

thebigbang

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The amateur astronomer's guide to the sky

M13:

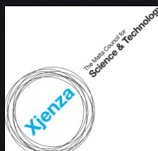
Cluster of
300,000 stars

▶▶▶ Page 8

Special supplement

Islands of astronomy

by Prof. Godfrey Baldacchino
and Dr. Alex Gatt



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Messier's observatory in Paris

In Chapter I of Book III of the famed French literary work *Les Misérables*, author Victor Hugo provides the reader with a quick sketch of contemporary Parisian politics, culture, and art in 1817. He describes all of the big names, events, fads, and fancies of Parisian life at that time before introducing more characters of the story. Hugo wrote this section from memory some 40 to 45 years after the fact; for this reason, many of the names mentioned are inaccurate, and some descriptions refer to events which are obscure even to scholars. Despite this, one sentence is of interest to astronomers.

In this chapter, Hugo includes a mention of the observatory of Charles Messier, the astronomer whose work on the discovery of comets led to the compilation of a catalogue of deep sky objects known today as the Messier Catalogue. We read: "On the platform of the octagonal tower of the Hôtel de Cluny, the little shed of boards, which had served as an observatory to Messier, the naval astronomer under Louis XVI, was still to be seen."

Hôtel de Cluny, or Clugny as it was spelt in Messier's time, was constructed in 1480 on the ruins of Roman baths, as the temporary Paris residence for the abbots of the Clugny order and their guests. In the 18th century, it was rented to the administration of the French navy. In Messier's time, its address was Rue de Mathurins.

The wooden observatory of the navy was erected by Nicholas Delisle in 1748, and was used by Charles Messier throughout his professional life from the 1750s until shortly before his death in April 1817.

In 1832, the French archaeologist Alexandre du Sommerard (1779-1842) established himself at Hôtel de Cluny, together with his collection of art. After his death, his estate was purchased by the French state, and in 1843 it was turned into a museum.

Hôtel de Cluny is still there in Paris; its address is now 6, Place Paul Painlevé, in the Latin Quarter. It now houses the Musée National du Moyen Ages, des Thermes et de l'Hôtel de Cluny (National Museum of the Middle Ages, of the Baths and the Hôtel de Cluny), and contains a variety of medieval artifacts, in particular a fine collection of tapestries which include the masterpiece *La Dame à la Licorne* ('The Lady and the Unicorn'). The museum is open to the public, and well worth a visit.■

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Messier's observatory was built on the top of the octagonal tower (at left) of Hôtel de Cluny. The structure was made of wood and glass, and had opening windows.



Hôtel de Cluny is located near Rue Saint-Jacques (St. James Street) which used to be the starting point for pilgrims leaving Paris to make their way along the 'chemin de St-Jacques' that led eventually to Santiago de Compostela (see *The Big Bang*, No. 91, page 3). Appropriately, the Hôtel is decorated with motives connected with the saint, including scallop shells.



ON THE COVER

Thousands of stars form a spectacular array in the globular cluster M13 which lies within the summer constellation of Hercules. Globulars are among the oldest structures in the Milky Way and M13 is typical of its class. This photograph was taken by Leonard Ellul Mercer under a gibbous Moon on June 19, 2013 with a 25.4-cm Ritchey-Chretien telescope and an ST10 XME CCD camera.

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Astronomy in national flags

Tony Tanti

Many national flags depict one or more astronomical objects as features of their design, though not all represent real celestial bodies.

Some time ago, just for fun, I examined the national flags of the 193 countries that form the United Nations and found that 85 display some kind of astronomical symbolism, whether the Sun, Moon or stars. That is 44% — which must say something about the meaning of astronomical themes for humankind.

Stars are usually depicted in flags with five points, but they can have six, seven points, or many points. Real stars, of course, have no points when viewed through a telescope on a steady night. Mobile planets are not depicted, perhaps because they would be hard to 'place' on a flag! The highly mobile Moon, however, finds its way onto flags in crescent and full-phase form.

A minority of stars are representations of actual asterisms. Other flag stars have symbolism for individual countries. This article presents celestial objects and patterns highlighted on national flags, and gives the political reasons why they were chosen to adorn such an important symbol.

