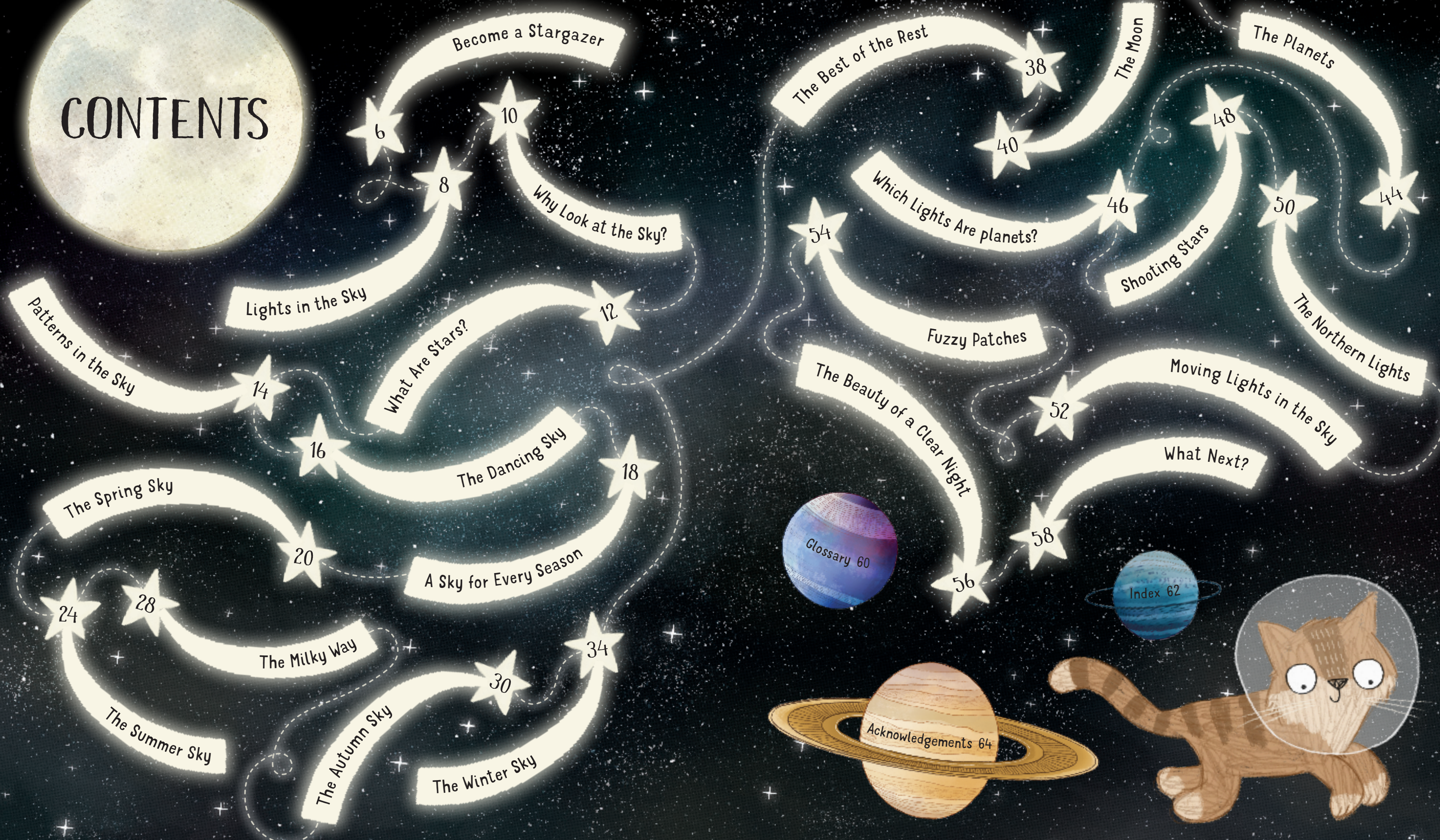




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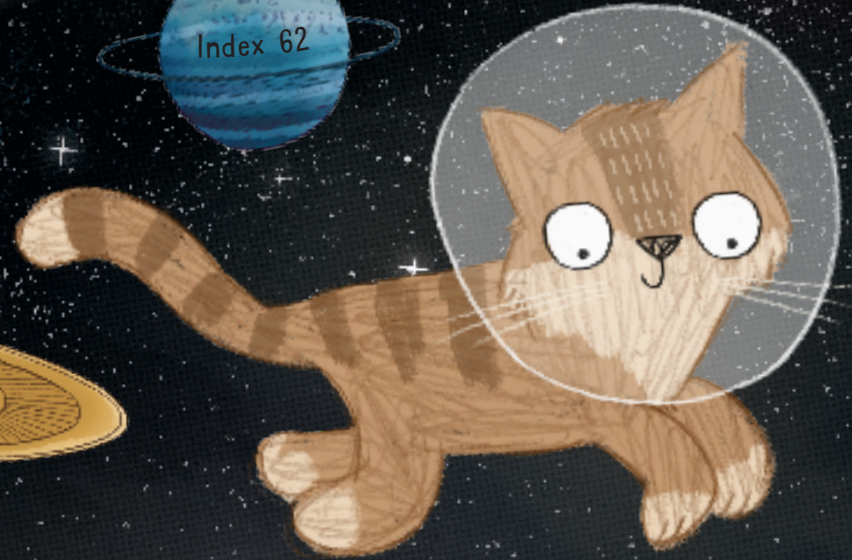
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BE PREPARED.

I bet you are desperate to head out and start stargazing. But if you really want to enjoy being out under the stars, there are a few things you need to know first.

WHAT YOU NEED

The best stargazing happens in winter because the Sun rises late and sets early, leaving lots of hours of darkness in between. The winter sky also has the brightest stars. But winter nights can be very, very cold. (And even summer nights can get chilly.) You will be spending a few hours outside, not moving much, so you need to make sure you can stay warm.

Here's are the essential things to take with you.



WHERE TO GO.

If you live in a place where there is a lot of light at night, it can make it hard to spot stars. So look for a dark site close to home, like:

- ★ a park with trees that hide the streetlights
- ★ playing fields on the edge of town
- ★ a hill you can climb to get above the lights

If you've chosen well, the sky will look darker than the view outside your door. The stars will look brighter and more colourful, they'll twinkle a lot more, and there'll be more of them.

WHOM TO GO WITH.

And because you'll be away from the safety of lights and other people, you need to be careful. So ...

- ★ Always take an adult along.
- ★ Carry a phone.
- ★ Tell someone where you're going, how long you'll be and what time you'll be back.

Now you're ready to set off on an exciting adventure of discovery that will change your life!



BECOME A STARGAZER

My name is Felicity and I am a cat who loves to watch the stars. And you want to know more about what you can find up there in the night sky. So let me be your guide to the wonders of stargazing.

