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Stars are scattered across the night sky like sequins on velvet. Over 2000 of them are visible to the unaided eye at any one time under the clearest conditions, but most are faint and insignificant. Only a few hundred stars are bright enough to be prominent to the naked eye, and these are plotted on the monthly sky maps in this book. The brightest stars of all act as signposts to the rest of the sky, as shown on pages 08–09.

It is a welcome fact that you need to know only a few dozen stars to find your way around the sky with confidence. This book will introduce you to the stars month by month, without the need for optical aid, so that you become familiar with the sky throughout the year.

What is a star?

All stars are suns, blazing balls of gas like our own Sun, but so far away that they appear as mere points of light in even the most powerful telescopes. At the centre of each star is an immense natural nuclear reactor, which produces the energy that makes the star shine. Stars can shine uninterrupted for billions of years before they finally fade away.

Many bright stars have noticeable colours – for example, Antares, Betelgeuse and Aldebaran are reddish-orange. A star's colour is a guide to its temperature. Contrary to the everyday experience that blue means cold and red is hot, the bluest stars are actually the hottest and the reddest stars are the coolest. Red and orange stars have surfaces that are cooler than that of the Sun, which is yellow-white. The hottest stars of all appear blue-white, notably Rigel, Spica and Vega. On the star charts in this book, the brightest stars are coloured as they appear to the unaided eye. Faint stars show no colour to the eye at all. Star colours are more distinct when viewed through binoculars or telescopes.

The familiar twinkling of stars is nothing to do with the stars themselves. It is caused by currents of air in the Earth's atmosphere, which produce an effect similar to a heat haze. Stars close to the horizon twinkle the most because we see them through the thickest layer of atmosphere (see diagram). Bright stars often flash colourfully from red to blue as they twinkle; these colours are due to the star's light being broken up by the atmosphere.

What is a planet?

Nine planets, including the Earth, orbit the Sun. The basic difference between a star and a planet is that stars give out their own light but planets do not. Planets shine in the sky because they reflect the light of the Sun. They can consist mostly of rock, like our Earth, or they can be composed of gas and liquid, as are Jupiter and Saturn.

Planets are always on the move, so they cannot be shown on the maps in this book. The three outermost planets – Uranus, Neptune and Pluto – are too faint to be seen with the naked eye. The innermost planet, Mercury, keeps so close to the Sun that it is perpetually engulfed in twilight. So there are only four planets that are prominent to the eye in the night sky: Venus, Mars, Jupiter and Saturn. The positions of these four planets each month for a five-year period are given in the monthly notes in this book. The planets appear close to the plane of the ecliptic, the Sun's yearly path around the sky, which is marked as a dashed green line on the maps.

The brightest planet is Venus, for two reasons: it comes closer to the Earth than any other planet, and it is entirely shrouded by highly reflective clouds. Venus is popularly termed the morning or evening 'star', seen shining brilliantly in twilight before the Sun rises or after it has set. As Venus orbits the Sun it goes through phases like those of the Moon, noticeable through small telescopes and binoculars.

The second-brightest planet as seen from Earth is Jupiter, the largest planet of the Solar System. Binoculars reveal its rounded disk and four brightest moons. Mars, when closest to us, appears as a bright red star, but it is too small to show much detail through small telescopes. Saturn at its closest appears to the eye like a bright star, and binoculars just show the outline of the rings that girdle its equator.

It is often said that planets do not twinkle, but this is not entirely correct. Some twinkling of planets can be seen on particularly unsteady nights, but since planets are not point sources they certainly twinkle far less than stars.

What is a constellation?

About 4500 years ago, people of the eastern Mediterranean began to divide the sky into easily recognizable patterns, to which they gave the names of their gods, heroes and fabled animals. Such star patterns are known as constellations. They were useful to seamen for navigation and to farmers who wanted to tell the time of night or the season of the year. By the time of the Greek astronomer Ptolemy in AD 150, 48 constellations were recognized.