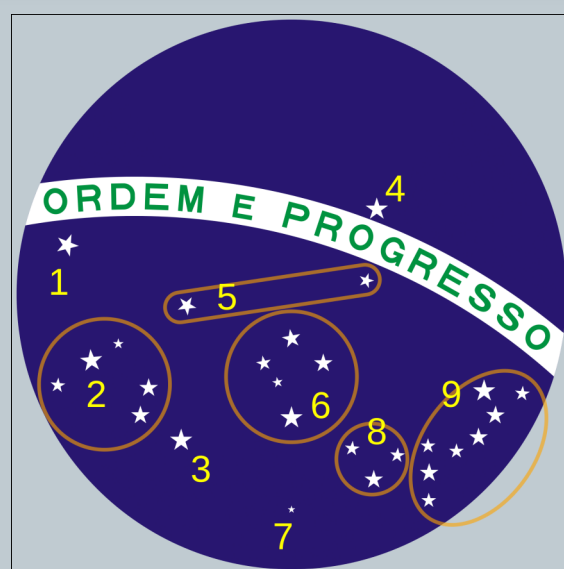
The stars in the flag of Brazil

If you have been watching the World Cup you could not help noticing the stars in the flag of Brazil. The flag of this nation of 200 million people is in fact one of the most recognisable flags in the world. However, its astronomical content, which is considerable, is very little known.

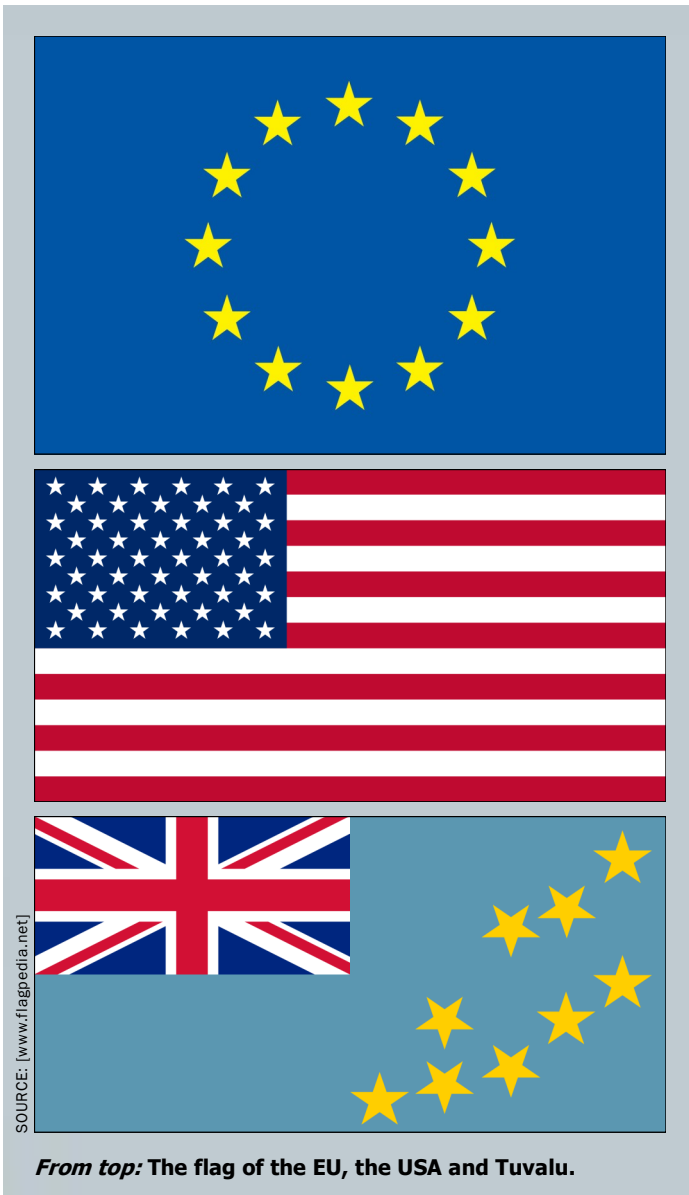
The national flag of Brazil is a blue celestial globe depicting a starry sky spanned by a curved white band with the national motto 'Ordem e Progresso' ('Order and Progress') inscribed, within a yellow rhombus, on a green field. Brazil officially adopted this design on November 19, 1889, after the emperor Pedro II was deposed and the country became a republic. The flag's blue circle currently has 27 white, five-pointed stars to represent the union's federated units — each star representing a specific state, plus one for the Federal District.

The stars in Brazil's flag depict the sky over Rio de Janeiro at 8:37 a.m. on November 15, 1889 — the day the Republic of Brazil was declared. At that moment, the Southern Cross in Crux, a constellation visible in the Southern Hemisphere, was on the meridian of Rio de Janeiro and its longer arm was vertical.

