Andromeda, Triangulum

Andromeda is a large, prominent northern constellation, commemorating the beautiful princess who was chained to a rock on the seashore to await the arrival of a monster, though fortunately the dauntless hero Perseus was first on the scene. Andromeda adjoins Perseus to one side and Pegasus to the other; why Alpheratz was transferred from the Flying Horse to the Princess remains a mystery.

The three leading stars of Andromeda are all of magnitude 2.1. Their individual names are often used; α is Alpheratz, β is Mirach and γ is Almaak. Their distances are respectively 72, 88 and 121 light-years; their luminosities 96, 115 and 95 times that of the Sun. Alpheratz is an A-type spectroscopic binary; Mirach is orange-red, with colour that is very evident in binoculars. It has been suspected of slight variability. Almaak is a particularly fine double, with a K-type orange primary and a hot companion which is said to look slightly blue-green by contrast. The pair can be resolved with almost any telescope, and the companion is a close binary, making a useful test for a telescope of about 25-centimetre (10-inch) aperture. δ, between Alpheratz and Mirach, is another orange star of type K.

R Andromedae, close to the little triangle of θ (4.61), σ (4.62) and ϱ (5.18), is a Mira variable which can at times rise above the sixth magnitude, and is readily identifiable because it is exceptionally red. The trick is to locate it when it is near maximum, so that the star field can be memorized and the variable followed down to its minimum – though if you are using a small telescope you will lose it for a while, since it drops down to almost the 15th magnitude.

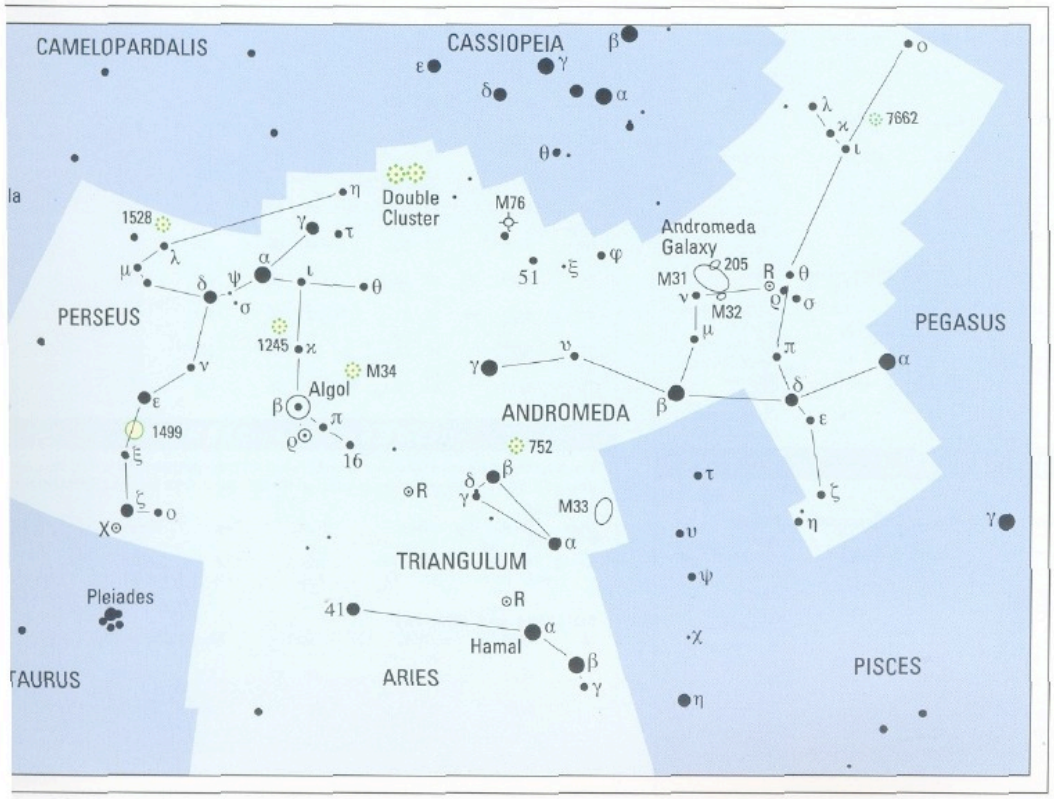
Of course the most celebrated object in Andromeda is the Great Spiral, M31. It can just be seen with the naked eye when the sky is dark and clear, and the Arab astronomer Al-Sûfi called it 'a little cloud'. It lies at a narrow angle to us, which is a great pity; if it were face-on it would indeed be glorious. The modern value for its distance is 2.2 million light-years, though if the Cepheid standard candles have been slightly under-estimated, as is possible, this value may have to be revised slightly upwards. It is a larger system than ours, and has two dwarf elliptical companions, M32 and NGC205, which are easy telescopic objects.

It has to be admitted that M31 is not impressive when seen through a telescope, and photography is needed to bring out its details. Novae have been seen in it, and there has been one supernova, S Andromedae of 1885, which reached the sixth magnitude – though it was not exhaustively studied, simply because nobody was aware of its true nature; at that time it was still believed that M31, like other spirals, was a minor feature of our own Galaxy.

The open cluster NGC752, between γ Andromedae and β Trianguli, is within binocular range, though it is scattered and relatively inconspicuous. It is worth seeking out the planetary nebula NGC7662, close to the triangle made up of γ, ϰ and τ; a 25-centimetre (10-inch) telescope shows its form, though the hot central star is still very faint.