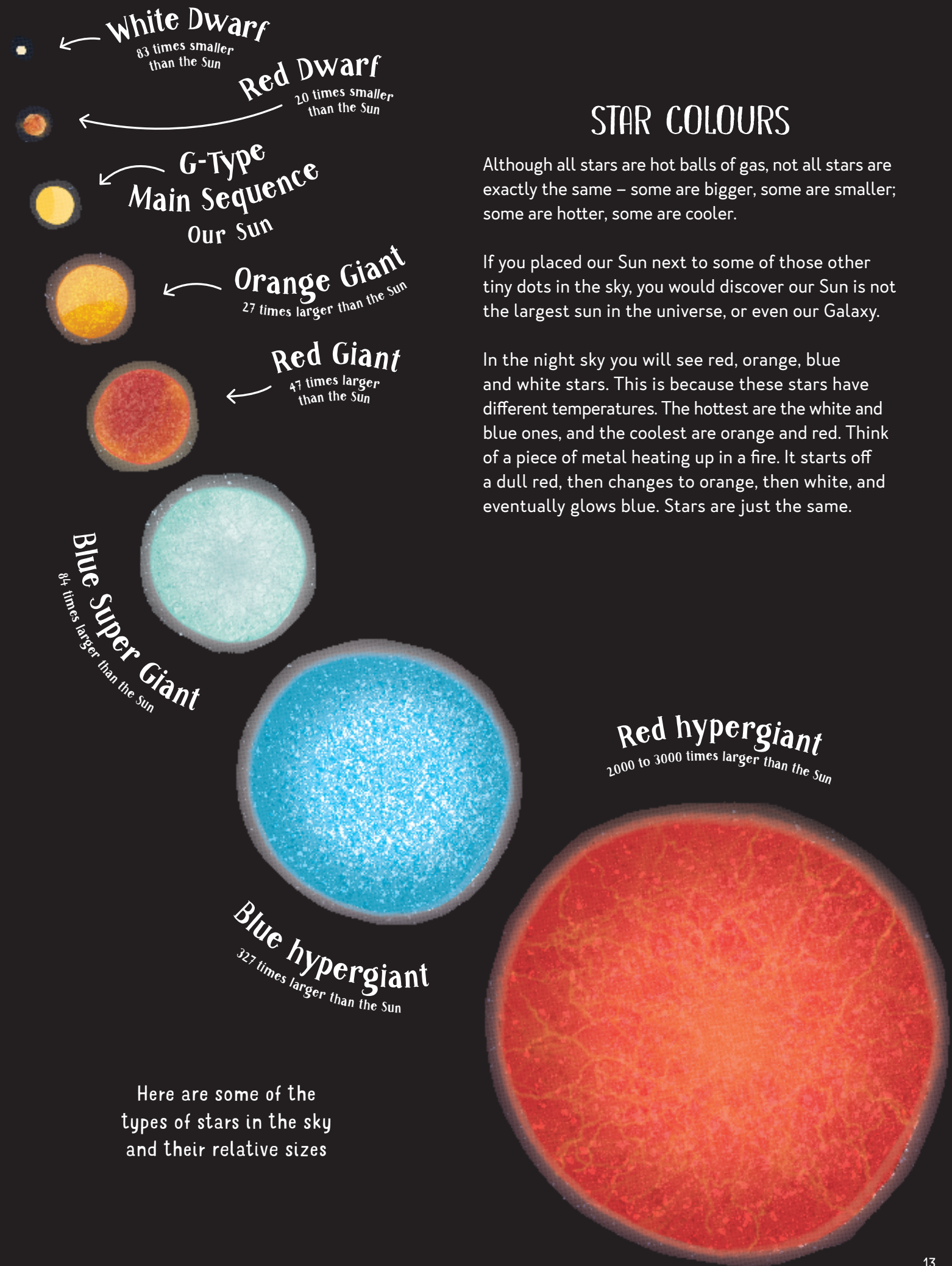
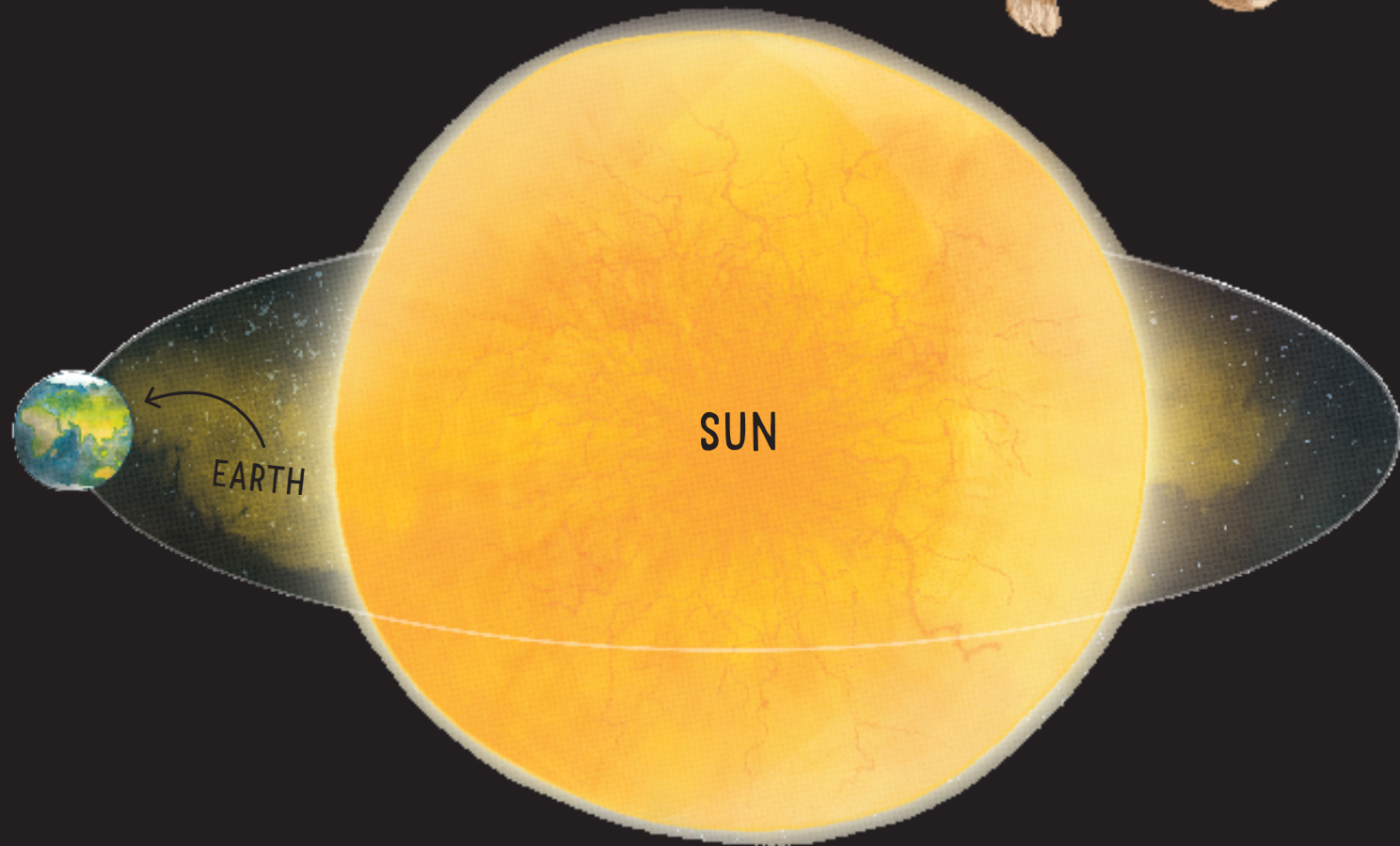


WHAT ARE STARS?