Actually, the flag portrays the stars as they would be seen by an imaginary observer an infinite distance above Rio de Janeiro standing outside the firmament in which the stars are meant to be placed (that is as found on a celestial globe). Thus, β Crucis appears to the right of the constellation and δ Crucis to the left, in mirror image of the way they actually appear in the sky (refer to the star map on the next page). The motto's band roughly coincides with the ecliptic.



The flag of Brazil. The stars are identified at right as follows: 1, Procyon (α Canis Minoris); 2, Canis Major, five stars, the largest depicting Sirius; 3, Canopus (α Carinae); 4, Spica (α Virginis); 5, Hydra; two stars, the largest depicting Alpheratz; 6, Crux Australis, the Southern Cross, five stars, the largest depicting α Crucis; 7, σ Octantis, the South Pole star; 8, Triangulum Australe; three stars of similar size; 9, Scorpius; eight stars, the largest depicting Antares.



of the Union, gaining statehood on January 3, 1959.

Other starry flags

There are many other national flags that bear one or more stars but have no connection to astronomy per se. The stars may represent number of states, of counties or of tribes among others but do not symbolise actual stars.

Without doubt, the most familiar starry flag with the Maltese is that of the European Union. It consists of 12 golden stars in a circle on a blue background. The stars symbolise the ideals of unity, solidarity and harmony among the peoples of Europe. The number of stars has nothing to do with the number of member countries, though the circle is a symbol of unity.

The flag of the EU was designed by Arsène Heitz and Paul M. G. Lévy in 1955 for the Council of Europe as its symbol, and the Council urged it to be adopted by other organisations. In 1985 the EU, which was then the European Economic Community, adopted it as its own flag at the initiative of the European Parliament. As part of the EU's usage, the flag appears on the euro banknotes and coins.

The EU flag bears resemblance to the 12-star halo of the Virgin Mary, as described in the *Apocalypse*, also known as the *Book of Revelation*, the final book of the *New Testament*:

"A great sign appeared in heaven, a woman clothed with the sun, and the moon under her feet, and on her head a crown of twelve stars." — Revelation 12:1

Official authorities of the EU disregard the biblical interpretation as myth. However, according to *The Economist* (October 28, 2004), the *Book of Revelation* was indeed the source of inspiration to designer Arsèhas.

The flag which has the largest number of stars is the stars and stripes of the United States of America. It consists of 50 white stars on a blue canton with a field of 13 alternating stripes, seven red and six white. None of the stars are linked to real stars; on the other hand, they stand for the 50 states of the Union, and the 13 stripes stand for the original 13 states.

The first official flag of the US was formally approved by the Congress on June 14, 1777, but the pattern was changed several times according to the new states that joined the Union. The colours of the flag are symbolic as well: Red symbolises hardiness and valour, white symbolizes purity and innocence and blue represents vigilance, perseverance and justice.

One of the most curious flags is the national flag of Tuvalu, a Polynesian island nation located in the Pacific Ocean, midway between Hawaii and Australia. Like many former and current British dependencies, the Tuvaluan flag is a blue ensign based on the Union Jack, which is shown in its canton; but has a sky blue field rather than the conventional blue. The stars represent the nine islands which comprise the Tuvalu archipelago; the arrangement is geographically correct, with the east towards the top (that is, north to the left).

Groups of large number of stars appear also on the flags of Bosnia & Herzegovina (nine stars in a diagonal), Cape Verde (ten stars in a circle), the People's Republic of China (one big star and a semicircle of four smaller stars), The Comoros (four stars aligned vertically), Honduras (five stars arranged in a rectangle), Kosovo (six horizontal stars), Myanmar (fourteen stars in a circle), Singapore (five stars forming a pentagon), The Solomon Islands (five stars in a square), Tajikistan (seven stars in



Messier 13, the great cluster in Hercules

Tony Tanti

300 years ago, the English astronomer Edmond Halley discovered one of the showpiece objects that grace the summer night sky.

Messier 13 (M13 for short) is considered to be the finest globular cluster in the northern half of the heavens. It is found in a star pattern called the Keystone — a lopsided square within the constellation Hercules which represents the great warrior of Greek mythology.

Edmond Halley in England discovered M13 in 1714, and stated that it could be seen with the naked eye “when the sky is serene and the Moon absent.” Fifty years later, the French comet hunter Charles Messier noted the cluster as “a nebula which I am sure contains no star,” a comment that more adequately describes the quality of his telescopes that the cluster. Because M13 looked very much like a comet to Messier, he listed the cluster in his catalogue to steer comet seekers away from it (see also page 2).

