The sky

by Ray Forma

Go to the end of this article to find more detailed information about the Star Chart, and how to use it, and a table of Moon phases. Use the table to help you with the timing of successful astronomy evenings for students. The best time for an astronomy evening is usually six days after New Moon.

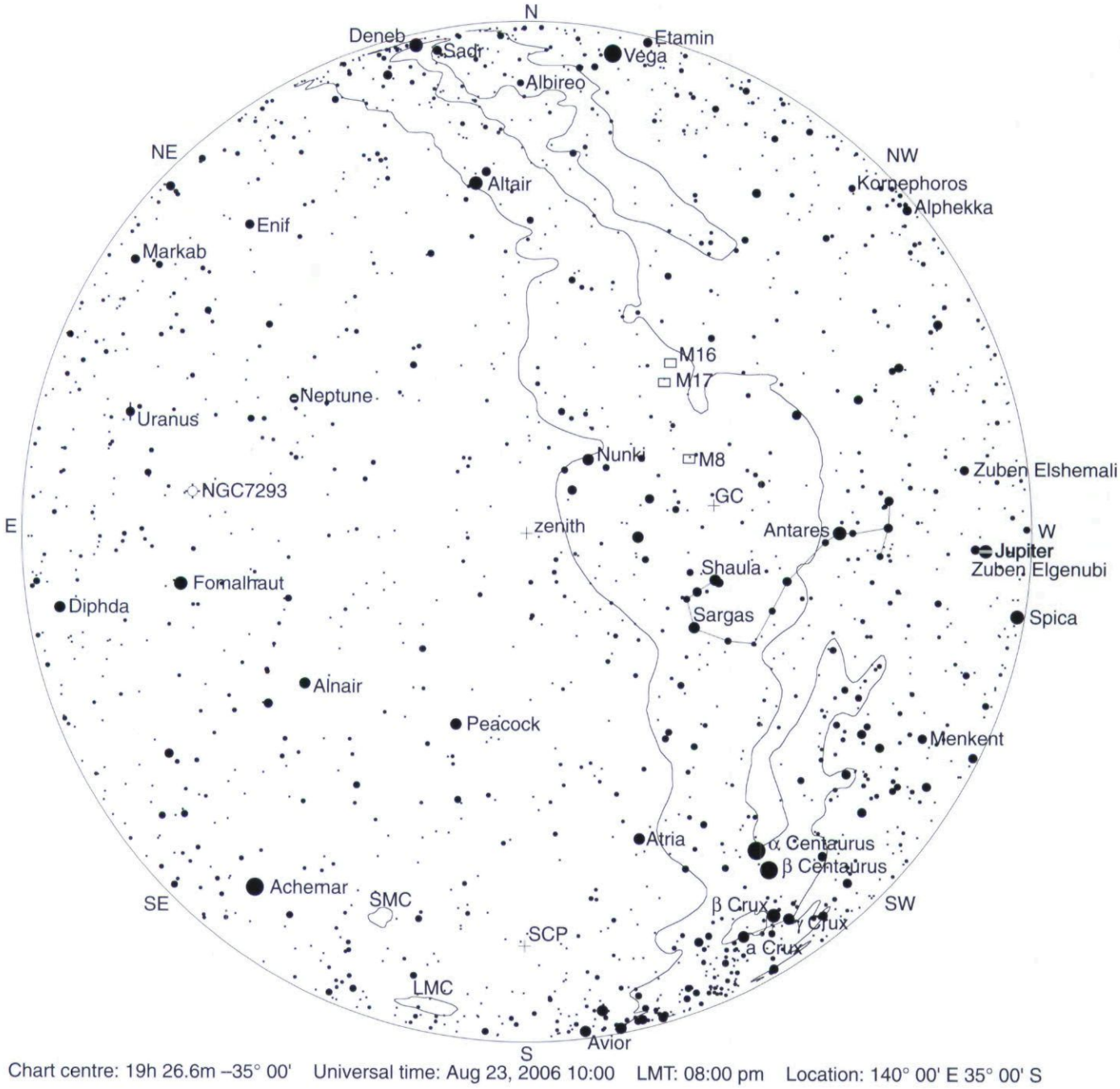

Chart centre: 19h 26.6m –35° 00' Universal time: Aug 23, 2006 10:00 LMT: 08:00 pm Location: 140° 00' E 35° 00' S