Since then, various astronomers have introduced new figures to fill the gaps between the existing ancient constellations. Many of the new groups lie in the far southern part of the sky that was invisible to the Greeks. Some of the newly invented constellations have since been abandoned, others have been amalgamated, and still others have had their names or boundaries changed. This haphazard process has left a total of 88 constellations, of all shapes and sizes, covering the entire sky like pieces of a jigsaw. They all have Latin names. The constellation names and boundaries are laid down by the International Astronomical Union, astronomy's governing body.

The stars in a constellation are usually unrelated, lying at widely differing distances from us and from each other (see diagram).
How did the stars get their names?

Most bright stars, and several not-so-bright ones, have strange-sounding names. Other stars are known merely by letters and numbers. These designations arose in various ways, as follows.

A number of star names date back to Greek and Roman times. For example, the name of the brightest star in the sky, Sirius, comes from the Greek word for sparkling or scorching, in reference to its brilliance. The name of another bright star, Antares, is also Greek and can be translated as 'like Mars' or 'rival of Mars', on account of its strong red colour, similar to that of the planet Mars. The brightest star in the constellation Virgo is named Spica, from the Latin meaning 'ear of wheat', which the harvest goddess Virgo is visualized holding.

But most of our star names are Arabic in origin, and were introduced into Europe in the Middle Ages through the Arab conquest of Spain. For example, Aldebaran is Arabic for 'the follower', from the fact that it follows the star cluster known as the Pleiades across the sky. Fomalhaut comes from the Arabic meaning 'mouth of the fish', from its position in the constellation Piscis Austrinus, the Southern Fish. Betelgeuse is a corruption of the Arabic yad al-jawza, meaning 'the hand of Orion'. Its name is often mistranslated as 'armpit of the central one'.

In all, several hundred stars have proper names, but only a few dozen names are commonly used by astronomers. Usually, astronomers refer to stars by their Greek letters, assigned in 1603 by the German astronomer Johann Bayer; hence these designations are known as Bayer letters. On this system, Betelgeuse is Alpha (α) Orionis, meaning the star Alpha in the constellation of Orion. Another system of labelling stars is by their numbers in a star catalogue compiled by the English astronomer John Flamsteed. These are known as Flamsteed numbers, and they are applied to fainter stars that do not have Bayer letters, such as 61 Cygni. (Note that the genitive, or possessive, case of a constellation's Latin name is always used with Bayer letters and Flamsteed numbers). Stars too faint to be included in these systems, or stars with particular characteristics, are referred to by the numbers assigned to them in a variety of specialized catalogues.

How far are the stars?

So remote are the stars that their distances are measured not in kilometres or miles but in the time that light takes to travel from them to us. Light has the fastest speed in the Universe, 300,000 km/sec (186,000 mile/sec). It takes just over 1 second to cross the gap from the Moon to the Earth, 8.3 minutes to reach us from the Sun, and 4.4 years to reach the Earth from the nearest star, Alpha Centauri. Hence Alpha Centauri is said to be 4.4 light years away.

A light year is equivalent to 9.5 million million km (5.9 million million miles), so that in everyday units Alpha Centauri is about 40 million million km (25 million million miles) away. Even our fastest space probes would take about 80,000 years to get to Alpha Centauri, so there is no hope of exploring the stars just yet.

Most of the stars visible to the naked eye lie from dozens to hundreds of light years away. It is startling to think that the light entering our eyes at night left those stars so long ago. The most distant stars that can be seen by the naked eye are over 1000 light years away, for example Deneb in the constellation Cygnus and several of the stars in Orion. Only the most luminous stars, those that blaze more brightly than 50,000 Suns, are visible to the naked eye over such vast distances. At the other end of the scale, the feeblest stars emit less than a thousandth of the light of the Sun, and even the closest of them cannot be seen without a telescope.

How bright are the stars?

