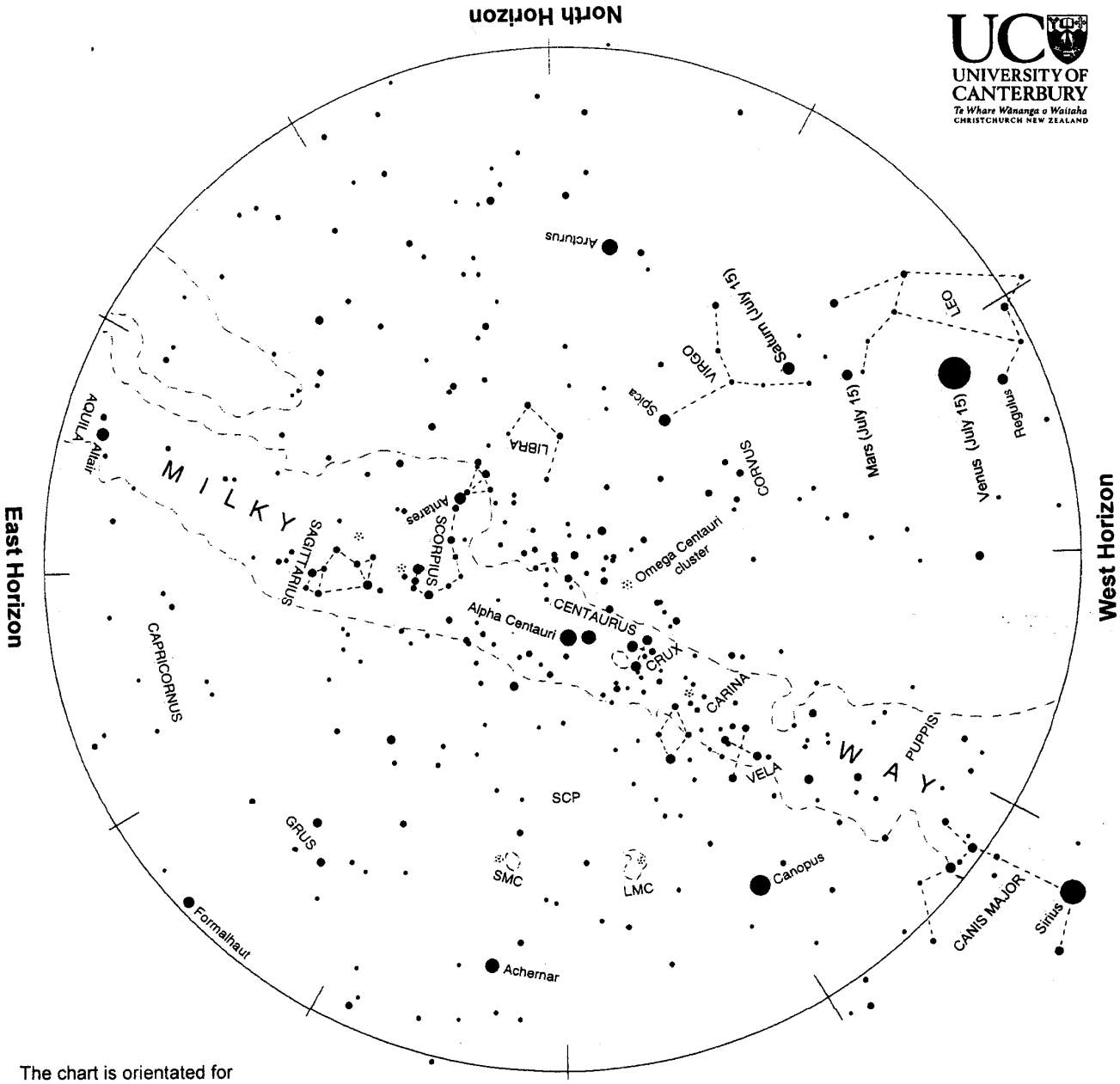

The chart is orientated for
June 15 at 10 p.m. NZST
July 1 at 9 p.m. "
July 15 at 8 p.m. "
Aug. 1 at 7 p.m. "

Evening sky in July 2010

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.