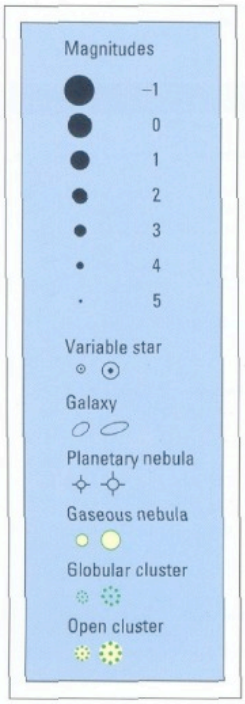
Triangulum is one of the few constellations which merits its name; the triangle made up of α, β and γ is distinctive even though only β is as bright as the third magnitude. There is one reasonably bright Mira star, R Trianguli, some way from γ, but the main object of interest is the Triangulum Spiral, M33, which lies some way from α in the direction of Andromeda, and is just south of a line joining α Trianguli to β Andromedae. It is looser than M31, but placed at a better angle to us. Some observers claim to be able to see it with the naked eye; binoculars certainly show it, but it can be elusive telescopically, because its surface brightness is low. It is much less massive than our Galaxy.

Aries. According to legend, this constellation honours a flying ram which had a golden fleece, and was sent by



***The constellations** in this map are best seen during evenings in northern autumn (southern spring), though it is true that the northernmost parts of Perseus and Andromeda – as well as Capella, in Auriga – are circumpolar from the British Isles or the northern United States and are always very low from Australia and New Zealand. Andromeda adjoins the Square of Pegasus, and indeed Alpheratz (α Andromedae) is one of the four stars of the Square. Aries is, of course, in the Zodiac, though precession has now carried the vernal equinox across the border of Pisces.*

Cassiopeia



Cassiopeia. The W shape of the constellation Cassiopeia is unmistakable, and is of special interest because one member of the pattern is variable, while another probably is.

The confirmed variable is γ, with a peculiar spectrum which shows marked variations. No changes in light seem to have been recorded until about 1910, and the magnitude had been given as 2.25. The star then slowly brightened, and there was a rapid increase during late 1936 and early 1937, when the magnitude rose to 1.6. A decline to below magnitude 3 followed by 1940, and then came a slow brightening; ever since the mid-1950s the magnitude has hovered around 2.2, slightly fainter than Polaris and slightly brighter than β Cassiopeiae. There is certainly no period; what apparently happens is that the star throws off shells of material and brightens during the process. A few other stars of the same type are known – Pleione in the Pleiades is a good example – but what are now known as 'GCAS' or Gamma Cassiopeiae variables, are rare. All of them seem to be rapid rotators. There may be a new brightening at any time, so that luminosity rises to about 6000 times that of our own Sun.

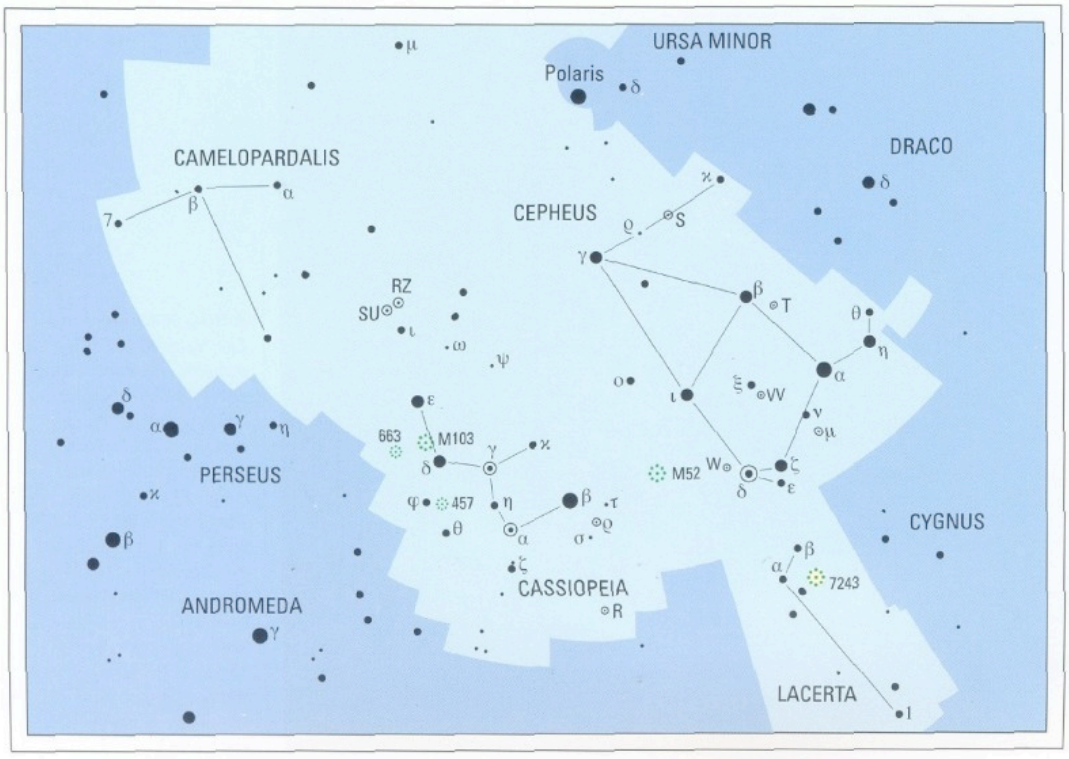
α Cassiopeiae (Shedir) is decidedly orange, with a K-type spectrum. It is 120 light-years away, and 190 times as luminous as the Sun. During the last century it was accepted as being variable, with a probable range of between magnitude 2.2 and 2.8; it was even suggested that there might be a rough period of about 80 days. Later observers failed to confirm the changes, and in modern catalogues α is often listed as 'constant', though my own observations between 1933 and the present time indicate that there are slight, random fluctuations between magnitudes 2.1 and 2.4, with a mean of 2.3. Generally speaking, the order of brilliance of the three main members of the W is γ, α, β, but this is not always the case, and watching the slight variations is a good exercise for the naked-eye observer. β itself fluctuates very slightly, but the range is less than 0.04 of a magnitude, so that in estimating γ and α it is safe to take the magnitude of β as 2.27.