All stars are hot balls of gas. And did you know that the best time to see a star is on a sunny day?

This is because our Sun is, in fact, a star!; The Sun is the closest star to Earth, which is why it looks bigger and brighter than all the lights in the sky. The Sun is enormous – if the Earth was the size of a pea, the Sun would be the size of a beach ball. It is also incredibly hot (about 15,000,000°C in the middle), which is why it blazes so brightly, and can burn you even though it's 140 million kilometres away.

During the day the Sun is bright white, but at sunset it turns orange, and then red. It is the atmosphere between the sun and us that makes it appear to change colour.



Here are some of the types of stars in the sky and their relative sizes

STAR COLOURS

Although all stars are hot balls of gas, not all stars are exactly the same – some are bigger, some are smaller; some are hotter, some are cooler.

If you placed our Sun next to some of those other tiny dots in the sky, you would discover our Sun is not the largest sun in the universe, or even our Galaxy.

In the night sky you will see red, orange, blue and white stars. This is because these stars have different temperatures. The hottest are the white and blue ones, and the coolest are orange and red. Think of a piece of metal heating up in a fire. It starts off a dull red, then changes to orange, then white, and eventually glows blue. Stars are just the same.

A SKY FOR EVERY SEASON



SPRING

There's always something fascinating and beautiful to see!

Let Me Explain

During the day, our closest star, the Sun is so bright that we can't see any other stars in the sky. So, it is only at night, when we are facing away from the Sun that we can see the rest of the stars.

And...

as the Earth journeys around the Sun over the course of a year, we look out at a different part of the universe in every season.

It was only when I'd been studying the night sky for a while that I began to realize something strange was going on. Although I could always see the Big Dipper, wheeling around the Pole Star, I could only see other stars and their patterns for a few months before they vanished.

Stars and their constellations come and go because each season has its own sky. We don't see exactly the same stars in spring as we do in summer, autumn or winter.

Stars that lie 'above' the Earth as it rolls around, like the Pole Star and the ones that make up the Big Dipper, can be seen pretty much all year round.

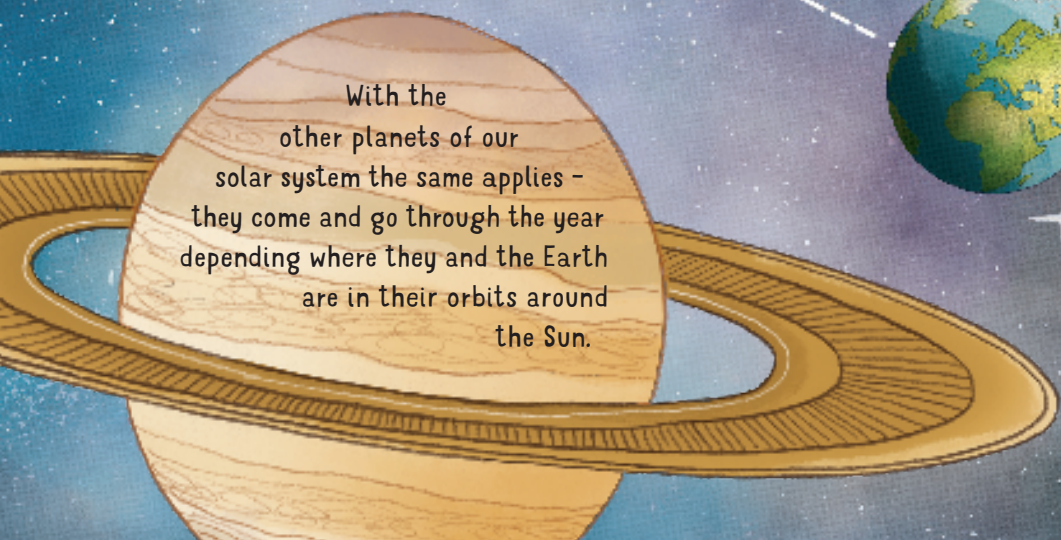
WINTER

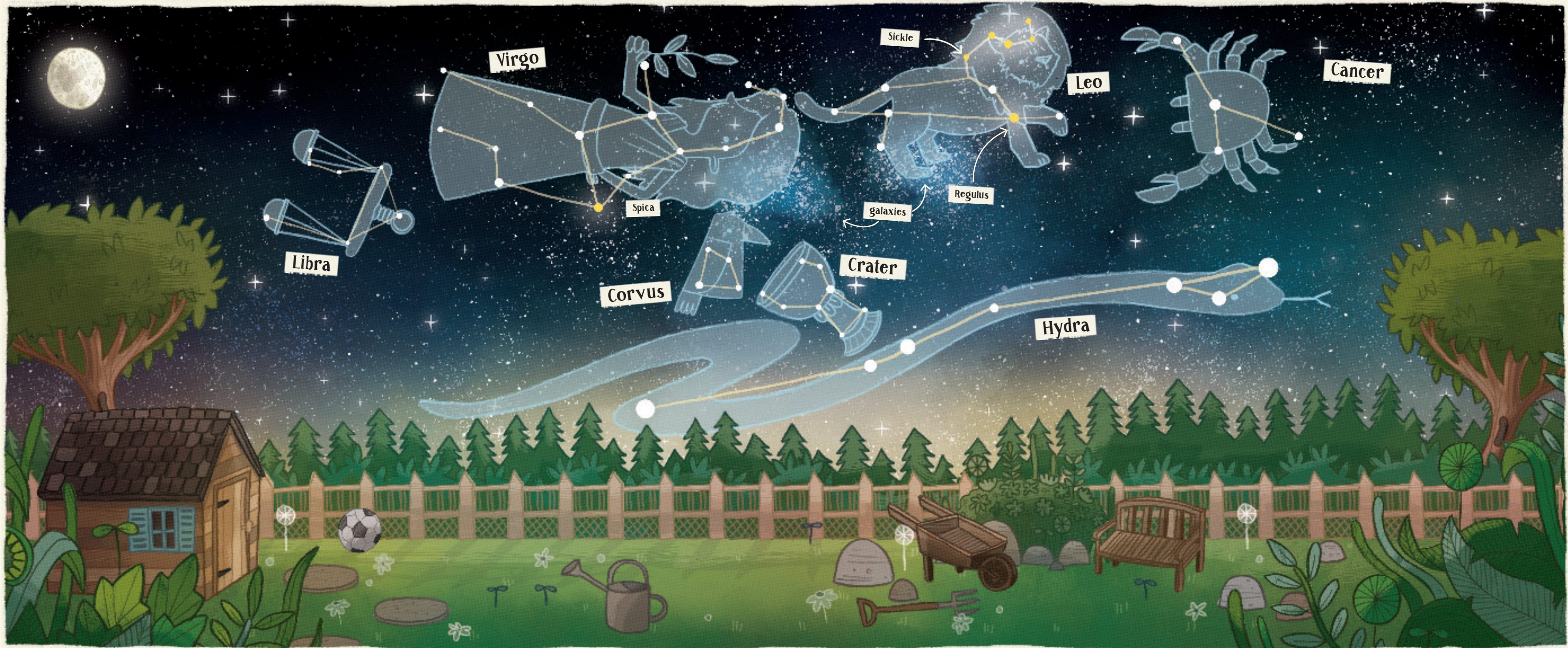


AUTUMN



With the other planets of our solar system the same applies - they come and go through the year depending where they and the Earth are in their orbits around the Sun.