Venus, the brilliant 'evening star', is seen in the northwest at sunset and sets mid evening. Mars and Saturn are above Venus. At the end of the month Mercury appears below Venus. Sirius, the brightest real star, sets in the southwestern twilight. Canopus, the second brightest star, is low in the southwest and swings down to the southern horizon later. The Pointers and Crux, the Southern Cross, are south of the zenith. Orange Arcturus in the north often twinkles red and green. The Scorpion is on its back high up the eastern sky with Sagittarius below it. Jupiter (not shown) rises in the east around 11 pm.

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 July 2010

Venus, the brilliant 'evening star' (planet really), appears in the northwest soon after sunset. It sets in the dark mid-evening sky making it an eye-catching object. It is bright enough to cast shadows in dark places. In a telescope its shape is like the moon just after first quarter. Venus is the same size as the earth and around 150 million km from us this month.

Venus, Mars and **Saturn** make a line up the northwest sky most of July. Mars is the fainter of the three and has a reddish tint. At the beginning of the month the three planets are equally spaced. By mid-July Venus and Mars will have moved closer to Saturn. At the end of the month Mars will be passing Saturn, making a widely spaced pair of 'stars' above Venus. This is all line-of-sight, of course: Mars is around 280 million km from us, on the far side of the sun, while Saturn is 1480 million km away. Mars is too small to be of interest in a telescope now. Saturn is worth a look. Its rings are nearly edge-on, looking like a spike through the globe of the planet. In July Mercury begins its best evening appearance of the year. At the end of the month it will be low in the early evening sky, on a line down from Mars and Venus.

Sirius, the brightest true star, sets in the southwest in early twilight twinkling like a diamond. **Canopus**, the second brightest star, is in the southwest at dusk. It swings down to the southern skyline before midnight then climbs 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.

South of the zenith are 'The Pointers ', Beta and **Alpha Centauri**. They point to **Crux** the Southern Cross on their right. Alpha Centauri is the third brightest star in the sky. 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 easily split the pair. Beta Centauri, like most of the stars in Crux, is a blue-giant star hundreds of light years away.

Arcturus, in the north, is the fourth brightest star in the sky, and the brightest in the northern hemisphere. It is 120 times the sun's brightness and 37 light years away. When low in the sky Arcturus twinkles red and green. It sets in the northwest around midnight.

East of the zenith is the orange star **Antares**, marking the heart of the Scorpion. The Scorpion's tail, upside down, is stretched out to the right of Antares making 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. Red giants are dying stars, wringing the last of the thermo-nuclear energy out of their cores. Big ones like Antares end in massive supernova explosions. Below Scorpius is 'the teapot' made by the brightest stars of Sagittarius. It is also upside down in our southern hemisphere view.

The **Milky Way** is brightest and broadest in the east toward **Scorpius** and **Sagittarius**. In a dark sky it can be traced up past the Pointers and Crux, fading toward Sirius. 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. A scan along the Milky Way with binoculars shows many clusters of stars and some glowing gas clouds.

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

Jupiter (not shown) rises in the eastern sky around 11 pm mid-month. It is the brightest 'star' in the late night sky and shines with a steady golden light. Binoculars show the disk of Jupiter and perhaps one or two of its bright moons. A small telescope easily shows all four moons and stripes in Jupiter's clouds.

*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.