ϱ, which lies close to β and midway between σ (magnitude 4.88) and τ (4.87), is unquestionably variable, but nobody is sure of its type. It is an exceptionally luminous supergiant, equal to at least 130,000 Suns, and is 4800 light-years away; for most of the time it hovers around magnitude 4.8, so that σ makes a convenient comparison star (although τ is also at a comparable magnitude, it is suspected of variability, and is better avoided). Occasionally ϱ drops to below the sixth magnitude, though this has not happened now for more than 40 years. The spectrum too is variable, and can range from type F8 to early M. The star is an excellent target for the binocular-user, since when a new minimum occurs early warning will be important.

R Cassiopeiae, a normal Mira star, can reach naked-eye visibility at maximum. The supernova of 1572 flared up near ϰ; the site is now identified by its radio emissions. η Cassiopeiae is a wide, easy double. ι is also easy, and there is another seventh-magnitude companion at a separation of just over 8 seconds of arc.

There are two Messier open clusters in Cassiopeia, neither of which is of special note; indeed M103 is less prominent than its neighbour NGC663 (C10), and it is not easy to see why Messier gave it preference. NGC457 is of more interest. It contains several thousands of stars, and is an easy binocular object. φ Cassiopeiae, magnitude 4.98, lies in its south-eastern edge, and if it is a genuine cluster member – as seems likely – it must have a luminosity well over 200,000 times that of the Sun; the distance is at least 9000 light-years.

The Milky Way crosses Cassiopeia, and the whole constellation is very rich. Here too we find the galaxies Maffei 1 and 2, which are so heavily obscured that they are difficult to see; Maffei 1 is almost certainly a member of the Local Group.



◀ ***Apart from Ursa Major,*** *Cassiopeia is much the most conspicuous of the far northern constellations. It and Ursa Major lie on opposite sides of the celestial pole, so that when Ursa Major is high up, Cassiopeia is low down, and vice versa – though neither actually sets over any part of the British Isles or the northern United States. Cepheus is much less prominent, and is almost lost from southern countries; Lacerta and Camelopardalis are very obscure.*

Cygnus, Aquila

Magnitudes
−1
0
1
2
3
4
5
Variable star
Galaxy
Planetary nebula
Gaseous nebula
Globular cluster
Open cluster

Lyra is a small constellation, but it contains a wealth of interesting objects. α (Vega) is the brightest star in the northern hemisphere of the sky apart from Arcturus, and is distinguished by its steely-blue colour; it is 26 light-years away, and 52 times as luminous as the Sun. During 1983 observations made from IRAS, the Infra-Red Astronomical Satellite, showed that Vega is associated with a cloud of cool material which may be planet-forming, though it would certainly be premature to claim that any planets actually exist there. Vega's tenth-magnitude companion, at a separation of 60 seconds of arc, merely happens to lie in almost the same line of sight; there is no real connection.

β Lyrae (Sheliak) is an eclipsing binary with alternative deep and shallow minima; it is the prototype star of its class. Its variations are very easy to follow, because the neighbouring γ (3.24) makes an ideal comparison star; when β is faint there are other comparison stars in χ (4.3), δ (also 4.3), and ζ (4.4). R Lyrae is a semi-regular variable, very red in colour, with a rough period of 46 days; useful comparison stars are η and θ, both of which are listed as magnitude 4.4, though I find θ to be appreciably the brighter of the two.

Close to Vega lies ε Lyrae, a splendid example of a quadruple star. Keen-eyed people can split the two main components, while a 7.6-centimetre (3-inch) telescope is powerful enough to show that each component is again double. It is worth using binoculars to look at the pair consisting of δ^1 and δ^2; here we have a good colour contrast, because the brighter star is an M-type red giant and the fainter member is white. ζ is another wide, easy double.

M57, the Ring, is the most famous of all planetary nebulae, though not actually the brightest. It is extremely easy to find, since it lies between β and γ, and a small telescope will show it. The globular cluster M56 is within binocular range, between γ Lyrae and β Cygni; it is very remote, at a distance of over 45,000 light-years. Mythologically, Lyra represents the Lyre which Apollo gave to the great musician Orpheus.