THE SPRING SKY

Even though the spring sky doesn't have many really bright stars, there is still plenty to see!

Of the seven main constellations in the spring sky, Leo is the one you will see first. Leo is a huge cat, so I love this constellation especially, and it is named after a lion in Greek mythology that the hero Hercules fought and killed. Hydra and Cancer are also Hercules's unhappy victims. The constellation Virgo is associated with the Greek goddess of the harvest, and the smaller constellations of Corvus, Libra and Crater were also named by the Greeks after things they thought they resembled. And these are not the only things to see in the spring sky!

★ ★ ★ SPRING SKY EXTRAS ★ ★ ★

- ★ There are lots of galaxies to see - especially inside Leo itself and just below Virgo. But they are very far away and you will need binoculars or a small telescope to see them properly.
- ★ Look out for these bright stars: Regulus in Leo and Spica in Virgo.



Turn over to meet the constellations of the spring sky.



Leo: the Lion

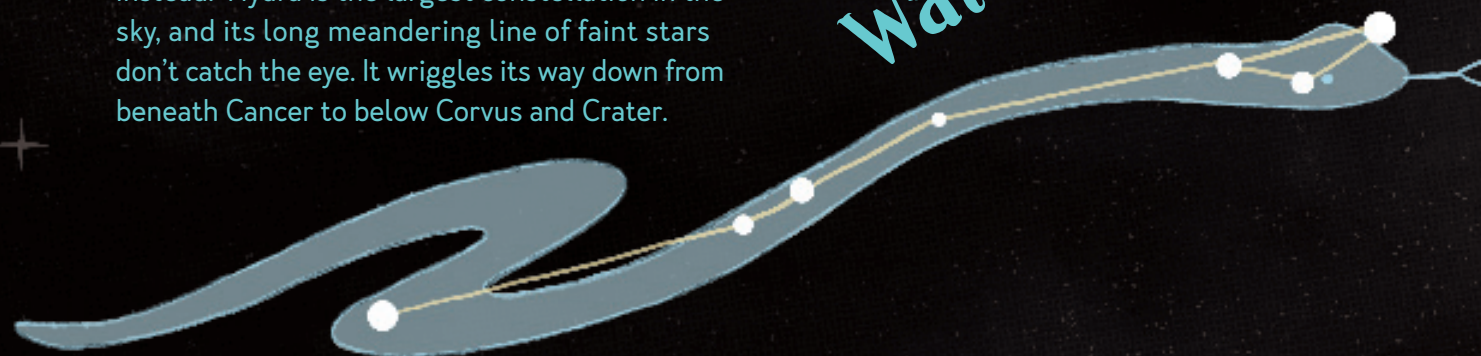
Leo is the easiest constellation to find because it sits in the middle of the Moon's passage across the spring sky. So if you can trace that you will be able to find Leo.

Leo is actually made out of two shapes, a triangle and a back-to-front question mark. Joined together they do actually resemble a cat lying down. The question mark is better known as the Sickle, because it looks like the tool farmers used to cut their crops.

The brightest star in Leo is Regulus, at the end of the Sickle's handle..

In Greek mythology, the Hydra was a terrifying serpent and pet of the Greek goddess Hera who she sent to kill Hercules. But Hercules killed Hydra instead. Hydra is the largest constellation in the sky, and its long meandering line of faint stars don't catch the eye. It wriggles its way down from beneath Cancer to below Corvus and Crater.

Hydra: the Water Snake



Cancer: the Crab

Cancer is named after a great crab and another pet of Hera's that she sent to help Hydra. But Hercules made short work of the poor crab, kicking it right up into the sky!

The best way to find Cancer is to look for a smudge of light beyond Leo. This is M44, the Beehive Cluster, and it sits right in the middle of the constellation. Through binoculars you'll see that the Beehive is made of dozens of stars, like a swarm of bees. The rest of Cancer is an upside-down 'Y' of relatively faint stars.

Virgo: the Maiden



Virgo is the second largest constellation in the sky. It is supposed to resemble a beautiful woman, the Goddess of the Harvest, but as we saw on the page before it looks more like a stick figure lying on its side. Virgo has one bright star, Spica, and it's an obvious blue-white colour. It is actually two stars spinning around each other, but you'd need the world's most powerful telescope to see that. A normal telescope should reveal, however, lots of tiny smudges of light along the lower part of Virgo. These are incredibly far away galaxies.

Libra: the Scales



Much smaller than nearby Virgo, Libra is supposed to look like a set of old-fashioned measuring scales. I've always thought it looks more like a rocket, or a house!

Crater is a small constellation meant to represent the drinking cup (or crater) of the Greek god Apollo. It is hard to see because its stars are very faint. But it's always low in the sky in the northern hemisphere, visible just above trees or buildings. It is a little like a tipped-over, old-fashioned goblet, but I think it looks a lot like Corvus with a few extra stars.