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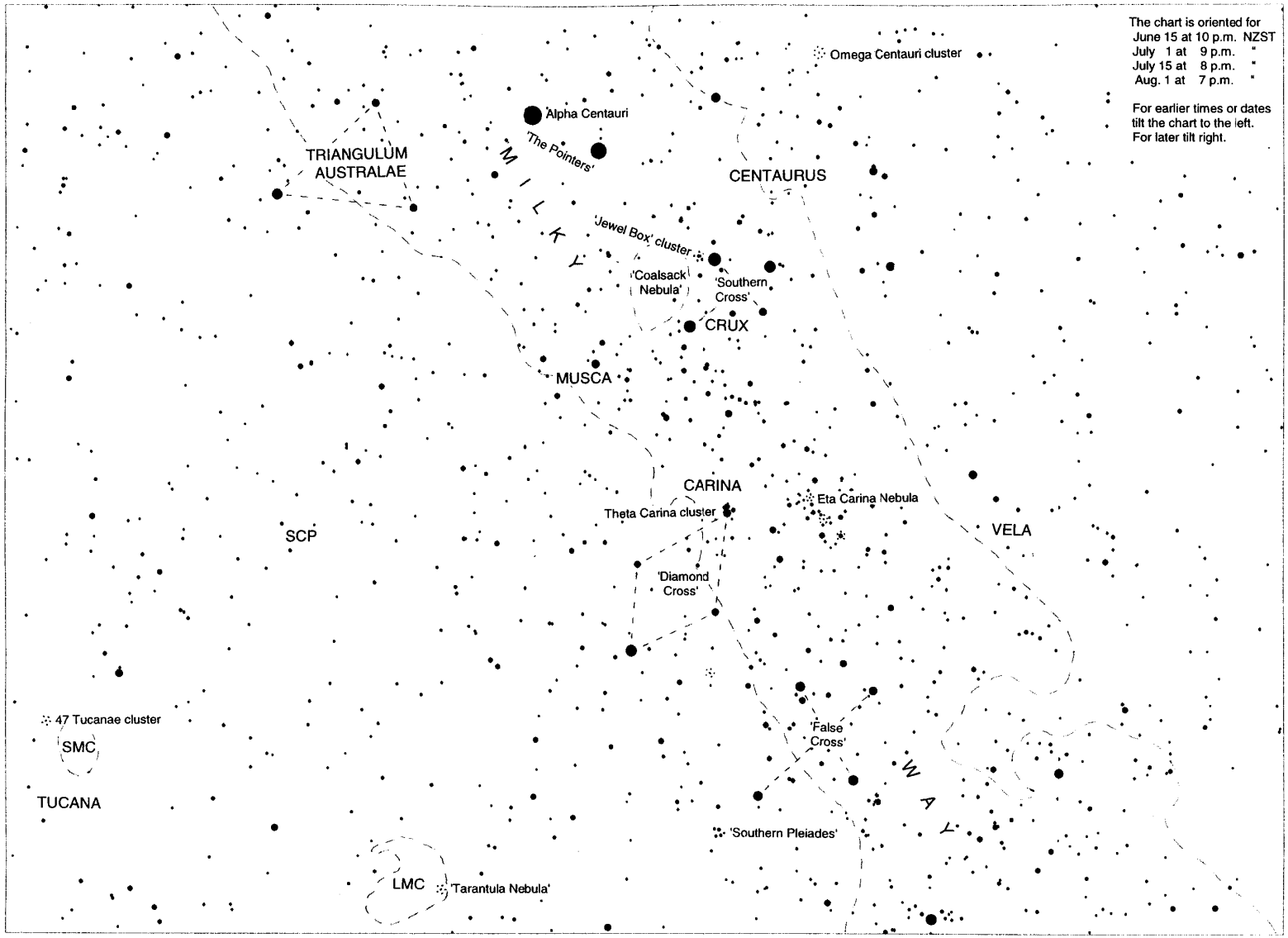

Southern Evening Sky in July

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 8770, New Zealand. www.canterbury.ac.nz