The stars visible to the naked eye range more than a thousand-fold in brightness, from the most brilliant one, Sirius, to those that can only just be glimpsed on the darkest of nights. Astronomers term a star's brightness its magnitude. The magnitude system is one of the odder conventions of astronomy.

Naked-eye stars are ranked in six magnitude classes, from first magnitude (the brightest) to sixth magnitude (the faintest). A difference of five magnitudes is defined as equaling a brightness difference of exactly 100 times. Hence a step of one magnitude corresponds to a difference of about 2.5 times in brightness. A difference of two magnitudes corresponds to a brightness difference of $2.5 \times 2.5 = 6.3$ times. Three magnitudes equals a brightness difference of $2.5 \times 2.5 \times 2.5 = 16$ times, and so on.

A star 2.5 times brighter than magnitude 1.0 is said to be of magnitude 0. Objects brighter still are assigned negative magnitudes. Sirius, the brightest star in the entire sky, has a magnitude of −1.4.

The magnitude system can be extended indefinitely to take account of the brightest and the faintest objects. For instance, the Sun has a magnitude of −27. Objects fainter than sixth magnitude are classified in succession as seventh magnitude, eighth magnitude, and so on. The faintest objects that can be detected by telescopes on Earth are about magnitude 25.

What are double stars?

Most stars are not single, as they appear to the naked eye, but have one or more companion stars, a number of which can be seen through small telescopes, and some with binoculars. The visibility of the companion star depends on its brightness and its distance from the primary star – the closer the stars are together, the larger the aperture of telescope that is needed to separate them.

Usually, the members of a star family all lie at the same distance from us and orbit each other like the planets around the Sun. A pair of stars genuinely related in this way is known as a binary. But sometimes one star simply lies in the background of
What are variable stars?

Not all stars are constant in brightness. Certain stars change noticeably in brightness from night to night, and some even from hour to hour. The brightest of the varying stars is Betelgeuse in Orion, which ranges a full magnitude (i.e. 2.5 times) between maximum and minimum intensity, taking many months or even years to go from one peak to the next. The variations in the light output of Betelgeuse are caused by changes in the actual size of the star. Although the variations of Betelgeuse have no set period, a number of stars pulsate regularly, like a beating heart, every few days or weeks. These are known as Cepheid variables, and they follow the rule that the longer the cycle of variation, the more luminous is the star.

Some stars which appear to vary in brightness are actually close pairs in which one star periodically eclipses the other, temporarily blocking off its light from us. The prototype of these so-called eclipsing binaries is Algol, in the constellation Perseus, which fades to one-third its usual brightness every 2 days 20 hours 49 minutes. This and other interesting variable stars are highlighted in the constellation notes.

The most spectacular of the varying stars are the novae, faint stars which can flare to thousands of times their usual brightness for a few days before sinking back into obscurity. Novae got their name, which is Latin for 'new', because in the past they were really thought to be new stars appearing in the sky. Now we know that a nova is actually an old, dim star that has flared up because gas has fallen onto it from a neighbour. Nova outbursts are unpredictable, and are often first spotted by amateur astronomers.

What is a comet?

During your sky watching, you will from time to time see a bright streak of light dash across the sky like a cosmic laser beam, lasting no more than a second or so. This is a meteor, popularly termed a shooting star. Do not misidentify shooting stars with satellites or high-flying aeroplanes, which look like moving stars but drift at a more leisurely pace.

Despite their name, shooting stars are nothing to do with stars at all. They are particles of dust shed by comets and are usually no bigger than a grain of sand. They plunge into the Earth's atmosphere at speeds from 10 to 75 km/sec (6 to 46 mile/sec). We see a glowing streak of hot gas as the dust particle burns up by friction with the atmosphere about 100 km (60 miles) above the Earth. The brightest meteors outshine the stars, and some break up into glowing fragments. Occasionally, much larger chunks of rock and metal penetrate the atmosphere and land on Earth. These are called meteorites.