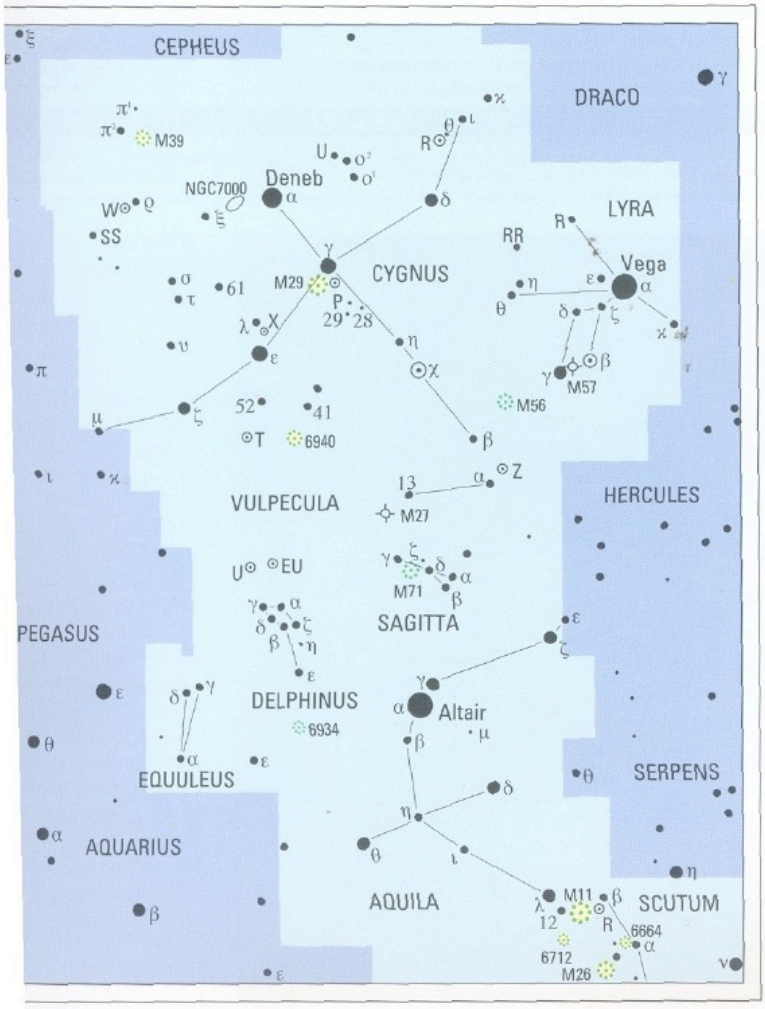
Cygnus, the Swan, said to represent the bird into which Jupiter once transformed himself while upon a clandestine visit to the Queen of Sparta, is often called the Northern Cross for obvious reasons; the X-pattern is striking. The brightest star, Deneb, is an exceptionally luminous supergiant, at least 70,000 times brighter than the Sun, and 1800 light-years away, so that we now see it as it used to be when Britain was occupied by the Romans. γ Cygni or Sadr, the central star of the X, is of type F8, and equal to 6000 Suns. One member of the pattern, β Cygni or Albireo, is fainter than the rest and also further away from the centre, so that it rather spoils the symmetry; but it compensates for this by being probably the loveliest coloured double in the sky. The primary is golden yellow, the companion vivid blue; the separation is over 34 seconds of arc, so that almost any small telescope will show both stars. It is an easy double; so too is the dim 61 Cygni, which was the first star to have its distance measured.

There are several variable stars of note. χ Cygni is a Mira star, with a period of 407 days and an exceptionally large magnitude range; at maximum it may rise to 3.3, brighter than its neighbour η, but at minimum it sinks to below 14, and since it lies in a rich area it is then none too easy to identify. χ is one of the strongest infra-red sources in the sky. U Cygni (close to the little pair consisting of o^1 and o^2) and R Cygni (in the same telescopic field with θ, magnitude 4.48) are also very red Mira variables.

P Cygni, close to γ, has a curious history. In 1600 it flared up from obscurity to the third magnitude; ever since 1715 it has hovered around magnitude 5. It is very luminous and remote, and is also known to be unstable. It is worth monitoring, because there is always the chance of a new increase in brightness; good comparison stars are 28 Cygni (4.9) and 29 Cygni (5.0)

The Milky Way flows through Cygnus, and there are conspicuous dark rifts, indicating the presence of obscuring dust. There are also various clusters and nebulae. The open cluster M29 is in the same binocular field as P and γ, and though it is sparse it is not hard to identify. M39, near ϱ, is also loose and contains about 30 stars.

NGC7000 is known as the North America Nebula. It is dimly visible with the naked eye in the guise of a slightly brighter portion of the Milky Way, and binoculars show it well as a wide region of diffuse nebulosity; photographs show that its shape really does bear a marked resemblance to that of the North American continent. It is nearly 500



◀ ***This map*** *is dominated by three bright stars: Deneb, Vega and Altair. Because they are so prominent during summer evenings in the northern hemisphere, I once referred to them as 'the Summer Triangle', and the name has come into general use, though it is quite unofficial and is inappropriate in the southern hemisphere. The Milky Way crosses the area, which is very rich. All three stars of the 'Triangle' can be seen from most inhabited countries, though from New Zealand Deneb and Vega are always very low.*

Orion, Canis Major

Magnitudes
−1
0
1
2
3
4
5
Variable star
Galaxy
Planetary nebula
Gaseous nebula
Globular cluster
Open cluster