With better instruments came better observations of M13. William Herschel estimated that the cluster contained at least 14,000 stars, and his son John reported “hairy-looking, curvilinear branches” of stars around the edge of the cluster. These star chains have been noted visually by others, but do not show on photographs.

When Lord Rosse in Ireland brought his large speculum-metal reflectors to bear on M13, observers found three equally spaced dark lanes originating near the cluster’s centre and running to its edge. In his classic 19th-century observing guide *Celestial Objects for Common Telescopes*, Rev. Thomas W. Webb mentioned that these rifts were “beautifully seen” by W. Buffham, who used a 9-inch (22.9-cm) silver-on-glass mirror made by George With. Webb went on to say that he too had “perceived” the lanes. Oddly enough, beginning soon after these observations, there is little mention of the features. Perhaps one reason was astronomical photography’s coming of age, for the lanes do not show on photographs, and observers were probably hesitant to assert sightings that were not clearly confirmed by the camera.

The increasing use of photography essentially put the astronomical artist out of work. One of the last detailed renderings of M13 came from Leopold Trouvelot, who worked with the 15-inch (38.1-cm) refractor at Harvard College Observatory in the 1870s. Trouvelot’s portrait shows some of the star chains noted by John Herschel and also hints of nebulosity around some stars. However, later observers were not able to confirm the nebulosity.

M13 is not the easiest of sky objects to spot, but once you find it, you will be able to go back to it again and again. In Malta the cluster bedecks the sky for at least part of the night most of the year. The cluster is up nearly all night long in May, June and July. In August and September the M13 stays up till after midnight.

M13 is located in the constellation Hercules, between summertime’s two brightest stars, Vega and Arcturus. About one-third the way from Vega to Arcturus, locate the four modestly bright stars forming the Keystone of Hercules. On the Arcturus side of the Keystone, M13 is found between the stars η Herculis and ζ Herculis.

On a dark, clear night, the unaided eye barely perceives the Hercules cluster as a faint and possibly fuzzy point of light. This ‘fuzzy’ star is much easier to make out in binoculars. A typical binocular field is about 5° to 6° in diameter, and the Hercules cluster is found about 2.5° south of η Herculis.

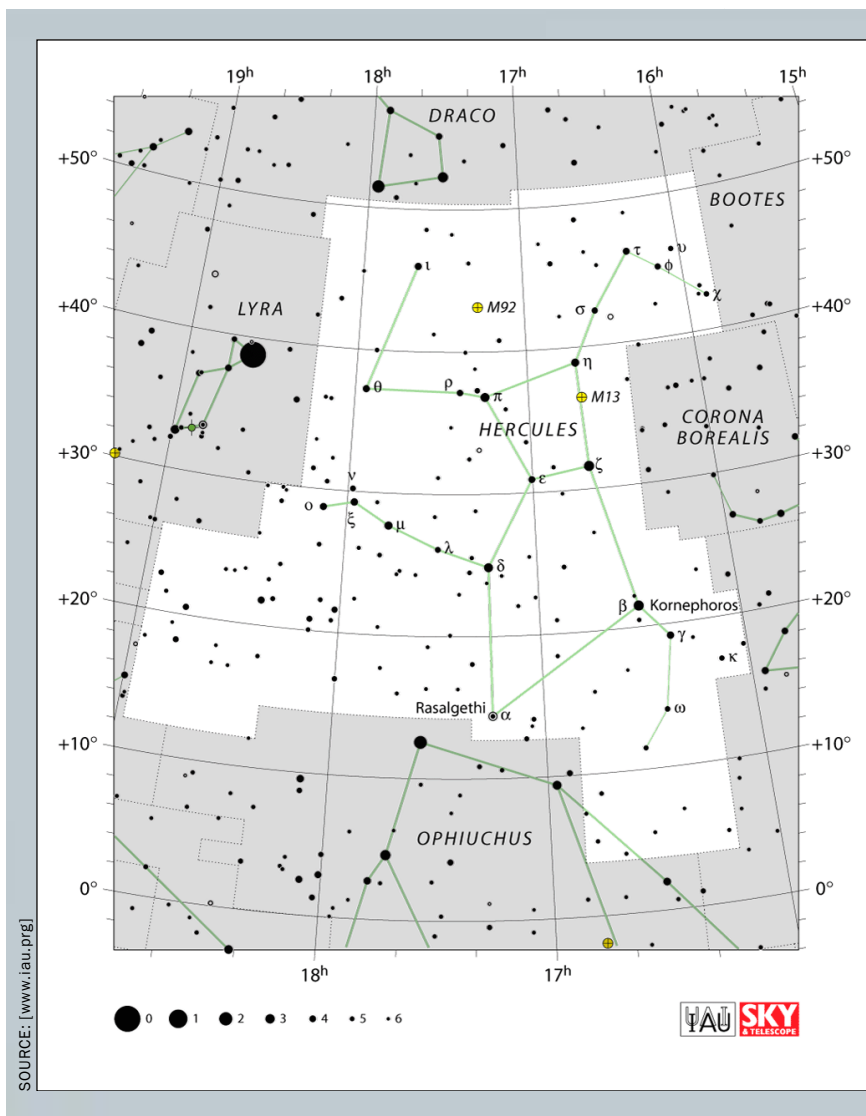
M13 is a huge globe-shaped stellar city teeming with hundreds of thousands of stars. At a distance of 25,000 light-years, the cluster stars crowd into a region 150 light-years in diameter, but approaching the cluster core upwards of 100 stars could be contained in a cube just 3 light-years on a side. For comparison, the closest star to the Sun is over 4 light-years away.