On any clear night, several meteors are visible to the naked eye each hour, burning up at random. These are known as sporadic meteors. But at certain times of the year the Earth ploughs through dust storms moving along the orbits of comets. We then see a meteor shower, when as many as 100 meteors may be visible each hour.

Owing to an effect of perspective, all the members of a meteor shower appear to diverge from a small area of sky known as the radiant. The meteor shower is named after the constellation in which its radiant lies: the Perseids appear to radiate from the constellation of Perseus, the Geminids from Gemini and so on. Meteor showers recur on the same dates each year, although the intensity of a shower can vary from year to year. As the Earth penetrates the swarm of dust, the number of meteors visible each hour builds up over a few days to its maximum, and then falls away again. Amateur astronomers monitor the progress of a shower by counting the number of meteors visible, and estimating their brightnesses.

When watching for meteors from a shower, do not gaze directly at the radiant, but scan about 90° to the side of it, where the meteor trails will be longest. A list of the year's main meteor showers is given in the table overleaf. Note that the maximum number of meteors quoted will be seen only in dark conditions, when the radiant is high in the sky. If the radiant is low, or if the sky is bright (for instance from moonlight), the number of meteors visible will be very much smaller.

What is a shooting star?

People often confuse comets with shooting stars, but they are quite different things. Whereas a shooting star appears as a brief streak of light, a comet looks like a hazy smudge hanging in the sky. A comet's movement against the star background is noticeable only over a period of hours, or from night to night. Comets are giant snowballs of frozen gas and dust that move on highly elongated orbits around the Sun, taking from a few years to many thousands of years to complete one circuit.

About three dozen comets are seen by astronomers each year. These are a mixture of new discoveries and previously known examples returning to the inner part of the Solar System. Most comets are too faint to be seen without a large telescope. Only rarely, perhaps every ten years or so, does one become bright
What is a galaxy?

Some objects that at first sight resemble nebulae are actually distant systems of stars beyond our Milky Way – other galaxies, many millions of light years apart, dotted like islands throughout the Universe. The smallest galaxies consist of approximately a million stars, while the largest galaxies contain a million million stars or more. We live in a fair-sized galaxy of at least 100,000 million stars.

Galaxies come in two main types: spiral and elliptical. Spiral galaxies have arms consisting of stars and gas winding outwards from their star-packed hubs. A sub-species of spiral galaxies, called barred spirals, have a bar of stars across their centre; the hub to the rim of the Galaxy, which is about 100,000 light years in diameter. Beyond the edge of the Galaxy is empty space, dotted with other galaxies.

On the monthly star maps, the Milky Way is indicated in light blue. Sparkling star fields spring into view if you sweep along this region with binoculars or small telescopes.

What is a Nebula?

Between the stars are vast clouds of gas and dust known as nebulae, the Latin for mist, a word that accurately describes their foggy appearance. They are best seen in clear country skies, away from smoke and streetlights. Some nebulae shine brightly, whereas others are dark. The most famous bright nebula is in Orion, visible to the naked eye as a softly glowing patch. The Orion Nebula is a gas cloud from which stars are forming, and the new-born stars at its centre light up the surrounding gas (see page 12). Other nebulae remain dark because no stars have yet formed within them. Dark nebulae become visible when they are silhouetted against dense star fields or bright nebulae. The Milky Way star fields in Cygnus are bisected by a major dark nebula, the Cygnus Rift. Certain nebulae are formed by the deaths of stars, including the so-called planetary nebulae which, despite their name, have nothing to do with planets. The name arose because, when seen through small telescopes, they often look like the disks of planets. Actually, planetary nebulae are glowing shells of gas sloughed off by stars like the Sun at the ends of their lives. Stars that are much more massive than the Sun die in violent explosions, splashing fountains of luminous gas into space. The most famous remnant of an exploded star is the Crab Nebula in the constellation Taurus (see page 56).

What is a Star Cluster?