Fig 1. *The Star chart*

During evenings at this time of the year, it is obvious that the centre of out Milky Way galaxy passes through local zenith. The star chart shows the position of our Galactic Centre, labelled GC, lying in the constellation of Sagittarius, very close to the boundary with Ophiuchus, the Serpent Bearer. I wonder, how big is the black hole that evidence indicates is at the centre? Clouds of dust totally obscure the optical view of our Galaxy's centre, and we should perhaps be thankful for this. Events at the centre probably generate lots of light, and this would keep us awake at this time of the year if that light could penetrate the dust.

There are many lovely nebulae in the area around the galactic centre, and it is worth scanning for them through binoculars with a decent aperture, on a tripod or similar support.

South of the Galactic Centre lies the big wintertime constellation of Scorpius, the celestial scorpion, one of the few constellations that actually looks like the creature it represents. Antares, or α-Scorpii, is an obvious red supergiant that is 530 light-years distant. Its surface temperature of 3280K gives it the colour similar to that of Mars. Since Antares is found within the Zodiac, which contains the apparent path of the Sun and planets, it is commonly mistaken for the red planet, a fact shown by its name, Antares, or 'Ant-Ares', which means 'like Mars', 'Ares' being the Greek name for the god of war. This magnificent first magnitude star is ranked the 15th brightest in the night sky. It is, however, a semi-regular variable that can change by several tenths of magnitude over a period of years. Its great distance reveals that it is truly luminous; to the eye over 10,000 times brighter than the Sun. Because it is cool, only 3280K at its surface, it radiates a considerable amount of its light in the invisible infrared. If you take that into account, the star becomes some 60,000 times brighter than our Sun. A low temperature coupled with high luminosity tells us that the star must be huge, luminosity and temperature giving a radius of about 3 Astronomical Units. It is so big that astronomers can easily detect and measure the size of its apparent disk, which gives an even bigger radius of 3.8 AU, three-fourths the size of the orbit of Jupiter. The difference is caused by uncertainties in distance, temperature, and the actual location of the mass-losing surface, as the star is slowly evaporating, encased itself in a gas cloud, or nebula, that shines by light scattered from the ultraluminous star within.

Antares, with a mass of 15 to 18 solar masses, probably does not have much time left to it. It is massive enough to one day develop an iron core and to eventually explode as a brilliant supernova. The event may be a million years off, an astronomical blink of an eye; or it may occur tonight, so keep a watch on one of the great stars of the night-time sky.

Due north, near the horizon, you will find Vega twinkling brightly. Vega, or α-Lyrae, is a star approximately 25.3 light-years away in the small constellation of Lyra, the Harp. Science fiction fans will be familiar with Vega, where writers make use of the evidence that indicates that Vega hosts a solar system. This system plays a role in Isaac Asimov's *Foundation* trilogy, and Carl Sagan's science fiction novel and film, *Contact*.

Vega is the fifth brightest star in the night sky. It is a 'nearby star', and together with Arcturus and Sirius, one of the brightest stars in the Sun's neighbourhood. It is twice as massive as our Sun and about fifty times as luminous. Vega's current age is about 500 million years. Since more powerful stars use their fusion fuel more quickly than smaller ones, Vega's estimated lifetime is only one thousand million years, approximately a tenth that of our Sun. After it leaves the main sequence, Vega is likely to become a yellow giant before entering the red giant stage, after which it will eventually shed its outer layers to become a white dwarf.