It is thought that there are around 250 globular clusters in the Milky Way galaxy. They orbit the Galaxy out-



SOURCE: [www.skyandtelescope.com]

M13 as it appeared in Lord Rosse’s 72-inch reflector. The drawing was made by Bindon Stoney about 1850 and clearly shows three lanes. Other 19th-century observers with much smaller telescopes also glimpsed these rifts, but there are no modern reports of them.



Left: Use this star map and binoculars to locate M13 in Hercules. The constellation can be found to the west of the bright star Vega in Lyra. **Above:** The Arecibo message to M13. Colour added to highlight its separate parts. The actual binary transmission carried no colour information.

In 1974, M13 was selected by Frank Drake and Carl Sagan as target for one of the first radio messages addressed to possible extra-terrestrial intelligent races, and sent by the big radio telescope at the Arecibo Observatory in Puerto Rico.

The message was transmitted on November 16, 1974 at a frequency of 2380 megahertz for a duration of 169 seconds. It consisted of a string of 1679 binary digits, or bits (1s and 0s). The message gives a few simple facts about humanity and its knowledge: from left to right in the picture above are numbers from one to ten, atoms including hydrogen and carbon, some interesting molecules, DNA, a human with description, basics of our Solar System, and basics of the sending telescope. ■

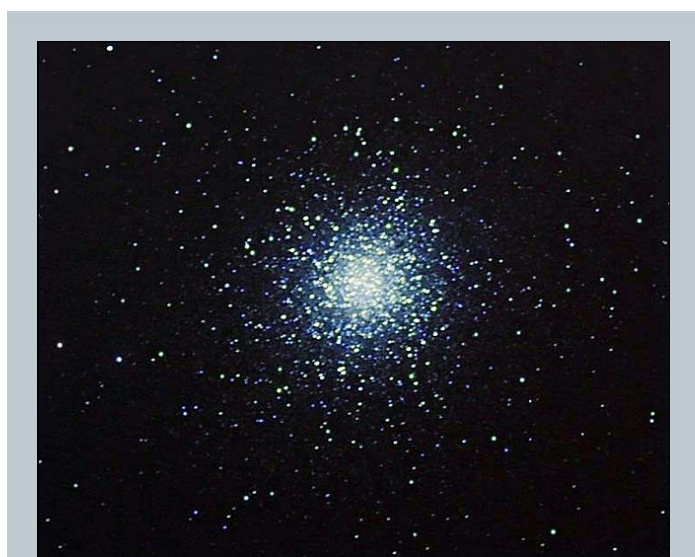
Further reading: See the entry about M13 in Wikipedia [http://en.wikipedia.org/wiki/Messier_13]. For historical observations and descriptions visit [<http://messier.seds.org/m/m013.html>]. Details about images of M13 taken by the Hubble Space Telescope can be found at the *Hubblesite* [<http://hubblesite.org/newscenter/archive/releases/2008/40/>].

side the galactic disk at tens of thousands of light-years away. In contrast, open star clusters like the relatively nearby Pleiades and Hyades reside within the galactic disk, and usually harbour a few hundred to a thousand stars.