In places, stars congregate in clusters, some of which are visible to the naked eye, most notably the group called the Pleiades in the constellation Taurus. There are two sorts of star cluster, distinguished by the types of stars in them and their location in the Galaxy. Open clusters are loose groupings of young stars dotted along the spiral arms of our Galaxy. Some open clusters are still surrounded by the remains of the gas clouds from which they were born. Open clusters can contain from a handful of stars up to a few thousand stars.

Altogether different in nature are the ball-shaped globular clusters, mostly found well away from the plane of the Milky Way. They are swarms of up to 300,000 stars, much more tightly bunched than in open clusters. The stars in globular clusters are very old – indeed, they include some of the oldest stars known. Since globular clusters are much farther from us than open clusters, they appear fainter. The best globular cluster for northern observers is M13 in the constellation Hercules (see page 32).

What is the Milky Way?

On clear, dark nights, a hazy band of starlight arches across the heavens. The Greeks called it the Milky Way. We know that the Milky Way consists of innumerable stars comprising an enormous wheel-shaped structure, the Galaxy, of which our Sun is a member. The stars that are scattered randomly over the night sky, forming the constellations, are among the nearest to us in the Galaxy. The more distant stars are concentrated into the crowded band of the Milky Way. The Milky Way, therefore, is the rest of our Galaxy as seen from our position within it. The Galaxy’s centre lies in the direction of the constellation Sagittarius, where the Milky Way star fields are particularly dense. Our Sun lies approximately two-thirds of the way from the hub to the rim of the Galaxy, which is about 100,000 light years in diameter. Beyond the edge of the Galaxy is empty space, dotted with other galaxies.

On the monthly star maps, the Milky Way is indicated in light blue. Sparkling star fields spring into view if you sweep along this region with binoculars or small telescopes.
spiral arms emerge from the ends of the bar. Our Galaxy is now thought to be a barred spiral. Elliptical galaxies have no spiral arms. They range in shape from almost spherical to flattened lens shapes. Time-exposure photographs with large telescopes are needed to bring out the full beauty of galaxies. Through binoculars and small telescopes, most galaxies appear only as hazy patches of light. Like nebulae, galaxies are best seen in clear, dark skies. The nearest major galaxy to us is just visible to the naked eye as a faint smudgy patch similar in apparent width to the full Moon in the constellation of Andromeda (see page 48).

How can I see satellites?

While casually watching the sky you may well see what looks like a moderately bright star drifting along, taking a few minutes to pass from one horizon to the other. This will be an artificial satellite, orbiting the Earth a few hundred kilometres up and lit by the Sun. (To confirm that it is not a high-flying aircraft, check with binoculars which will reveal an aircraft's lights, whereas a satellite will remain a star-like point.) Dozens of satellites are bright enough to be seen by the naked eye, most notably the International Space Station (ISS), which can be dazzling. You may even see the Space Shuttle on one of its periodic trips to and from the ISS. Satellites are easiest to see on summer nights, because the Sun then never gets far below the horizon and satellites are always in daylight. In winter, satellites will be visible only shortly after sunset and shortly before sunrise. Sometimes a satellite may fade in or out partway across the sky as it emerges from or vanishes into the Earth's shadow.

Some satellites flash as they move, particularly discarded rocket stages which are tumbling in orbit. The most extreme examples of flashing satellites are a system of communications satellites called Iridium. These are normally invisible, but occasionally sunlight reflects off their flat transmitter panels to create a brilliant flare that can last for several seconds.

Satellite predictions for any location can be obtained from an Internet website called Heavens Above:
http://www.heavens-above.com

How to look at the stars

To begin stargazing you need nothing more than your own eyes, supplemented by a modest pair of binoculars. The monthly star charts in this book are designed to be used for stargazing with the naked eye. With these charts, you will be able to identify the stars and constellations visible on any night of the year.