In about 14,000 AD, Vega will become the North Polar Star, owing to the precession of the equinoxes. Professional astronomers used Vega for the calibration of absolute photometric brightness scales. When the magnitude scale was fixed, Vega happened to be close to zero magnitude. Therefore, the visual magnitude of Vega was declared to be, by definition, zero at all wavelengths. This lasted for many years, but is no longer the case, because the apparent magnitude zero point is now defined as a specified numerical flux.

We see Vega from within 5° of its polar axis of rotation, but if you were looking along the plane of its equator, Vega would look about 23% fatter at the equator because, with a rotation period of about 12.5 hours, Vega rotates at 93% of the speed where inertial effects would make it disintegrate.

Many Messier objects are visible in the evenings at this time of year. If you have access to a moderate telescope or better, and have good observing environs, then it is worth getting hold of a Messier Catalogue and having a look at these objects. I have included some non-stellar objects in the Sky Chart.

The Helix Nebula, labelled NGC7293, is a 6.5 magnitude planetary nebula in Aquarius, well east of the zenith. The Helix Nebula is the closest example of a planetary nebula created at the end of the life of a Sun-like star. The star expels massive amounts of its outer gasses into space. In the case of the Helix Nebula, from our vantage point the expelled gases look as if we are looking down a helix. The remnant central stellar core, destined to become a white dwarf star, is so energetic that it causes the previously expelled gas to fluoresce. One day our Sun may look like this.

Fig 2. *The Helix Nebula, NGC 7293, as seen through the Hubble Space Telescope*

M16, the Eagle Nebula, lies some 7,000 light years distant in the constellation Serpens, the serpent, close to the borders with Scutum and Sagittarius, and in the next inner spiral arm of our Milky Way galaxy from us. It is a great cloud of interstellar gas and dust that is involved in a vivid episode of star formation.

It is best to use low magnification with telescopes to see M16. A 100 mm telescope reveals about 20 stars in an uneven background of fainter stars and nebulosity; three nebulous concentrations can be glimpsed under good observing conditions. Under very good conditions, you can see suggestions of dark obscuring matter to the north of the cluster. A 300 mm telescope will start resolving the dark pillars.

Fig 3. *The Eagle nebula, M16, as seen through a big telescope*

The 6.0 magnitude Omega Nebula, M17, also called the Swan Nebula, the Horseshoe Nebula, or, especially in the southern hemisphere, the Lobster Nebula, is a region of star formation, and it shines by excited emission, caused by the higher energy radiation of young stars. However, unlike many other emission nebulae, these stars are not obvious in optical images, but hidden in the nebula.

Distance estimates are between 5,000 and 6,000 light years, thus little less than that of its apparent neighbour, M16, the Eagle nebula. Apparently, these two star forming regions are indeed close together, in the same spiral arm of our Milky Way galaxy. It is visible to the naked eye under good observing conditions.

Fig 4. *The Omega or Lobster Nebula, M17, as seen through a 155 mm telescope*

From a dark site, M8, the Lagoon Nebula is visible to the unaided eye as a small bright patch below the large Sagittarius star cloud in our Milky Way. The Lagoon nebula is a beautiful sight in any size telescope, and takes its name from the dark lane that runs through the centre of the nebula.

Fig 5. *The Lagoon Nebula, M8, with a southern hemisphere flavour. Photographed by Ian Wallis with a 250 mm telescope from a suburban location in Perth, Western Australia*

The Zodiac that is not

One titbit of 'astronomical' information that most people seem to know is their 'star sign'. Few people know what it means, and fewer still know that it doesn't mean that at all, or at least that it hasn't for the past few thousand years.