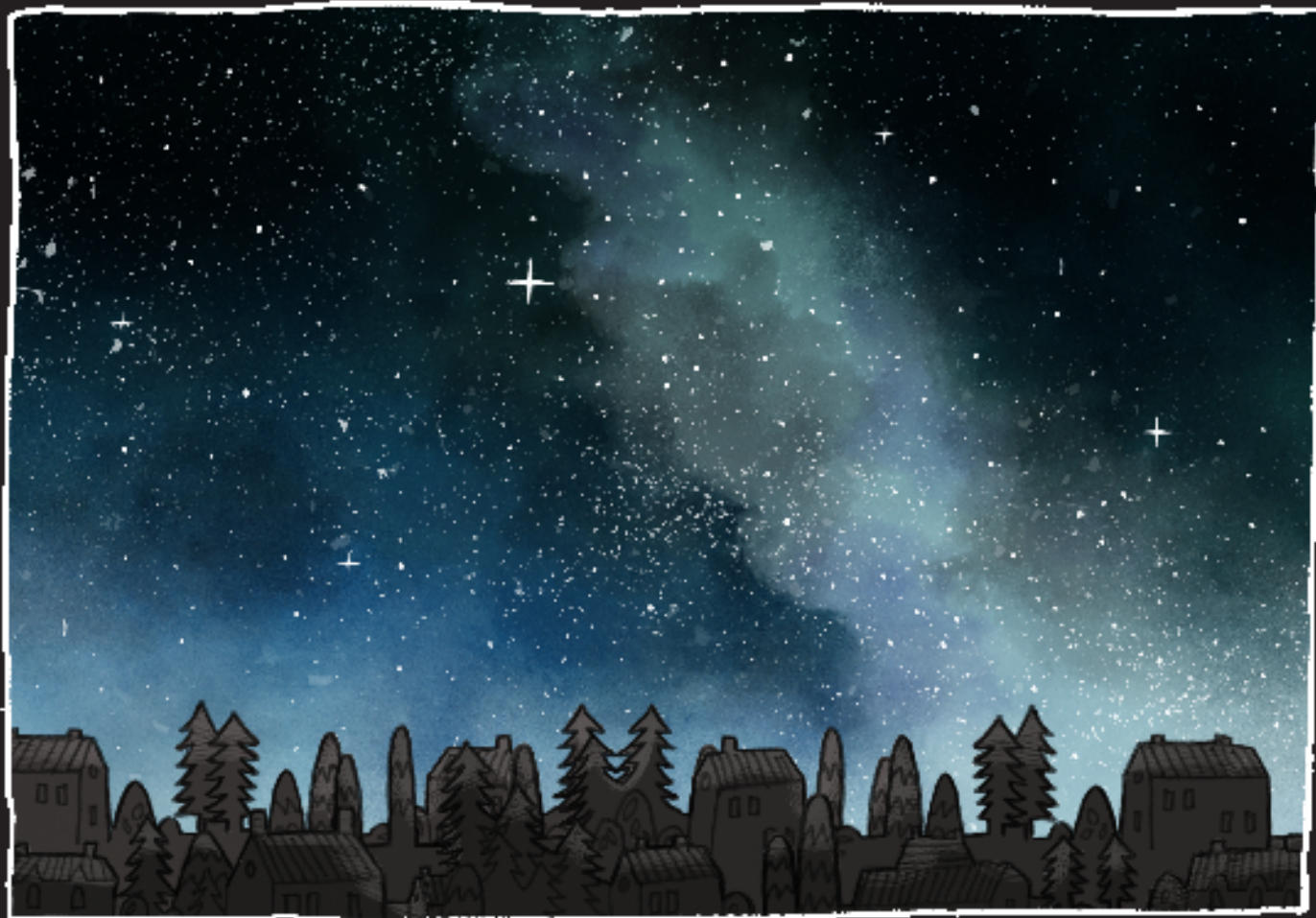


Crater: the Cup



Corvus: the Crow

The night sky is full of bird constellations. There's an eagle, a swan, and then, below and to the right of Spica in Virgo, there's Corvus the Crow. They all make me feel hungry. Corvus is a weird looking crow, however. It actually looks more like a squashed box.... or maybe a crow with the head bitten off. Yum!



THE MILKY WAY

Summer is the best time of year to see one of the most beautiful sights in the sky - the Milky Way.

The Milky Way is the galaxy that our Sun is part of. We are far out on a spiral arm of the galaxy, so in the summer we are in a position in our orbit around the Sun where we are looking back at the mass of our own Milky Way galaxy.

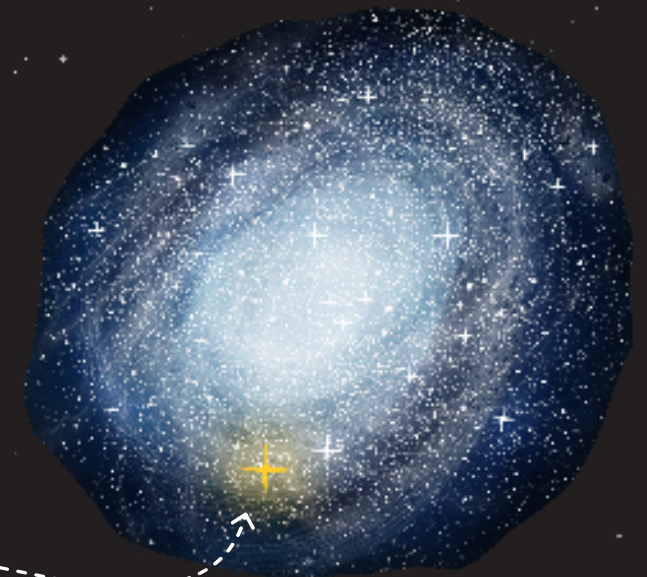
What you will see is a band of millions of stars so close together they seem to blend into one long cloud of stars. And our ancestors thought it looked like a trail of milk spilled across the sky.

The first you will perceive of the Milky Way is a long misty trail, almost cutting the sky in half. As your eyes adapt to the dark, you will see brighter areas that are big concentrations of stars. There are also dark areas, and these are dust clouds blocking the light of the stars.

In the southern hemisphere you can see the centre of the Milky Way. It is so bright you can read a book by the light of it!

Our Sun!

What the the Milky Way looks like from outside the galaxy.



Photographs often show the Milky Way in glorious colour, with a burning yellow-orange centre, and clumps and clouds of stars in blue and red. But your own eyes, even aided by binoculars or a telescope, are not sensitive enough to be able to see those colours.

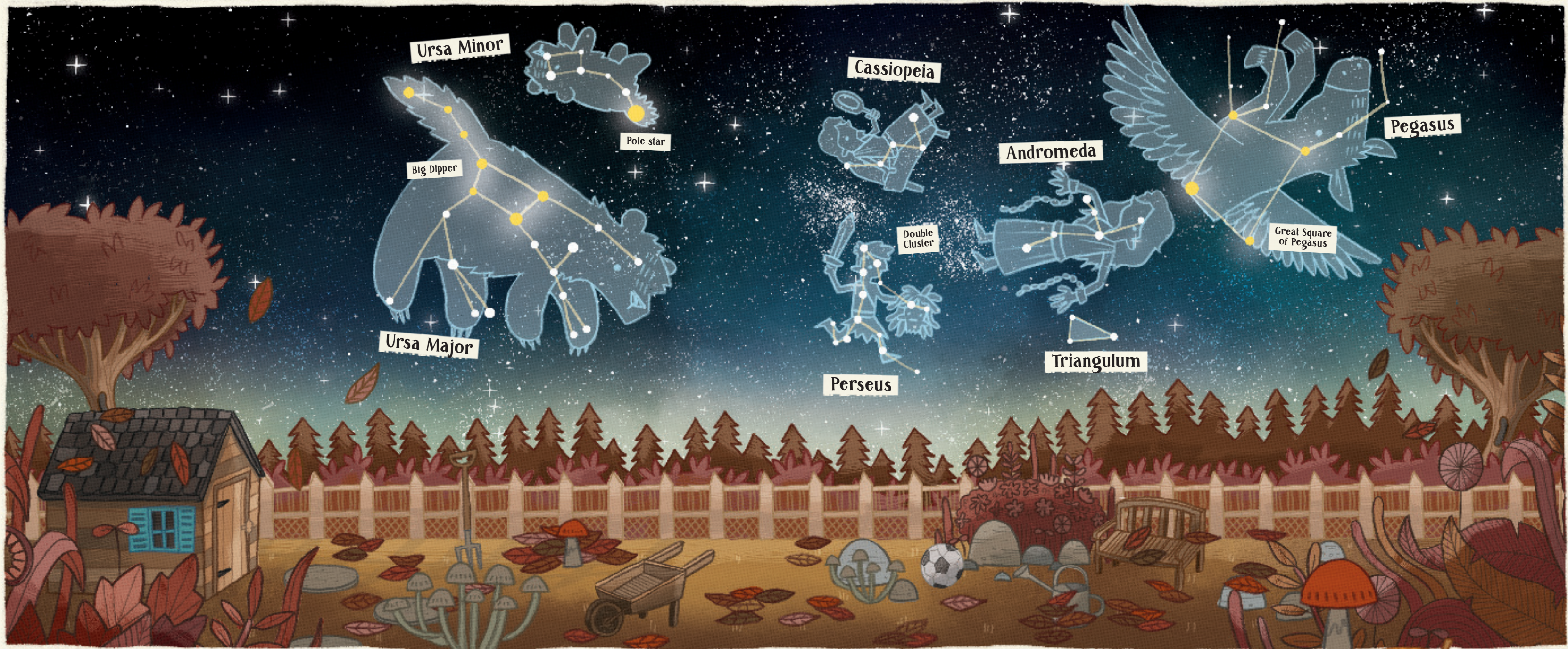


Most of the stars in the Milky Way are faint, so any light pollution, or a big, bright Moon, will drown them out. So at best you will see something that looks like a misty blue-grey cloud.