Specific constellations are featured in more detail in the monthly star notes, and to study the objects described in them requires some form of optical aid. Optical instruments collect more light than the naked eye does, thus showing fainter objects as well as making objects appear bigger by magnifying them. In astronomy, the ability of an instrument to collect light is often more important than the amount by which it magnifies. This is particularly so in the case of binoculars, which are an indispensable starting instrument for any would-be stargazer.

Binoculars usually have relatively low magnifications of between six and ten times, so they will not show detail on the planets, but their light-grasp will bring into view many stars and nebulae that are beyond reach of the naked eye. Binoculars have a much wider field of view than telescopes, and so are better suited for studying extended objects such as scattered star clusters. Even if you subsequently obtain a telescope, binoculars will always remain of use.

Binoculars bear markings such as 6 × 30, 8 × 40 or 10 × 50. The first figure is the magnification, and the second figure is the aperture of the front lenses in millimetres: the larger the aperture, the greater the light-grasp and hence the fainter the objects that you can see. Binoculars with high magnifications of 12 times or more are occasionally encountered, but these need to be mounted on a tripod to hold them steady.

Telescopes are rather like telephoto lenses, but whereas a telephoto lens on a camera is described by its focal length a telescope is described by its aperture. Remember that a telescope with an aperture of, say, 50 mm has the same light-grasp as a pair of 50 mm binoculars, but it can cost several times more. The main advantage of a telescope over binoculars is that it has higher magnification.

The smallest telescopes – those with apertures up to 75 mm (3 inches) – are of the refracting type, like a spyglass, which you look straight through. Larger telescopes, starting with apertures around 100 mm (4 inches), are usually reflectors, in which mirrors collect the light and bounce it into an eyepiece. Reflectors are cheaper to make in large sizes than refractors, and they usually have shorter tubes, which is more convenient. A third breed of telescope now commonly encountered combines lenses and mirrors. These are termed catadioptric telescopes and are best thought of as a modified form of reflector. Their main advantage is that they are compact and portable, but they are more expensive than basic reflectors, particularly those that have computer controls for finding objects.

A problem that becomes apparent on looking through a telescope is the unsteadiness of the atmosphere. Turbulent air currents make the image of a star or planet seem to boil and jump around, which limits the amount of detail that can be discerned, particularly at higher magnifications. The steadiness of the atmosphere is known as the seeing, and it changes markedly from night to night. You will be able to see more detail through a telescope on nights with steady air (i.e. good seeing).

Telescopes have interchangeable eyepieces which offer a range of magnifications. High magnifications are useful when studying fine detail on the planets or separating the close components of a double star. But no matter how much magnification you use on a small telescope, it will not show as much detail as a larger telescope. In fact, too high a power on a telescope will make the image so faint that you will end up seeing less than if you had used a lower power. A good rule of thumb is to keep to a maximum magnification of 20 times per 10 mm of aperture (50 times per inch). Do not be tempted by small telescopes that offer magnifying powers of many hundreds of times. In practice, such high magnifications will be unusable. Most of the objects mentioned in this book are within view of telescopes with an aperture of 100 mm or less, using low to medium magnifying powers.

**Naming star clusters, nebulae and galaxies**

Star clusters, nebulae and galaxies are often referred to by numbers with the prefix M or NGC. The M refers to Charles Messier, an eighteenth-century French comet hunter who compiled a list of over 100 fuzzy-looking objects that might be mistaken for comets. Astronomers still use Messier’s designations, and enthusiasts avidly track down the objects on his list. In 1888 a far more comprehensive listing of star clusters and nebulous objects was published, called the New General Catalogue of Nebulae and Clusters of Stars, or NGC for short. This was followed by two supplements known as the Index Catalogues (IC), bringing the total number of objects catalogued to 13,000, most of them only within reach of large telescopes. In this book we use the Messier numbers where they exist, or NGC and IC numbers otherwise.
Finally, be sure to wrap up warm when going out to observe, even on a mild evening. If you are observing with the naked eye or binoculars, sit in a reclining chair or lie on a sunbed. A comfortable observer sees more than an uncomfortable one.

