

The chart is orientated for
 Sep. 15 at 10 p.m. NZST
 Oct. 1 at 10 p.m. NZDT
 Oct. 15 at 9 p.m. "

Evening sky in October 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.

Golden Jupiter and orange-red Mars are the 'evening stars'. At dusk Jupiter appears northwest of the zenith and Mars in the east. As the sky darkens Saturn appears to the right of Jupiter and Mercury is seen low in the west. Mercury fades into the twilight late in the month. Orange Antares is midway down the west sky. Canopus is low in the southeast, twinkling colourfully. Crux, the Southern Cross, and the Pointers are in the south-west. Vega sets on the north horizon. The Milky Way spans the sky from north through west and into the south. The Magellanic Clouds, nearby galaxies marked as LMC and SMC on the chart, are misty glows above Canopus.

The Evening Sky in October 2020

Four planets light up the evening sky most of the month. **Jupiter** and **Mars** are the brightest 'stars' in the sky, so the first seen after sunset. Golden Jupiter is northwest of overhead. Orange Mars is low in the eastern sky. As the sky darkens **Saturn** appears to the right of Jupiter. **Mercury** is low in the southwest, looking like a lone bright star. It fades into the twilight after the 20th.

Of the four, Jupiter and Saturn are the most interesting in telescopes. Even a small telescope shows Jupiter's disk. Larger 'scopes will show the parallel bands in Jupiter's clouds. Jupiter's four big moons are lined up on either side of the planet, swapping positions from night to night. Jupiter is 760 million km from us mid-month. Saturn appears as an oval in a low-powered telescope as the rings and planet merge. Larger telescopes show the rings and Saturn's biggest moon Titan four ring-diameters from the planet. Smaller moons are closer in. Saturn is 1480 million km away. The moon will be near Jupiter and Saturn on the 22nd and 23rd.

Mars is at its closest to Earth mid-month, 63 million km away. In a telescope it is a small disk with some dusky markings. Mercury is catching up on us most of the month. It then passes between us and the sun on the 25th and moves into the dawn sky. The Moon will be near Mars on the 3rd, and near Mercury on the 18th.

Antares marks the body of the Scorpion. The Scorpion's tail loops up the sky in the evening, making a back-to-front question mark with Antares being the dot. The curved tail 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. Above and 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.

Canopus is low in the southeast at dusk often twinkling colourfully. It swings up into the eastern sky during the night. Canopus is 13 000 times the sun's brightness and 300 light years away. On the north skyline is **Vega**, setting in the early evening. It is 50 times brighter than the sun, 25 light years away and the 5th brightest star in the sky.

In the southwest are 'The Pointers', Beta and **Alpha Centauri**, making a vertical pair. They point down to **Crux** the Southern Cross. Alpha Centauri, the top Pointer, is the closest naked eye star at 4.3 light years away. Beta Centauri is a blue-giant star, very hot and very luminous, hundreds of light years away.