But if you look at it against a dark sky, and use binoculars, you will see thousands of stars, like grains of salt on black paper. Don't worry about identifying anything, just enjoy all the stars.

When you think that these specks of light are faraway suns, many with planets of their own, you can't help but wonder ... is anyone, or anything, looking back at me?





THE AUTUMN SKY

Sky-watchers like me celebrate the start of autumn because as the nights get longer and by midnight the sky is full of stars.

The main constellations of Ursa Major and Minor, Pegasus, Cassiopeia, Perseus, Andromeda and Triangulum are large, close together with bright stars that are easy to identify. Ursa Major and Minor contain two of the most famous features of the night sky: the Big Dipper and the Pole Star. And many of the other constellations have been named after the story of the great Greek hero Perseus who rode the winged horse Pegasus and saved the beautiful Andromeda from a horrible monster.

★ ★ ★ AUTUMN SKY EXTRAS ★ ★ ★

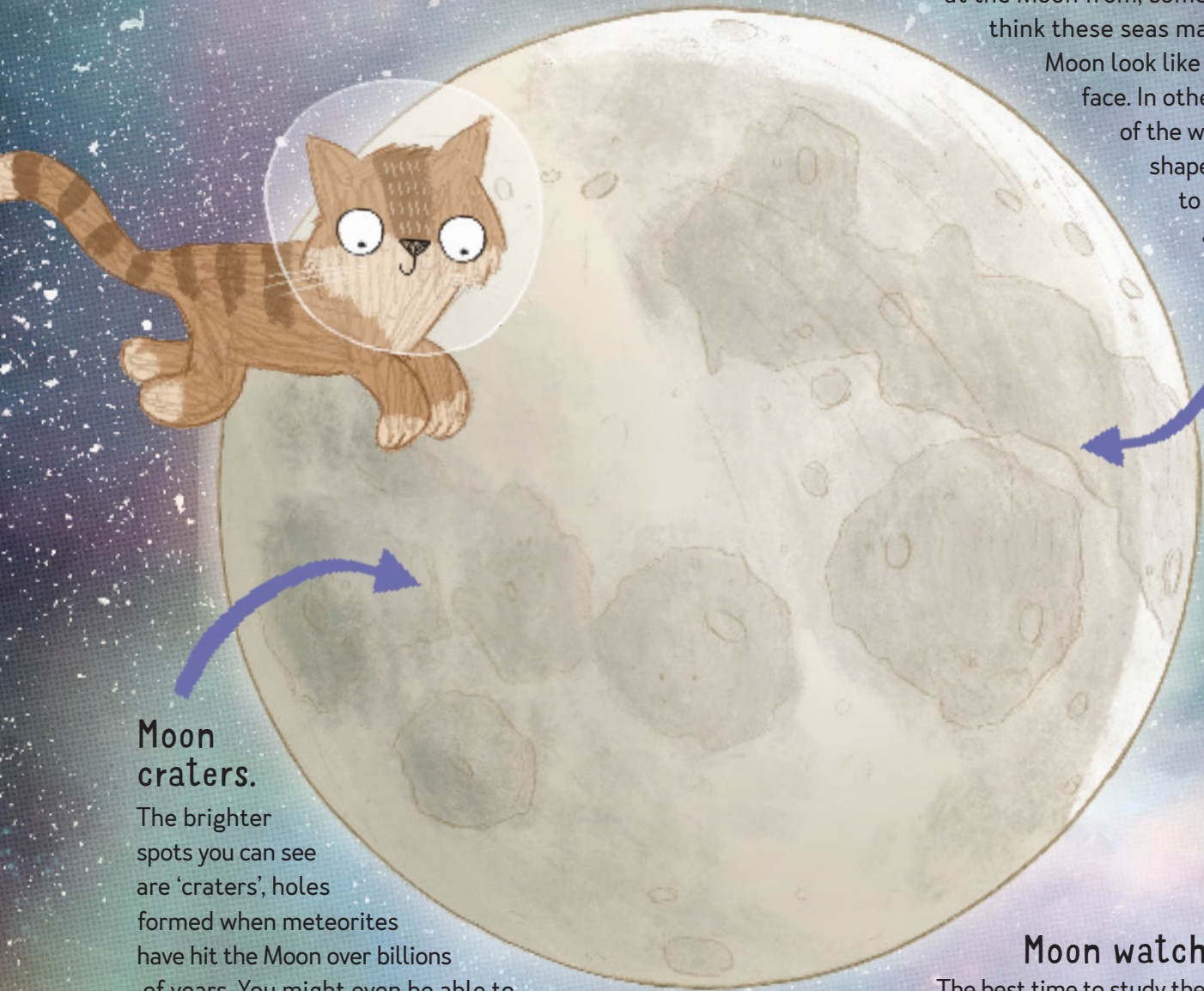
- ★ The Great Square of Pegasus - this asterism is where the constellations of Pegasus and Andromeda meet.
- ★ Watch out for the year's most reliable meteor shower.
- ★ With the naked eye, you can see a galaxy in the middle of Andromeda more than 2 million light years away!
- ★ Use binoculars or a small telescope to find a pair of star clusters called the Double Cluster between Perseus and Cassiopeia. They look like two piles of sugar grains.

Turn over to meet the constellations of the autumn sky.



THE MOON

The Moon is probably the first thing you will ever have seen in the sky. Did you know that it is actually a big ball of rock that circles the Earth?



Moon Seas. The Moon has darker areas on its surface. These are called seas, but they don't contain water – they are vast plains of frozen lava. Depending on what part of the Earth you look at the Moon from, some people think these seas make the Moon look like it has a face. In others parts of the world, the shapes seem to suggest a rabbit.

Moon craters.

The brighter spots you can see are 'craters', holes formed when meteorites have hit the Moon over billions of years. You might even be able to see bright lines spreading away from some of them. These 'rays' are splashes of debris left on the ground after the biggest and most recent meteorite impacts. And if you look at the Moon with binoculars or a telescope you can investigate these in even greater detail.

Moon watching.

The best time to study the Moon is a few days before or after it is in its full phase. Then using binoculars or a telescope you can see lots of detail along the Terminator line between the sunlit and dark parts of the Moon. There are dozens of craters with their rays to be seen, as well as jagged mountain ranges and smaller seas.