If you ask them, most people would say that a 'Gemini' is a person who was born when our Sun was in front of the stars of the constellation Gemini, the twins. That was true about 2,600 years ago, but it isn't today, for two reasons:

1 When, more than two thousand years ago, the ancients set up the astrological star sign system, they divided our Sun's apparent annual path into twelve equally spaced "signs," each 30° wide, with each sign only approximately coinciding with its constellation. Cancer, for example, is a small constellation, and Pisces is huge, but the ancients accorded both one twelfth of our Sun's annual path. The constellation Cancer, composed of stars, never coincided exactly with the sign of Cancer, which is a 30° wide zone along our Sun's path. About 70 years ago the international Astronomical Union settled the problem of vague constellation boundaries when it published a set of specifications for each constellation. This defining of the boundaries added a constellation to the zodiac. According to the current official constellation boundaries that all astronomers use, our Sun passes through 13 constellations, not 12. The 'thirteenth constellation' of the zodiac is Ophiuchus the Serpent Bearer, and our Sun is in front of its stars during the first half of December. About one person in twenty is an 'Ophiuchan', but few of them know it.

2 The dates that our Sun spends in each constellation have shifted by a few weeks. For example, our Sun was originally in front of the stars of Gemini during the first two weeks of May. Now, our Sun is in front of the stars of Taurus during the same two weeks. What happened? Our Earth is wobbling as it spins. Because our Moon and Sun are constantly pulling on the Earth's equatorial bulge, the Earth wobbles like a spinning top. This wobbling, or precession, is so slow that our Earth takes 25,800 years to complete one wobble. The easiest way to think of this motion is to visualize the Earth's axis as sweeping out a huge circle in the sky that includes its current position at the South Celestial Pole (SCP on the Star Chart) and Canopus, α-Carinae, the second brightest of the night-time stars. Canopus will be the South Polar star in 12,000 years. Another way to think about it is to imagine that the position of our Sun at the vernal equinox, slowly drifts around the sky. The vernal equinox is the one that occurs in March. Five thousand years ago our Sun was in Taurus, near the Pleiades star cluster, on that first day of the northern spring. By the time of Christ, our Earth's wobbling had us seeing our Sun on the boundary between Aries and Pisces on the same date. Six centuries from now our Sun will be in Aquarius as the northern spring begins, and the 'Age of Aquarius', a long overdue age of universal peace and brotherhood, will finally dawn.

Not only has our view of our Sun on the first day of northern spring shifted over the past few thousand years; so has our view of our Sun on every date. For example, our Sun used to enter Cancer at the moment of our winter solstice, giving rise to the term tropic of Cancer for the latitude where our Sun is overhead on that date. Currently our Sun is in Taurus at our winter solstice, two constellations away from its 'original' position.

When, in the second century BC,

the Greek astronomer Hipparchus discovered our Earth's wobble, astrologers had a problem. Our Sun was supposed to be in Aries as the northern spring began, but it was really in front of the stars of Pisces. The astrologers took this bombshell in their stride and declared that the zodiacal signs drifted with our Sun and that our Sun was therefore still in the sign of Aries, even though it was actually in front of the stars of Pisces.

So, the fixed stars of the constellations have stayed in the same direction, but the signs have drifted to the west relative to them, and they no longer coincide. If you were born during the first two weeks of May 2600 years ago, you were born when our Sun was in both the sign and constellation of Taurus. Now during those weeks our Sun is in Aries. Astrologically speaking, you are still a Taurus; astronomically speaking you are an Aries. Likewise, most Libras are really Virgos, and so on. To add insult to injury, most Sagittarians are really Ophiuchi. Of the 366 possible birthdates, the signs that astrologers use correspond to the astronomical constellations 14% of the time. The astrological signs are wrong by one constellation for 84% of people, and by two constellations for the other 2%.

So much for the effect that the stars have on our lives. The astrological effect that 'Aries' is supposed to exert follows the drifting Sun, not the stars. If astrology works, its mysterious forces therefore come from arbitrary directions in space that have nothing to do with the stars that lie in those directions.

The table below lists the dates when our Sun is in the real astronomical constellations of the zodiac. The dates fluctuate by a day from year to year.