Orion, the Hunter, is generally regarded as the most splendid of all the constellations. The two leaders are very different from each other; though lettered β, Rigel is the brighter, and is particularly luminous, since it could match 60,000 Suns and is some 900 light-years away. If it were as close to us as Sirius, its magnitude would be −10, and it would be one-fifth as brilliant as the full Moon. It has a companion star, which is above magnitude 7, and would be easy to see if it were not so overpowered by Rigel, and even so it has been glimpsed with a 7.6-centimetre (3-inch) telescope under good conditions. The companion is itself a close binary, with a luminosity 150 times that of the Sun. α (Betelgeux) has a official magnitude range of from 0.4 to 0.9, but it seems definite that at times it can rise to 0.1, almost equal to Rigel. Good comparison stars are Procyon and Aldebaran, but allowance must always be made for extinction. The apparent diameter of Betelgeux is greater than for any other star beyond the Sun, and modern techniques have enabled details to be plotted on its surface.

The other stars of the main pattern are γ (Bellatrix), κ (Saiph) and the three stars of the Belt, δ (Mintaka), ε (Alnilam) and ζ (Alnitak). Bellatrix is 2200 times as luminous as the Sun; all the others outshine the Sun by more than 20,000 times, and are over 1000 light-years away. Indeed, Saiph is not much less powerful than Rigel, but is even more remote, at 2200 light-years. Mintaka is an eclipsing binary with a very small range (magnitude 2.20 to 2.35), while both it and Alnitak have companions which are easy telescopic objects.

σ, in the Hunter's Sword, is a famous multiple, and of course θ, the Trapezium, is responsible for illuminating the wonderful nebula M42. M43 (an extension of M42) and M78 (north of the Belt) are really only the brightest parts of a huge nebular cloud which extends over almost the whole of Orion. Other easy doubles are ι and λ.

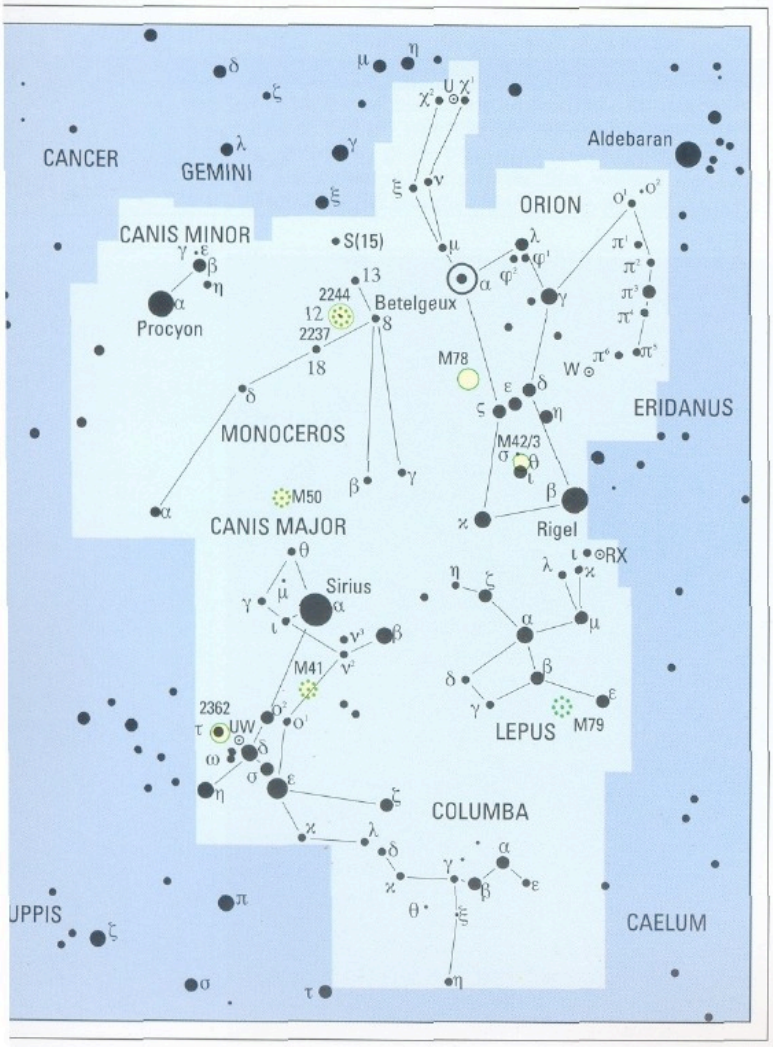
The red semi-regular variable W Orionis is in the same binocular field with π^6 (magnitude 4.5), the southernmost member of a line of stars which, for some strange reason, are all lettered π. It has an N-type spectrum, and is always within binocular range; its colour makes it readily identifiable, and it is actually redder than Betelgeux, though the hue is not so striking because the star is much fainter. U Orionis, on the border of Orion and Taurus, is a Mira star which rises to naked-eye visibility at maximum; it is a member of a well-marked little group lying between τ Tauri and η Geminorum.

Canis Major, Orion's senior Dog, is graced by the presence of Sirius, which shines as much the brightest star in the sky even though it is only 26 times as luminous as the Sun; it is a mere 8.6 light-years away, and is the closest of all the brilliant stars apart from α Centauri. Though it is pure white, with an A-type spectrum, the effects of the Earth's atmosphere make it flash various colours. All stars twinkle to some extent, but Sirius shows the effect more than any others simply because it is so bright. The white dwarf companion would be easy to see if it were not so overpowered; the revolution period is 50 years. It is smaller than the planet Neptune, but is as massive as the Sun.

