the past two million years. M8 is about 140 light years across and 5200 light years away. Nearby is **M20**, called the Trifid Nebula from its three-lobed appearance. It is seen as a small glowing patch in binoculars. **M16** and other nebulae are also found in this area.

Globular clusters, spherical clouds of ancient stars, are found throughout the region. The brightest is **M4** by Antares. It is also one of the closest at 7 000 l.y. away but is dimmed by a dust cloud between us and it. In binoculars and small telescopes globular clusters appear as round fuzzy spots. Others marked on the chart, with their distances in light years, are **M10** (14 000 l.y.), **M12** (19 000), **M19** (27 000), **M22** (10 000), **M55** (20 000), **M62** (22 000), **M80** (30 000) and NGC **6541**. The concentration of globular clusters in this part of the sky was an early clue that the centre of the galaxy lay in this direction and was a long way from us.

*One light year (l.y.) is about 10 000 billion km, 10^{13} km, or 6 000 billion miles. Sunlight takes 8 minutes to reach us and 4 hours to get to Neptune the most distant big planet. Light takes 4 years to get to the nearest star.



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

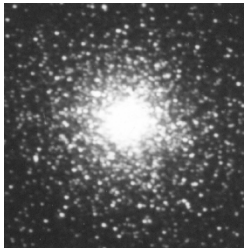
The chart shows the southern and southwest sky. Interesting star clusters and nebulae are indicated with asterisks. They are described on the other side of this page.

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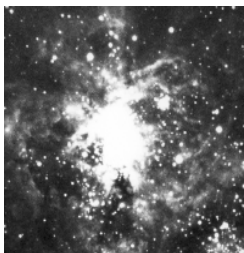


Interesting Objects in the Southern Sky

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 it 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. A telescope that magnifies 30x splits the pair. (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 300 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 7000 light years away.. The cluster formed less than 10 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 60 times heavier than the sun and a 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 10 million years old.