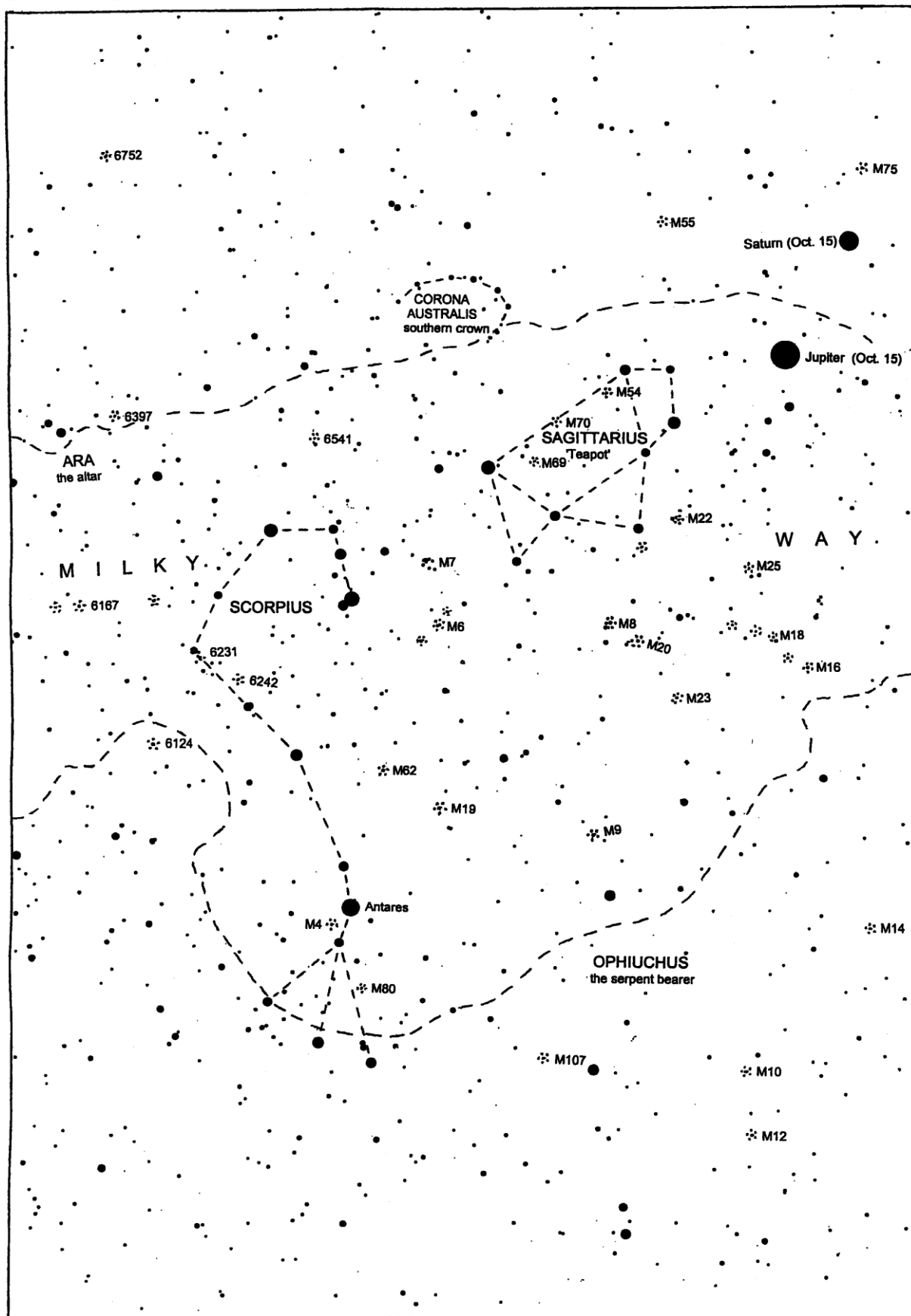
The **Milky Way** is brightest and broadest in Scorpius and Sagittarius. In a dark sky it can be traced down to the south. In the north it meets the skyline right of **Vega**. From northern New Zealand the star **Deneb** can be seen near the north skyline in the Milky Way. It is the brightest star in **Cygnus** the Swan. 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, with a black hole four million times the sun's mass, is hidden by dust clouds in space. Its direction is a little outside the Teapot's spout. The nearer 'interstellar' clouds appear as gaps and slots in the Milky Way. The dust and gas has come from old stars that have thrown much of their material back into space as they faded or blew up. New stars eventually condense from this stuff. A scan along the Milky Way with binoculars shows many clusters of new stars and some glowing clouds of left-over gas. There are many in Scorpius and Sagittarius and in the Carina region.

The Large and Small Clouds of Magellan, LMC and SMC, look like two misty patches of light in the southeast 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 around 160 000 light years away; the SMC around 200 000 l.y.

On moonless evenings in a dark rural sky the **Zodiacal Light** is visible in the west. It looks like late twilight: a faint broad column of light around Mercury, fading out at the Milky Way. It is sunlight reflecting off meteoric dust in the plane of the solar system. The dust may have come from a big comet, centuries ago.

Brilliant **Venus** is the 'morning star'. It rises about 50 minutes before the sun all month.

*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 Western Evening Sky in October 2020

The chart shows the western sky at dusk. Golden Jupiter, the brightest 'star' in the sky, is at the top of the chart. Saturn is above and right of Jupiter. A line through Saturn and Jupiter points down to orange Antares, the heart of the Scorpion. Many star clusters and a few nebulae are in the area, some obvious to the naked eye. Those visible in binoculars or small telescopes are indicated with asterisks. They are described in the notes.

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 in the Western Sky in October 2020

Golden **Jupiter** and cream-coloured **Saturn** are markers for this region. Jupiter is the brightest 'star' in the night sky. Saturn is above and right of it. Jupiter and Saturn are interesting objects in a telescope. Any telescope will show Jupiter's disk and its four 'Galilean' moons. One might also see parallel bands in Jupiter's clouds. A small telescope shows Saturn's rings and its largest moon, Titan, four ring diameters from the planet. A larger telescope might show Saturn's smaller moons closer to the rings than Titan.

A line through Saturn and Jupiter points down to orange **Antares**, the heart of **Scorpius**. The Scorpion is head-down, tail-up in the evening sky now. 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 12 times that of the sun, so the star is mostly extremely thin gas spread around a hot dense core. A 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 either a neutron star or a black hole, depending on the star's mass. In the resulting explosion -- a supernova -- chemical elements heavier than iron are made. The heavy elements on earth shows that we are made of 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 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 fizzing off gas rich in carbon (forming soot, roughly speaking) and silicon (smoke-particle-sized sand).