ε (Adhara), δ (Wezea), η (Aludra) and o^2 are all very hot and luminous; Wezea, indeed, could match 130,000 Suns, and is over 3000 light-years away. It is not easy to appreciate that of all the bright stars in Canis Major, Sirius is much the least powerful. Adhara, only just below the official 'first magnitude', has a companion which is easy to see with a small telescope.

There are two fine open clusters in Canis Major. M41 lies in the same wide field with the reddish ν^2, forming a triangle with ν^2 and Sirius; it is a naked-eye object, and can be partly resolved with binoculars. NGC2362, round the hot, luminous star τ (magnitude 4.39), is 3500 light-years away, and seems to be a very young cluster; with a low power it looks almost stellar, but higher magnification soon resolves it. In the same low-power field is the β Lyrae eclipsing binary UW Canis Majoris, which is an exceptionally massive system. According to one estimate the masses of the two components are 23 and 19 times that of the Sun, so that they rank as cosmic heavyweights. The total luminosity of the system is at least 16,000 times that of the Sun.

Canis Minor, the Little Dog, includes Procyon, 11.4 light-years away and 10 times as luminous as the Sun. Like Sirius, it has a white dwarf companion, but the dwarf is so faint and so close-in that it is a very different object. The



◀ ***Orion*** *is probably the most magnificent of all the constellations, and since it is crossed by the celestial equator it is visible from every inhabited country (though from the proposed observatory at the South Pole, Rigel will be permanently above the horizon and Betelgeux never!). Orion is a superb guide to other groups; the Belt stars point southwards to Sirius and northwards to Aldebaran. Orion and his retinue dominate the evening sky all through northern winter (southern summer). The stars in the southernmost part of this map do not rise over Britain.*

Pegasus

Pegasus forms a square – though one of its main stars has been stolen by the neighbouring Andromeda. The stars in the Square of Pegasus are not particularly bright; Alpheratz is of the second magnitude, the others between 2.5 and 3. However, the pattern is easy to pick out because it occupies a decidedly barren region of the sky. On a clear night, try to count the number of stars you can see inside the Square first with the naked eye, and then with binoculars. The answer can be somewhat surprising.

Three of the stars in the Square are hot and white. α Pegasi (Markab) is of type B9, 100 light-years away and 75 times as luminous as the Sun. γ (Algenib), which looks the faintest of the four, is also the most remote (520 light-years) and the most powerful (equal to 1300 Suns); the spectral type is B. The fourth star, β (Scheat), is completely different. It is an orange-red giant of type M, and the colour is evident even with the naked eye, so that binoculars bring it out well, and the contrast with its neighbours is striking. Moreover, it is variable. It has a fairly small range, from magnitude 2.3 to 2.5, but the period – around 38 days – is more marked than with most other semi-regular stars. The changes can be followed with the naked eye, α and β make good comparison stars.

When making estimates of this kind, allowance has to be made for what is termed extinction, the dimming of a star due to atmospheric absorption which naturally increases at lower altitudes above the horizon (see table).

The right ascensions of β and α are about the same, and the difference in declination is about 13 degrees. Suppose that β is at an altitude of 32 degrees; it will be dimmed by 0.2 of a magnitude. If α is directly below (as it may be to northern-hemisphere observers; in southern altitudes the reverse will apply) the altitude will be 32 − 13 = 19 degrees, and the dimming will be 0.5 magnitude. If the two look equal, α will actually be the brighter by 0.3 magnitude, so that β will be 2.7. Try to find a comparison star at an altitude equal to that of the variable. This is unimportant with telescopic variables; extinction will not change noticeably over a telescopic or binocular field of view.

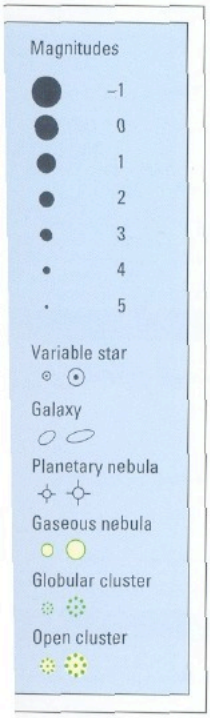
It is also interesting to compare the real luminosities of the stars in the Square. As we have seen, absolute magnitude is the apparent magnitude which a star would have if it could be seen from a standard distance of 10 parsecs, or 32.6 light-years. The values for the four stars are: Alpheratz −0.1, α Pegasi +0.2, β Pegasi −1.4 (rather variable), and γ −3.0, so that γ would dominate the scene.