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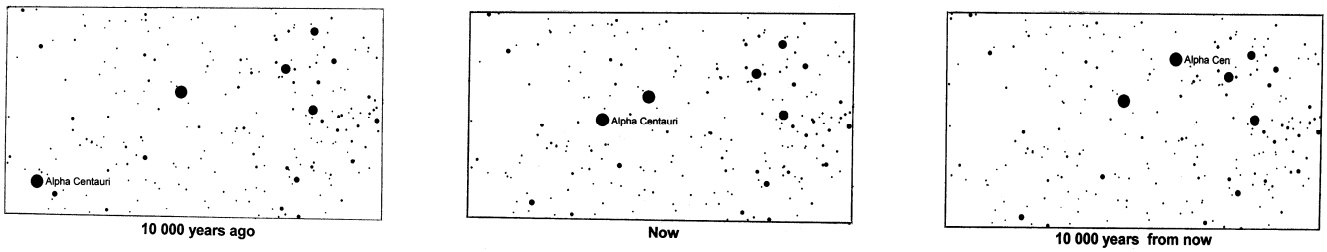
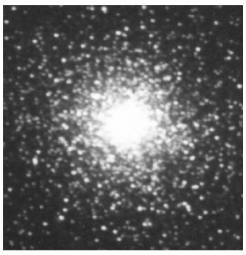
Interesting Objects in the Southern Sky

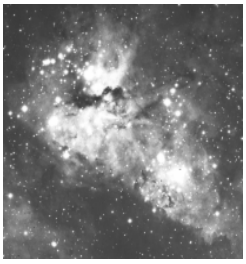
The Pointers, Beta and **Alpha Centauri**, are just south of overhead. **Crux**, the Southern Cross, is on their right and slightly lower. Below and right of Crux are two other cross-shaped patterns: the 'Diamond Cross' and 'False Cross'. These patterns, along with stars as far down the sky as Canopus, are part of Argo the ship, an ancient constellation in Mediterranean cultures. (Canopus isn't shown on this chart; see it on the All-Sky chart.) Astronomers found Argo too big for star cataloguing purposes so broke the ship up into **Carina** the keel, Puppis the deck and **Vela** the sails. The Milky Way forms a background for most of these constellations.

The stars in a constellation generally have no relation to one another. They are at different distances and originated at different times. Some stars in the Centarus-Crux region are an exception to this rule. Beta Centauri and three of the four bright stars in Crux are part of a very scattered group called the Scorpius-Centaurus Association. Its stars are young (a few million years old), very bright, and hundreds of light years* away. Alpha Centauri, on the other hand, is the closest naked eye star, just 4.3 l.y. away. The head star of Crux, 90 l.y. away, is also much closer than the other bright stars of Crux. Over time the nearer stars appear to move against the background of distant stars as our sun and all the other stars orbit the centre of the galaxy. The pictures below show how the Pointers and Crux looked in the past and how they will appear in the future.





Omega Centauri, west of the zenith, is a globular cluster, a ball-shaped cluster of millions of stars. Its total mass is six million times the sun's. It is 17 000 light years away and 200 light years across. Globular clusters are very ancient, around 10 billion years old, twice the age of the sun. Omega Centauri is the biggest of the hundred-odd globulars randomly orbiting our galaxy. It may originally have been the core of a small galaxy that collided with the Milky Way and was stripped of its outer stars.



Eta Carinae nebula, a luminous spot in the Milky Way below Crux, is a glowing gas cloud about 8000 light years from us. The thin gas glows in the ultra-violet light of nearby hot young stars.

The golden star in the cloud, visible in binoculars, is Eta Carinae. (Eta, η, is Greek 'e') It is estimated to be to be 60 times heavier than the sun and a million times brighter. Dust clouds dim it. Eta Carinae is expected to explode as a supernova soon; in the next few thousand years. Many star clusters are found in this part of the sky.

Coalsack nebula, left of Crux, looks like a hole in the Milky Way. It is a cloud of dust and gas 300 light years away, dimming more distant stars. Many 'dark nebulae' can be seen along the Milky Way, appearing as slots and holes. These clouds eventually form new stars.

The Jewel Box, on the top left edge of Crux, is a compact cluster of young bright stars about 7000 light years away. The cluster formed less than 10 million years ago. A telescope is needed to see it well.

Large & Small Clouds of Magellan (LMC & SMC) appear as two luminous clouds, easily seen by eye in a dark sky. They are galaxies like the Milky Way but much smaller. Each is made of billions of stars. Both clouds are about 160 000 light years away, very close by for galaxies.