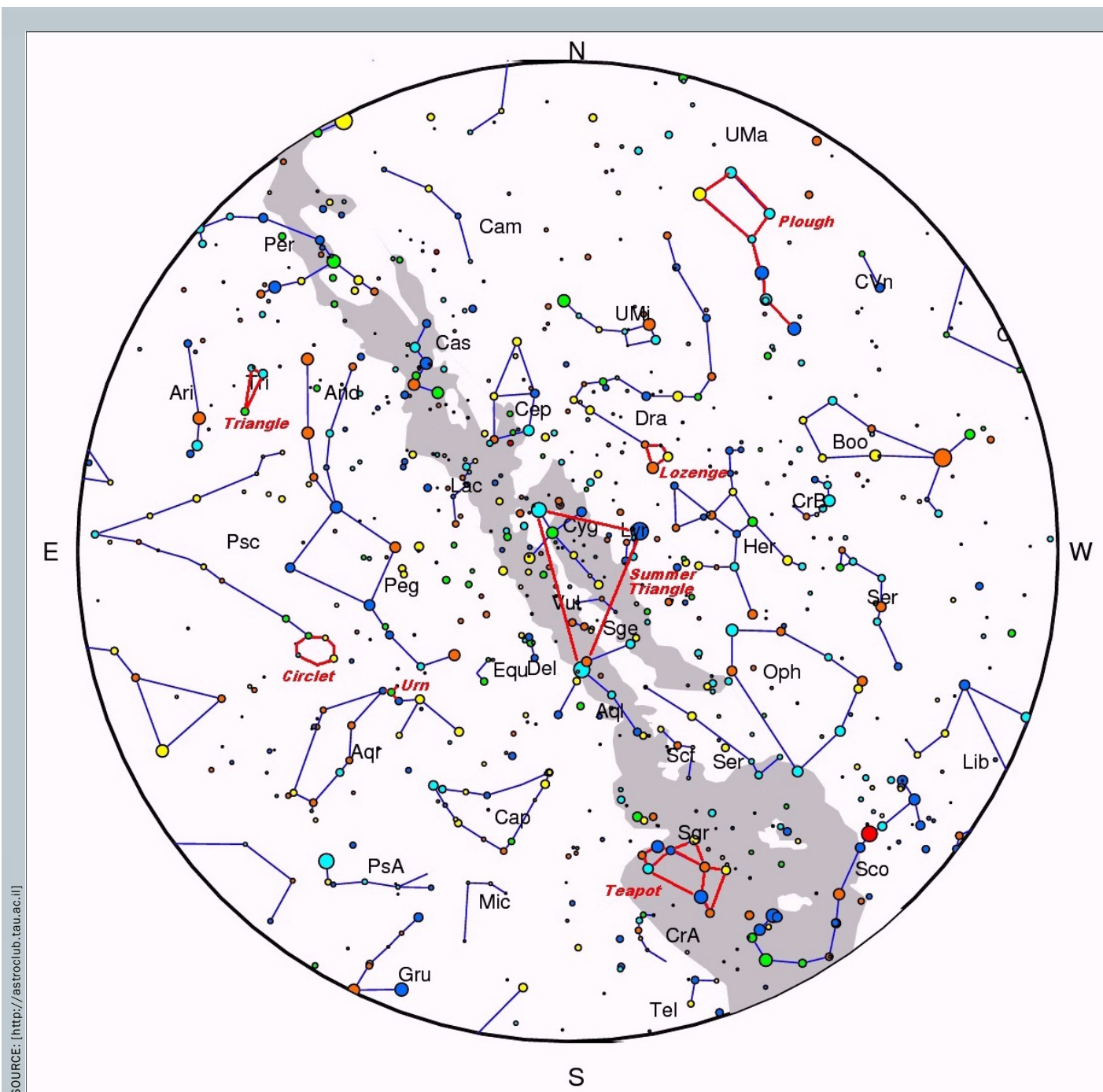
Globular star clusters, unlike open star clusters are tightly held together by gravity. Whereas open clusters break up after hundreds of millions of years, globular clusters remain intact after billions of years. When you gaze at M13 or other globulars, you are looking at stars that are thought to be 12 to 13 billion years old. That is almost as old as the Universe.

In a small telescope M13 looks like a ball of light with the centre brighter than the outer edges. It is seen flanked by two 7th-magnitude stars. The small bright core is visible even on a poor night, and the darker the night, the more of the cluster you will be able to see. In fact, the bright central part is only about a fifth of the total radius of the cluster.

A small telescope will show a slightly grainy texture to the cluster; a 15-cm telescope can start to resolve an incredible number of individual stars along the edges. In his *Celestial Handbook*, Robert Burnham describes the view of the cluster in a 12" (30-cm) or larger telescope as "an incredibly wonderful sight; the vast swarm of thousands of glittering stars, when seen for the first time or the hundredth, is an absolutely amazing spectacle."



For this portrait of M13 Winston Grech used a Meade Deep Sky Imager III on his William Optics FLT 110 telescope. It is a stack of a number of exposures taken with various filters. Processing was carried out with Photoshop CS.