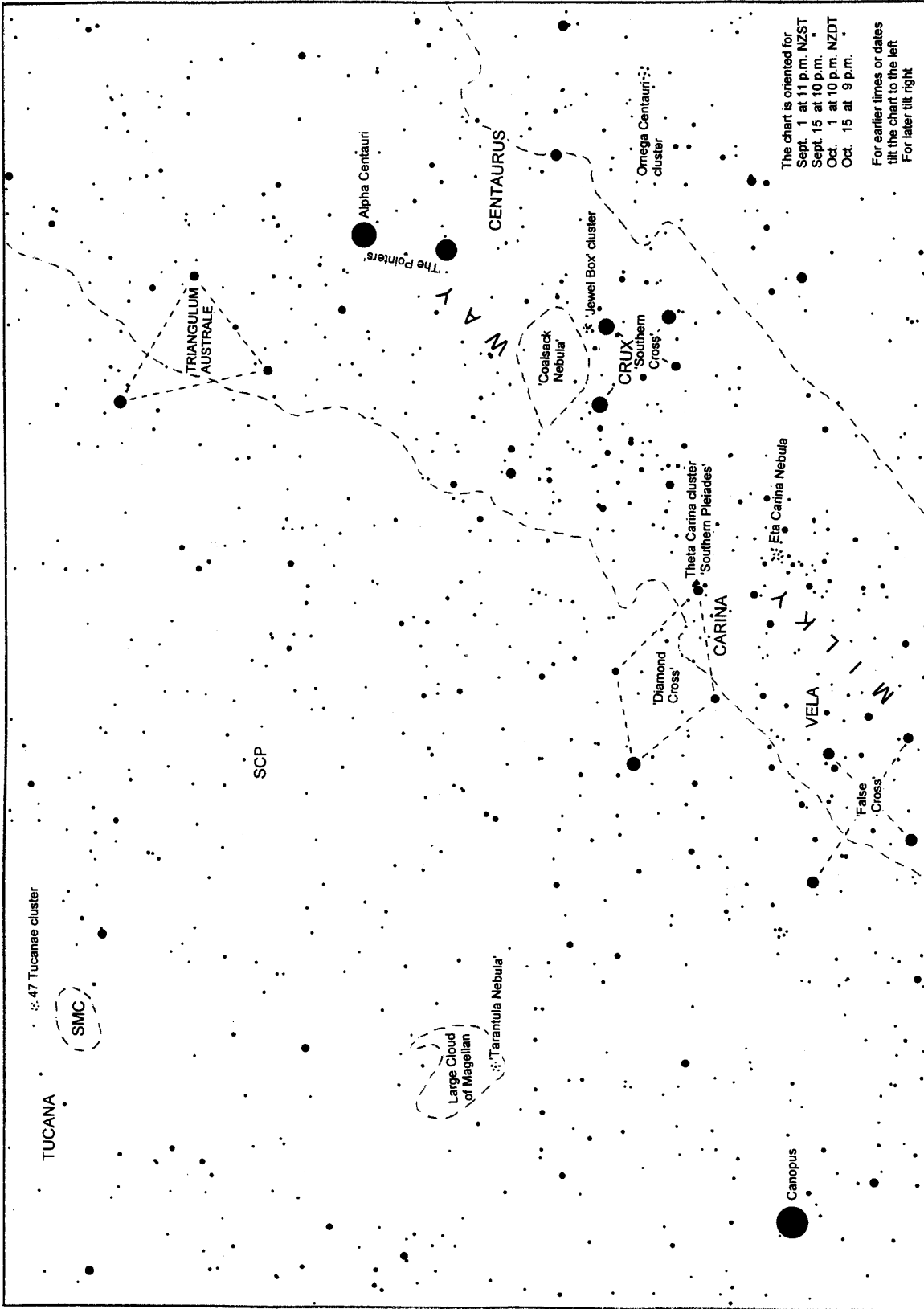
On the chart the direction to the centre of the galaxy is below the Teapot's spout and left of M8. Infrared telescopes show stars orbiting the invisible black hole at high speed. From the speed and orbits of these stars it is calculated that the central black hole is four million times heavier than the sun. Other observations show 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. Ironically, Messier is remembered for his catalogue, not his comets. The NGC (New General Catalogue) objects were too far south to be seen from Paris.

Roughly midway between Jupiter and Antares 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 7000 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 far away 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.

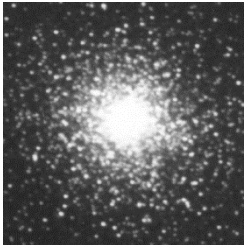


Southern Evening Sky in October
 The chart shows the southern and southwest sky. Interesting star clusters and nebulae are indicated with asterisks. They are described on the other side of this page.

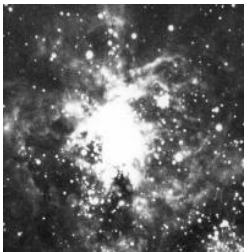
Chart produced by Guide 8 software, www.projectpluto.com. Labels and text added by Alan Gilmore, Mt John Observatory of the University of Canterbury, P.O. Box 56, Lake Tekapo 7945, New Zealand. www.canterbury.ac.nz

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.



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 50x 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 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 7000 light years away. The cluster formed around 16 million years ago. 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 **Theta Carina cluster** or **Southern Pleiades** is a cluster on the west end of the 'Diamond Cross'. It is also called the 'Five of Diamonds' cluster, the reason obvious when viewed 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.