*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.

Text and photos by Alan Gilmore, Mt John Observatory of the University of Canterbury,
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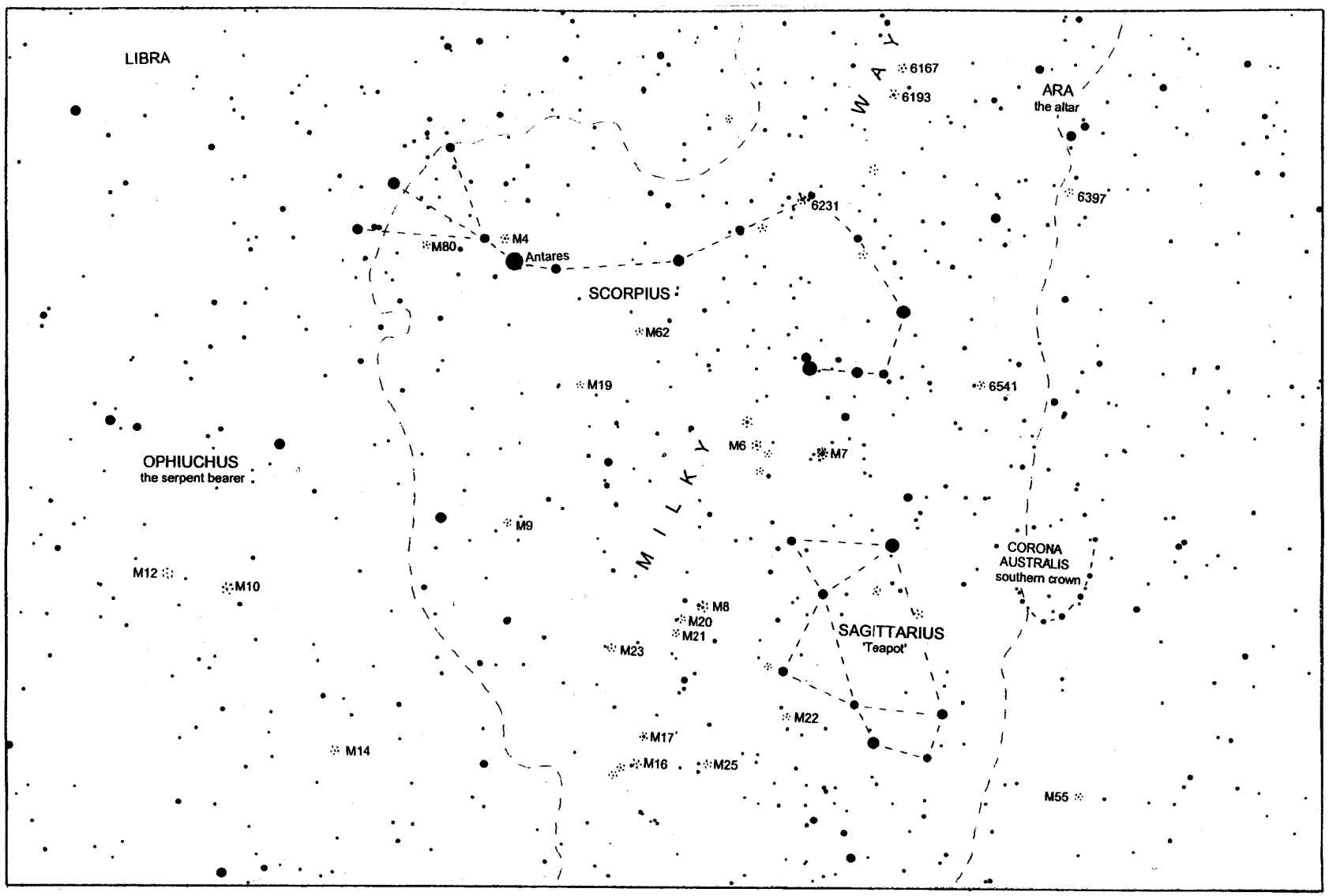