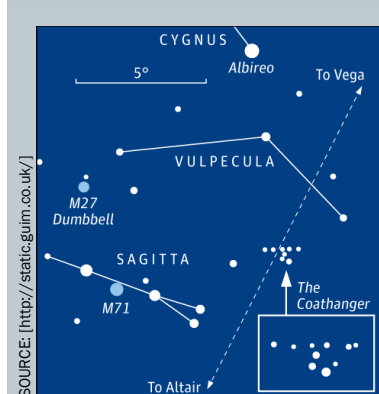
Asterisms visible in summer evenings are labelled in this star map which shows the night sky in early September at about 10 p.m. Central European Summer Time.

stellations border those of Vega, Deneb, and Altair.

There is much to notice within the Summer Triangle: The tip of little Sagitta, the Arrow, and M27, the Dumbbell Nebula, are almost on the same line from Altair to Deneb. The strange little Brocchi's Cluster or Coathanger is almost on the line from Vega to Altair, 3/5ths of the way from the former to the latter. The wonderful double star Albireo, β Cygni, and the red long-period variable star χ Cygni are not far from the Triangle's centre. Little Delphinus, the Delphinus, the Dolphin, lies just beyond the Deneb-Altair line. Its sprightly form is only 6° long from nose to tail.

Other geometric patterns gracing our sky in late summer evenings are the small, dim Urn or Water Jar — a kind of sideways letter 'Y' of stars in Aquarius — and the Circlet forming the western fish of Pisces. Meanwhile the

Teapot sits in the southwest, the Plough is dropping in the northwest, and the Lozenge of Draco's head reaches toward Vega overhead. The Northern Cross of Cygnus almost splits the Summer Triangle. And, last of all, the tiny constellation Triangulum, the Triangle, is just rising in the northeast.■



Finder chart for the Coathanger asterism in Vulpecula.

sky agenda summer 2014

July

- 01: Venus 4.1° N of Aldebaran
- 04: Earth at perihelion: 1.016682 A.U. from the Sun
- 04: Pluto at opposition
- 05: Moon at first quarter
- 06: Moon near Mars
- 08: Moon near Saturn
- 12: Full Moon
- 12: Mercury at greatest elongation: 21° W; in the morning sky
- 13: Moon at perigee: 358,260 km from the Earth
- 14: Mars 1.3° N of Spica
- 19: Moon at last quarter
- 24: Moon near Venus
- 24: Jupiter in conjunction with the Sun
- 25: Moon near Mercury
- 26: Moon near Jupiter
- 26: New Moon
- 28: Moon at apogee: 406,567 km from the Earth