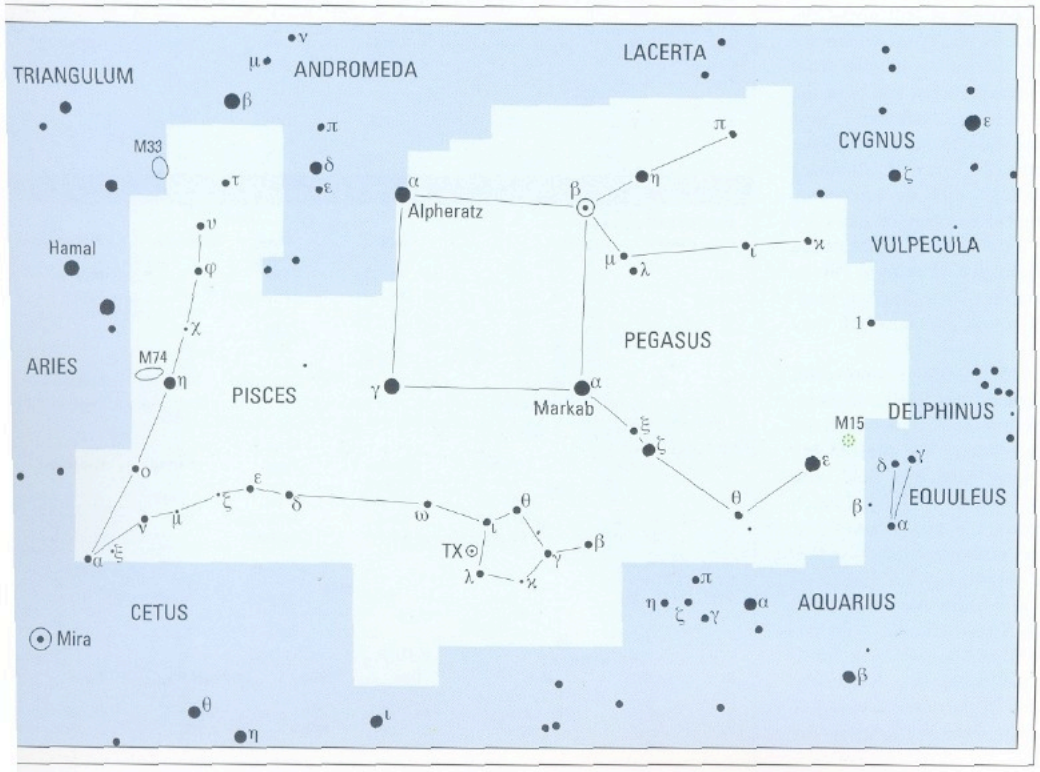
The other leading star of Pegasus is ε, which is well away from the Square and is on the border of Equuleus. It is a K-type orange star, 520 light-years away and 4500 times as luminous as the Sun. It has been strongly suspected of variability, and naked-eye estimates are worthwhile; α is a good comparison, though in general ε should be slightly but detectably the brighter of the two.

The globular cluster M15, close to ε, was discovered in 1746 by the Italian astronomer Maraldi. To find it, use θ and ε as guides. It is just below naked-eye visibility, but binoculars show it as a fuzzy patch; it has an exceptionally condensed centre, and is very rich in variable stars. It is also very remote, at a distance of over 49,000 light-years. The real diameter cannot be far short of 100 light-years.

Pisces is one of the more obscure Zodiacal constellations, and consists mainly of a line of dim stars running along south of the Square of Pegasus. Mythologically its associations are rather vague; it is sometimes said to represent two fishes into which Venus and Cupid once changed themselves in order to escape from the monster Typhon, whose intentions were anything but honourable.

α, magnitude 3.79, has three proper names: Al Rischa, Kaïtain or Okda. It is a binary, not difficult to split with a small telescope; both components have been suspected of slight variability in brightness and colour, but firm evidence is lacking. Both are of type A, and the distance from us is 100 light-years. ζ is another easy double, and here too slight variability has been suspected.





◀ ***Pegasus*** *is the most prominent constellation of the evening sky during northern autumn (southern spring). The four main stars – one of which has been illogically transferred to Andromeda – make up a square, which is easy enough to identify even though maps tend to make it seem smaller and brighter than it really is. In fact the brightest star in Pegasus, ε, is some way from the Square. Pisces is a very dim Zodiacal constellation occupying the area between Pegasus and Cetus.*

Ursa Minor

Ursa Minor, the Little Bear is notable chiefly because it contains the north celestial pole, now marked within one degree by the second-magnitude star α (Polaris). At present it is moving even closer to the pole, and will be at its nearest (within 28 minutes 31 seconds) in the year 2102. Navigators have found it very useful indeed, because to find one's latitude on the surface of the Earth all that has to be done is to measure the height of Polaris above the horizon and then make a minor correction. (Southern-hemisphere navigators are not so lucky; their pole star, σ Octantis, is very faint indeed.) As a matter of interest, the actual pole lies almost along a line connecting Polaris with Alkaid in the tail of the Great Bear.

Polaris itself was known to the early Greeks as 'Phoenice', and another name for it, current during the 16th and 17th centuries, was Cynosura. It is of spectral type F8, so that in theory it should look slightly yellowish, but most observers will certainly call it white. The ninth-magnitude companion, lying at a distance of over 18 seconds of arc, is by no means a difficult object; it was discovered in 1780 by William Herschel, and is said to have been glimpsed with a 5-centimetre (2-inch) telescope, though at least a 7.6-centimetre (3-inch) instrument is needed to show it clearly. Polaris lies at a distance of 680 light-years. It is a powerful star, about 6000 times as luminous as the Sun.