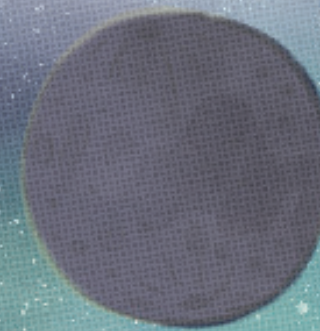
The Moon's phases

Have you noticed how the Moon changes shape every month? That is because what we see of the Moon depends on what light from the Sun is reflected off the Moon's surface.

As it whirls around the Earth, and the Earth whirls around the Sun, sunlight falls on different parts of the Moon, creating what we think of as the phases of the moon.

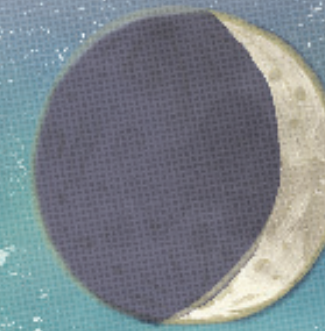
Because it happens with such regularity, ancient humans decided to use it as a way to measure time – and all of our earliest calendars are based off of the phases of the Moon.

Nowadays we use a solar calendar (eg. based off of our movement around the Sun), but still important events like harvests are based on the Moon's phases.



New Moon

The 'new' Moon is just a dark faint circle in the sky because none of the sun's light is reflecting off of it.



Waxing Crescent

Once light begins to be reflected off the Moon's surface, the Moon enters its second phase, and each night the sliver of light grows larger and larger.



First Quarter

The Moon's third phase occurs when the light covers fully half of the Moon,



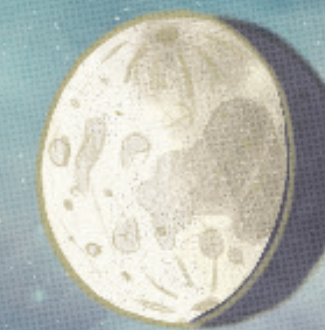
Waxing Gibbous

In the fourth phase, the light continues to spread across the surface. Gibbous actually means an illuminated part greater than a half circle, but smaller than a full circle.



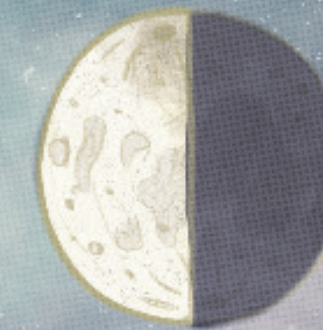
Full Moon

Once the light covers a full circle of the Moon's surface, we enter the fifth phase.



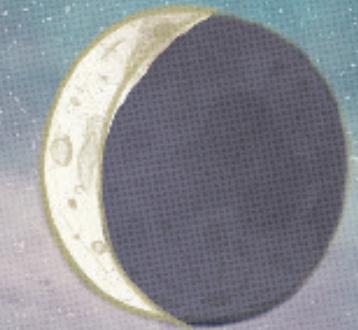
Waning Gibbous

In the seventh phase, the whole process starts to go in reverse as less and less light is reflected off the Moon's surface.



Third Quarter

In the eighth phase, the light again reaches the halfway point.

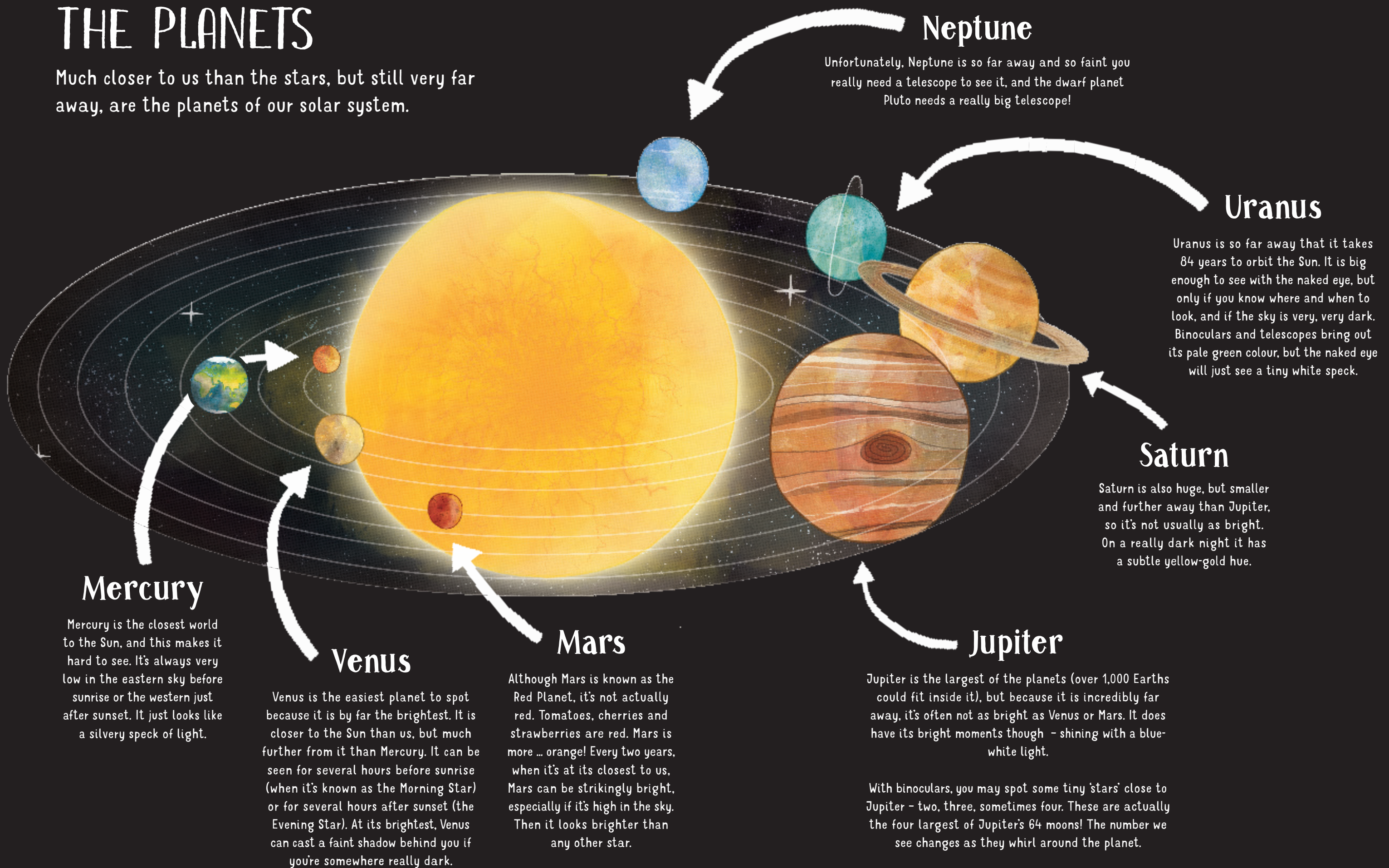


Waning Crescent

And in the ninth phase, the crescent appears again before it disappears completely to create the 'new' Moon.

THE PLANETS

Much closer to us than the stars, but still very far away, are the planets of our solar system.