Table 1. ***Astronomical constellations of the Zodiac***

Constellation	Dates
Capricornus	January 19 to February 15
Aquarius	February 16 to March 11
Pisces	March 12 to April 18
Aries	April 19 to May 13
Taurus	May 14 to June 19
Gemini	June 20 to July 20
Cancer	July 21 to August 9
Leo	August 10 to September 15
Virgo	September 16 to October 30
Libra	October 31 to November 22
Scorpius	November 23 to November 29
Ophiuchus	November 30 to December 17
Sagittarius	December 18 to January 18

Significant events

August 30 – The Moon passes a few degrees south of Jupiter

September 7 – The Moon eclipses Uranus, as seen from many parts of Australia. Maximum occurs at about 14:48 UTC in the east of the country; and about an hour earlier in the west. Note that this is the next day local time for Eastern Australia.

September 26 – A 4 day old Moon crescent passes south of Jupiter, which is fading into the sunset over the next few days.

October16 – Fomalhaut, α-Piscis Astrini, is about 5° north of the zenith.

Most of October – The planet Mercury is making a fairly good evening apparition. Its path is always just south of Jupiter in the twilight sky, with its high point being on October 17. On October 24 the 2 day old Moon crescent passes just south of Mercury.

The September equinox occurs at 05:04 UTC on 23 September. Throughout Australia that event will occur on 24 September, local time. At that time, we enter the spring leg of our journey around the Sun. That journey will last till our summer solstice occurs on 22 December at 01:23 UTC, ending a spring that is 89,85 days long. Throughout Australia, summer solstice will be on 23 December, local time.

How to use the Star Chart

To use the sky chart go outside at the appropriate date and time, and hold the chart, upside-down above your head. Then turn around till the direction marks around the chart's edge are pointing in the correct compass directions. Now the chart should give you a condensed view of the sky that you see beside the chart.

Because no single sky chart will do for all localities in Australia, I have generated one for a position about 100 km east of Adelaide. It shows what the sky should look like at 35° south latitude anywhere in Australia at around 8:00 pm local time on 23 August. If you are situated further north then you may not be able to see those objects in the far south of the chart. Similarly, observers further south may not be able to view the northernmost objects on the chart.

Table 2. ***Phases of the Moon over the coming year. The times are UTC (Universal Time)***

New Moon	First Quarter	Full Moon	Last Quarter
Jul 25, 2006 04:20	Aug 2, 2006 08:40	Aug 9, 2006 10:50	Aug 16, 2006 01:50
Aug 23, 2006 19:15	Aug 31, 2006 22:55	Sep 7, 2006 18:45	Sep 14, 2006 11:15
Sep 22, 2006 12:00	Sep 30, 2006 11:05	Oct 7, 2006 03:15	Oct 14, 2006 00:30
Oct 22, 2006 05:30	Oct 29, 2006 21:25	Nov 5, 2006 13:00	Nov 12, 2006 17:55
Nov 20, 2006 22:20	Nov 28, 2006 06:30	Dec 5, 2006 00:25	Dec 12, 2006 14:40
Dec 20, 2006 13:50	Dec 27, 2006 14:45	Jan 3, 2007 13:55	Jan 11, 2007 12:50
Jan 19, 2007 03:50	Jan 25, 2007 22:55	Feb 2, 2007 05:45	Feb 10, 2007 09:55
Feb 17, 2007 16:10	Feb 24, 2007 07:50	Mar 3, 2007 23:15	Mar 12, 2007 04:00
Mar 19, 2007 02:50	Mar 25, 2007 18:10	Apr 2, 2007 17:15	Apr 10, 2007 18:15
Apr 17, 2007 11:50	Apr 24, 2007 06:35	May 2, 2007 10:15	May 10, 2007 04:35
May 16, 2007 19:35	May 23, 2007 21:05	Jun 1, 2007 01:10	Jun 8, 2007 11:50
Jun 15, 2007 03:05	Jun 22, 2007 13:15	Jun 30, 2007 13:50	Jul 7, 2007 17:00

Use the chart 4 minutes earlier than 8:00 pm for every day before 23 August, and 4 minutes later for every day after 23 August. TS

Enjoy looking up!

About the author:

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