The only other reasonably bright star in Ursa Minor is β (Kocab), which is very different to Polaris; it is of type K, and its orange colour is evident even with the naked eye. It is 29 light-years from us, and equal to 95 Suns. Kocab and its neighbour γ (Pherkad Major) are often called 'the Guardians of the Pole'. The rest of the Little Bear pattern is very dim, and any mist or moonlight will drown it. Neither are there any other objects of immediate interest.

Draco, the Dragon, is a large constellation, covering more than 1000 square degrees of the sky, but it contains no really bright stars. It is not difficult to trace. Beginning more or less between the Pointers and Polaris, it winds its way around Ursa Minor, extending up to Cepheus and then towards Lyra; the 'head', not far from Vega, is the most prominent part of the constellation, and is made up of γ (Eltamin), β, ν and ξ. ν is a particularly wide, easy double, with equal components; really keen-sighted people claim to be able to split it with the naked eye, and certainly it is very evident with binoculars. The two are genuinely associated, and share a common motion through space, but the real separation between them is of the order of 350,000 million kilometres. Each component is about 11 times as luminous as the Sun.

Eltamin is an ordinary orange star, 100 light-years away and 107 times as luminous as the Sun, but it has a place in scientific history because of observations made of it in 1725–6 by James Bradley, later to become Astronomer Royal. Bradley was attempting to measure stellar parallaxes, and Eltamin was a suitable target because it passed directly over Kew, in Outer London, where Bradley had his observatory. He found that there was indeed a displacement, but was too large to be put down to parallax – and this led him on to the discovery of the aberration of light, which is an apparent displacement of a stationary object when observed from a moving one.

ε Draconis, close to the rather brighter δ, is an easy double. The primary was once suspected of being variable between magnitudes 3¾ and 4¾, but this has not been confirmed. The spectral type is G8. σ Draconis or Alrakis, magnitude 4.68, is one of the closest of the naked-eye stars; its distance from us is less than 19 light-years. It is a K-type dwarf, much less luminous than the Sun.

α Draconis (Thuban) was the north pole star at the time when the Pyramids were built. Since then the pole has shifted out of Draco into Ursa Minor; in the future it will migrate through Cepheus and Cygnus, reaching Lyra in 12,000 years from now – though Vega will never be as

Magnitudes
−1
0
1
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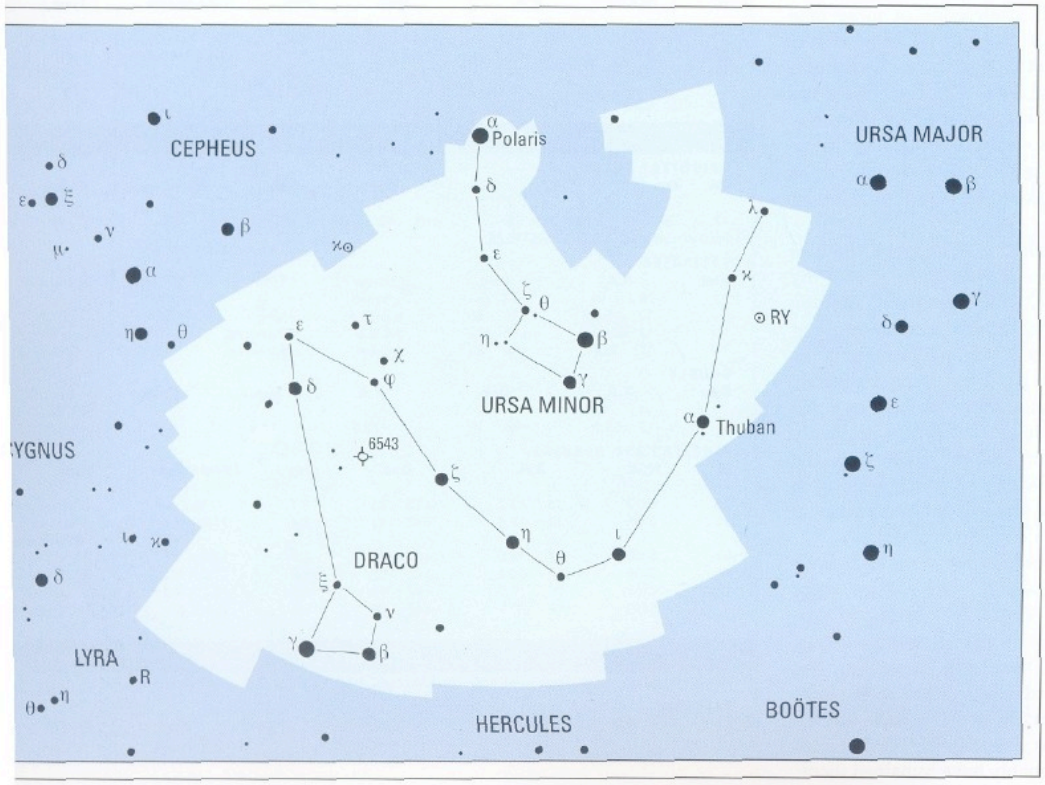
4
5
Variable star
Galaxy
Planetary nebula
Gaseous nebula
Globular cluster
Open cluster



◀ ***The north celestial pole*** *is marked within one degree by Polaris in Ursa Minor. All the constellations shown here are circumpolar from Britain and much of Europe and North America. Polaris can be identified by using the 'Pointers', Merak and Dubhe, as guides; Draco sprawls from the region near the Pointers almost as far as Vega. Lyra is shown here, but described in Star Map 8.*