How to use the maps in this book

There are twelve all-sky charts in this book, one for each month of the year, usable every year. They show the sky as it appears between latitudes 30° north and 60° north at fixed times of night that are convenient for observation. To understand the maps, imagine the night sky as a dome overhead. The maps are a flattened representation of that dome. When you look upwards you must think of the maps as being stuck to the dome of the sky, arching over you on all sides.

To use the maps, turn them so that the direction marked at the bottom of the map – north, south, east or west – matches the direction you are facing. The map then depicts the sky as it appears at 10 p.m. in mid-month. The sky will look the same at 11 p.m. at the start of the month and 9 p.m. at the end of the month. (NB: one hour must be added to these times when daylight saving is in operation, designated DST in the key.) A table at the bottom of each monthly map shows the times at which the sky appears the same in other months.

If you wish to observe at times other than those in the table, you must make allowance for the changing appearance of the sky caused by the rotation of the Earth, which turns through 15° every hour. When your observing time differs by a full two hours from the time shown on a map, you will have to change maps. For every additional two hours’ difference in time, go forwards or backwards another map as necessary. Inspection of the tables at the bottom of each chart will show that, for example, the appearance of the sky at 10 p.m. in mid-May is the same as at 6 a.m. in mid-January.

Changing maps will be necessary to find when planets are visible if they are located in constellations not above the horizon at 10 p.m. in a given month. For example, if a planet lies in Sagittarius during January, we have to move forward four maps to find the map on which Sagittarius first appears above the horizon – the May map. The time table tells us that Sagittarius, and hence the planet, do not rise until nearly dawn in January.

Four horizons are shown on the maps, for observers at latitude 30° north, 40° north, 50° north and 60° north. It should not be difficult to work out where the horizon falls on the maps for your specific latitude. You will be able to use the maps from anywhere between latitudes 30° north and 60° north, and up to 10° outside these limits there will be hardly any discrepancy between what the maps show and the way the sky appears. Note how your latitude affects the stars that are visible.

The monthly all-sky maps show the brightest stars down to magnitude 5.0, realistically depicting the sky as seen by the naked eye on an averagely clear night. The maps of individual constellations show stars down to magnitude 6.5, plus fainter selected stars and numerous objects of interest for users of binoculars and small telescopes.

Scale in the sky

One difficulty when matching up the maps in a book with the appearance of the real sky is the matter of scale. Most people overestimate the size of objects in the sky. For example, it is a remarkable fact that the full Moon, which is half a degree across, can be covered by the width of a pencil held at arm’s length. (Try it!) An outstretched palm will cover the main stars of Orion, and you can cover most of the stars in the Plough with your hand. An upright hand at arm’s length has a height of about 14° from wrist to fingertips.

How can we judge whether a particular constellation covers a large or a small area of sky? The width of a fist held at arm’s length makes a convenient distance indicator, about 7° wide. As a guide to scale, each of the constellation maps in this book carries an outline of a fist for comparison. If your hand is unusually big or small the comparison will not be exact, but it will still be a useful guide to the size of constellation you are looking for.

Scale in the sky: A fist held out at arm’s length is a convenient measure of angular size in the sky. Here a fist is shown in comparison with the seven stars of the Plough (or Big Dipper) in Ursa Major.
How the sky changes with the seasons

The sky is like a clock and a calendar. It changes in appearance with the time of night and with the seasons of the year. For example, look at the diagrams below of the area around the north pole of the sky. At 10 p.m. at the start of the year, the familiar saucershaped seven stars known variously as the Plough or Big Dipper is standing on its handle to the right of Polaris, the north pole star. At the same time of night three months later, the Plough is almost directly overhead, while the W-shaped constellation of Cassiopeia sits low on the northern horizon. By July, the Plough appears to the left of Polaris. At 10 p.m. in October the Plough is scraping the northern horizon, while Cassiopeia rides high. In another three months the stars are back to where they started and the yearly cycle begins anew.

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