29: Mercury at perihelion

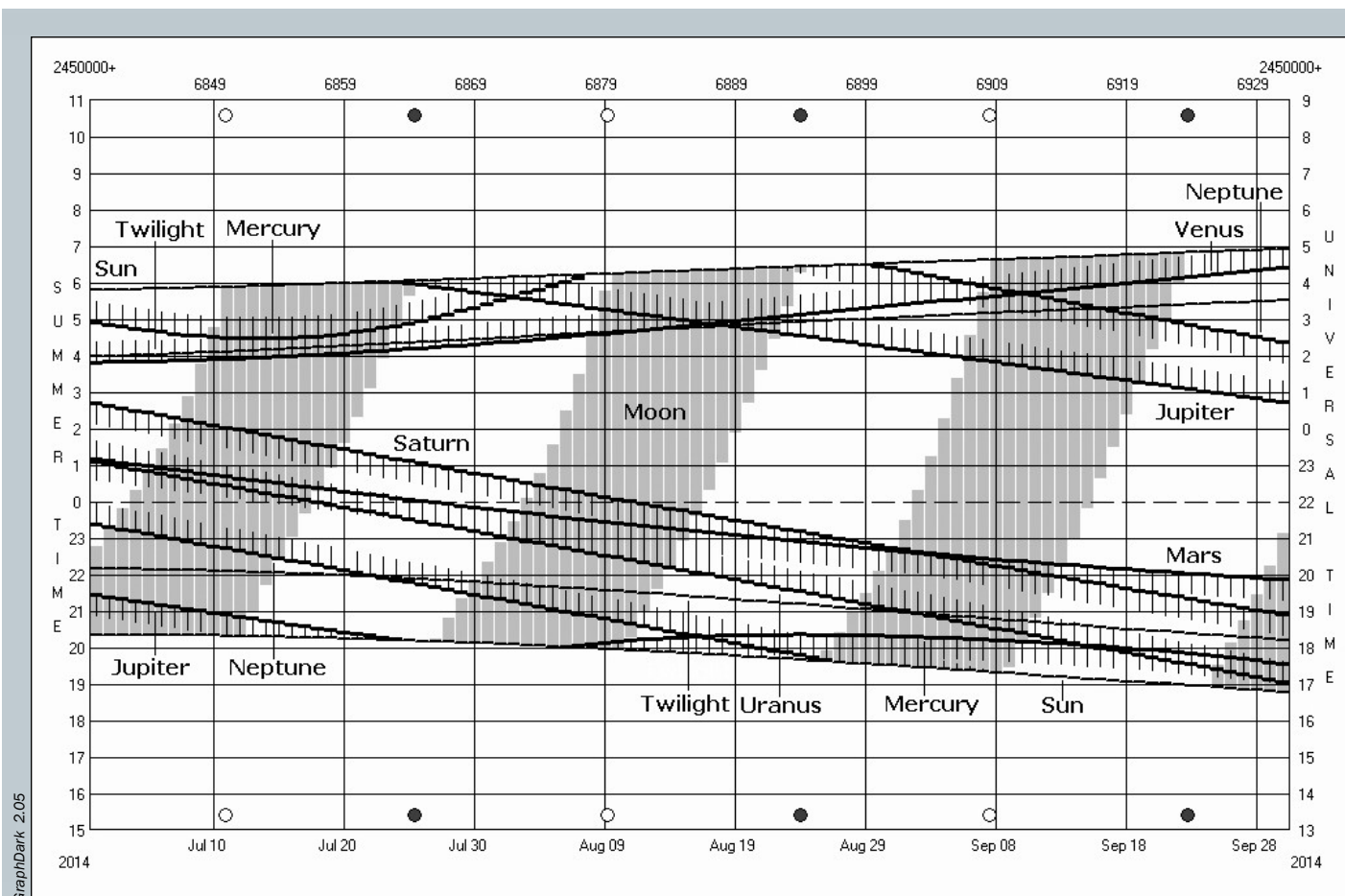
August

- 02: Mercury 0.9° N of Jupiter
- 03: Moon near Mars
- 04: Moon at first quarter
- 04: Moon near Saturn
- 08: Mercury at superior conjunction
- 08: Nearly full Moon occults ρ Sgr (mag. 3.9); see *The Big Bang*, No. 105, pg. 5
- 10: Full Moon
- 10: Moon at perigee: 356,896 km from the Earth
- 12: Perseid meteor shower at maximum, ZHR 80; unfavourable
- 15: Mercury 1.2° N of Regulus
- 17: Moon at last quarter
- 18: Venus 0.2° N of Jupiter (see pg 10)
- 18: Mars 0.9° S of the Beehive star cluster (M44)
- 18: Jupiter 1.1° S of M44
- 23: Moon near Jupiter
- 24: Moon near Venus
- 24: Moon at apogee: 406,523 km from the Earth
- 25: New Moon
- 25: Mars 3.4° S of Saturn

- 27: Moon near Mercury
- 29: Neptune at opposition
- 31: Moon near Saturn

September

- 01: Moon near Mars
- 02: Moon at first quarter
- 05: Venus 0.7° N of Regulus
- 05: Venus at aphelion
- 08: Moon at perigee: 358,389 km from the Earth
- 09: Full Moon
- 16: Moon at last quarter
- 18: The waning crescent Moon occults λ Gem (mag. 3.6); see *The Big Bang*, No. 105, pg. 5
- 20: Moon near Jupiter
- 20: Moon at apogee: 405,845 km from the Earth
- 20: Mercury 0.5° S of Spica
- 21: Mercury at greatest elongation: 26° E; in the evening sky
- 23: Autumnal equinox
- 23: Moon near Venus
- 24: New Moon
- 26: Moon near Mercury
- 28: Moon near Saturn
- 28: Mars 3.1° N of Antares
- 29: Moon near Mars



For any date during summer, the chart above tells the time when astronomical events occur during the night. Dates on the chart run horizontally from left to right. Time runs vertically from bottom to top, and is labelled along the left and right sides. Find the date you want on the bottom side of the chart, and read upward to find the times of the rising and setting of the Sun, Moon and planets, as well as the beginning and end of astronomical twilight (Sun 18° below the horizon). Tick marks on planet lines denote rising if above, setting if below a line. The Moon's new and full phases are indicated at the top and bottom edges (black disk is a new Moon, white disk is a full Moon). Julian dates (day begins at 12:00 Universal Time) are shown at the top.