Eastern Evening Sky in July

The chart shows the eastern sky 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

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Interesting Objects East of Overhead on Winter Evenings

Antares is the brightest star in the region. It is orange coloured; being a 'red giant' star. (The 'red' of red giants is usually more an orange tint.) It is 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 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. The outer regions of the star have expanded to a very spread-out gas. The core is wringing the last of the thermo-nuclear energy out of elements like helium, carbon, oxygen and neon. In about two million years the core of Antares will run out of energy and collapse, triggering a spectacular supernova explosion. (The sun will become a red-giant in about seven billion years time but it ends up as a white dwarf star, not a supernova.)

Antares marks the heart of Scorpius. In the evening at this time of year the Scorpion is on its back with its tail on the right, curving upward then turning down and curling clockwise. The sting is the horizontal line of bright stars pointing toward Antares. In Maori star lore the tail's hook is the 'fish hook of Maui'. By midnight the scorpion's tail is directly overhead.

At the right-angle bend in the 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 sky. Were it as close at the Pleiades (400 l.y.) then its brightest stars would be as bright as Sirius. Below 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. (The older a star cluster, the fewer bright stars it has.)

Below M7 and fainter is **M6**, the 'butterfly cluster'. M6 is around 1300 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 18th 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 to enough to have been seen by Messier but are too far south to be seen from Paris.

Left of the Sagittarius 'Teapot' 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 million years or so.) Ultraviolet light from one particularly hot star is lighting up the leftover gas, making it glow. On colour photos it appears pink due to hydrogen atoms fluorescing in the UV light. Below M8 is **M20**, the Trifid Nebula, 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 (gas and dust clouds) are **M16** and **M17.**

Globular clusters, spherical clusters of ancient stars, are found throughout the region. The brightest is **M4** by Antares. It is also one of the closest at 10 000 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 lies a black hole three 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.

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Lunar Eclipse June 26-27, and Others

On Saturday June 26 New Zealand, the South Pacific and the eastern two-thirds of Australia see all of a partial lunar eclipse.

The moon begins to enter the penumbra, the fuzzy edge of Earth's shadow, around 8:56 pm but little change will be seen in the moon's appearance for an hour. Gradually it will become obvious that the lower edge of the moon is darker than the upper. The darkening will be plain around 10:17 when the moon begins to enter the umbra, the dark central shadow.

The fuzzy bight out of the moon's lower edge will grow till 11:39 when it will cover more than half the moon's width. After that it diminishes until the moon leaves the umbra at 1:00 a.m. The shading across the moon will persist for a while as the moon moves out of the penumbra. It leaves the penumbra completely at 2:21 a.m.

In summary: penumbral eclipse begins 8:56 p.m. NZST
Umbral eclipse begins 10:17
Maximum eclipse (0.452) 11:39
Umbral eclipse ends 1:00 a.m.
Penumbral eclipse ends 2:21

For diagrams see the eclipse page on http://www.rasnz.org.nz/

On December 21 New Zealand, the South Pacific and eastern Australia see the second half of a total lunar eclipse. Most of the North Island will see the moon rise almost fully eclipsed. Only a small part of the upper edge will out of the umbra. By moon-rise in the South Island the moon will be completely eclipsed in the umbra. This is bound to attract a lot of attention.

Maximum eclipse is at 9:17 p.m. NZDT (8:17 UT). The moon begins to leave the umbra at 9:54 and is fully clear by 11:02. It leaves the penumbra at 0:06 a.m.

Our luck with lunar eclipses continues into 2011. On the morning of June 16 the moon will set fully eclipsed, as seen from New Zealand. That eclipse begins the penumbral phase at 5:23 a.m. At 6:23 it touches the umbra and is fully immersed by 7:22 when it is setting in northeast NZ. Southerners will see the setting moon at mid eclipse. The moon is likely to be quite dark in colour as it will then be close to the centre of the umbra.

-- by Alan Gilmore with help from the Astronomical Almanacs for 2010 and 2011.