Mercury

Mercury is the closest world to the Sun, and this makes it hard to see. It's always very low in the eastern sky before sunrise or the western just after sunset. It just looks like a silvery speck of light.

Venus

Venus is the easiest planet to spot because it is by far the brightest. It is closer to the Sun than us, but much further from it than Mercury. It can be seen for several hours before sunrise (when it's known as the Morning Star) or for several hours after sunset (the Evening Star). At its brightest, Venus can cast a faint shadow behind you if you're somewhere really dark.

Mars

Although Mars is known as the Red Planet, it's not actually red. Tomatoes, cherries and strawberries are red. Mars is more ... orange! Every two years, when it's at its closest to us, Mars can be strikingly bright, especially if it's high in the sky. Then it looks brighter than any other star.

Neptune

Unfortunately, Neptune is so far away and so faint you really need a telescope to see it, and the dwarf planet Pluto needs a really big telescope!

Uranus

Uranus is so far away that it takes 84 years to orbit the Sun. It is big enough to see with the naked eye, but only if you know where and when to look, and if the sky is very, very dark. Binoculars and telescopes bring out its pale green colour, but the naked eye will just see a tiny white speck.

Saturn

Saturn is also huge, but smaller and further away than Jupiter, so it's not usually as bright. On a really dark night it has a subtle yellow-gold hue.

Jupiter

Jupiter is the largest of the planets (over 1,000 Earths could fit inside it), but because it is incredibly far away, it's often not as bright as Venus or Mars. It does have its bright moments though - shining with a blue-white light.

With binoculars, you may spot some tiny 'stars' close to Jupiter - two, three, sometimes four. These are actually the four largest of Jupiter's 64 moons! The number we see changes as they whirl around the planet.



SHOOTING STARS

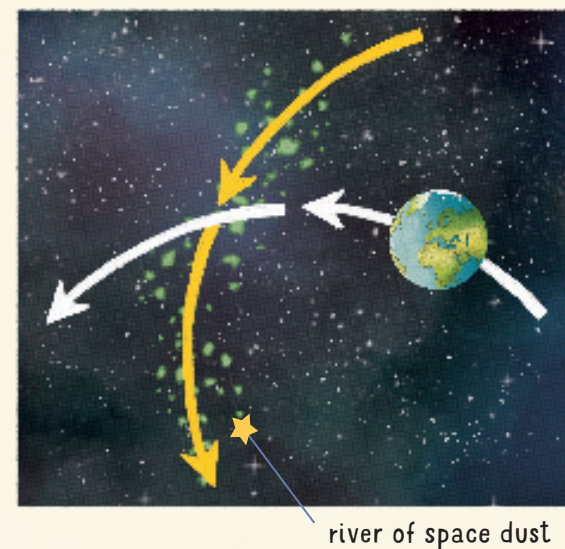
One night there was a sudden streak of light in the sky.
I thought a star had fallen from the sky!

It was a shooting star, which isn't really a star at all. They are meteors – bits of space dust plunging super-fast through Earth's atmosphere. The friction makes them burn up and that creates streaks of light in the sky. They range from very faint to very bright and usually vanish in less than a second. Some are blue, green or gold, but most are blue-white.

When the Earth's orbit takes it through a kind of river of 'space dust', you'll see lots of shooting stars. Astronomers call this a 'meteor shower'.

There are around a dozen meteor showers every year, but some are more impressive than others. The best ones are in mid-August, late October, mid-November and mid-December.

How meteor showers happen



river of space dust

Fireballs and meteorites

Sometimes larger bits of space rock enter the Earth's atmosphere. They are very bright, move more slowly and will often flare dramatically several times before fading away. These are called 'fireballs'. Only a very few meteors do not burn up completely and reach the ground. They will often shine as bright as the Moon, and its arrival is usually announced by a window-rattling, bone-shaking sonic boom. Once on the ground they are known as a meteorite.

GLOSSARY



★ ASTERISM

an obvious group of stars within a constellation

★ ASTRONOMER

a scientist who studies the night sky

★ AURORA

The interaction of flares from the Sun with gases in our atmosphere. The Northern Lights (the Aurora Borealis) is the most famous aurora.

★ AXIS

the term used for the line on which the Earth spins.

★ CONJUNCTION

When two bodies appear to meet in the night sky.

★ CONSTELLATION

an area of the sky supposed to represent a character, creature or object from ancient myths or stories.

★ CRATER

Pits made on the surface of the Moon by meteorites.

★ DARK ADAPTATION

the time it takes for your eyes to adjust to the darkness of a night sky.

★ FAINT FUZZY

Distant objects visible as patches of fuzzy lights.

★ FIREBALL

A very bright shooting star that moves slowly across the sky and which flares dramatically before fading away.

★ GALAXY

a vast, gravitationally bound, system of stars (billions of them). Our galaxy is the Milky Way.

★ INTERNATIONAL SPACE STATION

Or ISS. Currently the largest manmade satellite and a centre for astronauts of many different countries.

★ LIGHT POLLUTION

the lights from our manmade environment that make viewing the night sky difficult

★ LUNAR ECLIPSE

The moment when the Sun, Earth and Moon are aligned in such a way that the Earth casts a shadow on the moon.

★ METEOR/SHOOTING STAR

A meteor is a bit of matter from space that when it enters the Earth's atmosphere usually burns up, and thus creates a shooting star. There are two kinds of shooting star: fireballs and meteors.

★ METEOR SHOWER

When the Earth's orbit takes it through a trail (or 'river') of space rock left behind by a comet that then burns up as meteors in the atmosphere.

★ METEORITE

A piece of a meteor that doesn't actually burn up in the atmosphere, but which lands on the planet's surface as a rock or piece of metal (or a mixture of the two).

★ NEBULA

an enormous cloud of gas and dust far out in space.

★ NORTHERN LIGHTS

The Aurora Borealis. See Aurora.

★ OPEN CLUSTER

A grouping of dozens or even hundreds of stars.

★ ORBIT

The path of a planet or star. The Earth orbits around the Sun, and the Sun follows an orbit in the galaxy.

★ PHASES OF THE MOON

The different shapes that the Moon appears to take (from crescent to full) over the course of a month, as the Sun's light reflects on it from different angles.

★ PLANET

A mass of material, rounded by its own gravity, that orbits a star. The Earth is one of eight planets orbiting our Sun.

★ POLAR AXIS

the term referring to the line on which the Earth spins

★ SATELLITE

Any object that orbits a planet. The Moon is the

Earth's largest satellite, but there are also many, much smaller manmade satellites that orbit our planet, such as the International Space Station (ISS)

★ SOLAR ECLIPSE

When the Moon passes between the Sun and the Earth.

★ SPACE JUNK

Term used for all the many no-longer-functioning manmade stuff that continues to orbit our planet.

★ SPACE ROCK

The stuff that meteors are made of.

★ STAR ATLAS

A book of maps of the night sky seen at different times of the year and at different places on the planet.

★ STAR CLUSTER

A subgroup of stars within a galaxy that are gravitationally bound to each other.

★ STAR HOPPING

When you move from looking at one group of stars to another in the night sky.

★ SUN/STAR

Gigantic hot balls of gas.

★ TERMINATOR

The line between the sunlit and dark parts of any object in our solar system.