



# my FIRST BOOK OF SPACE

CAMILLA  
DE LA BEDOYERE

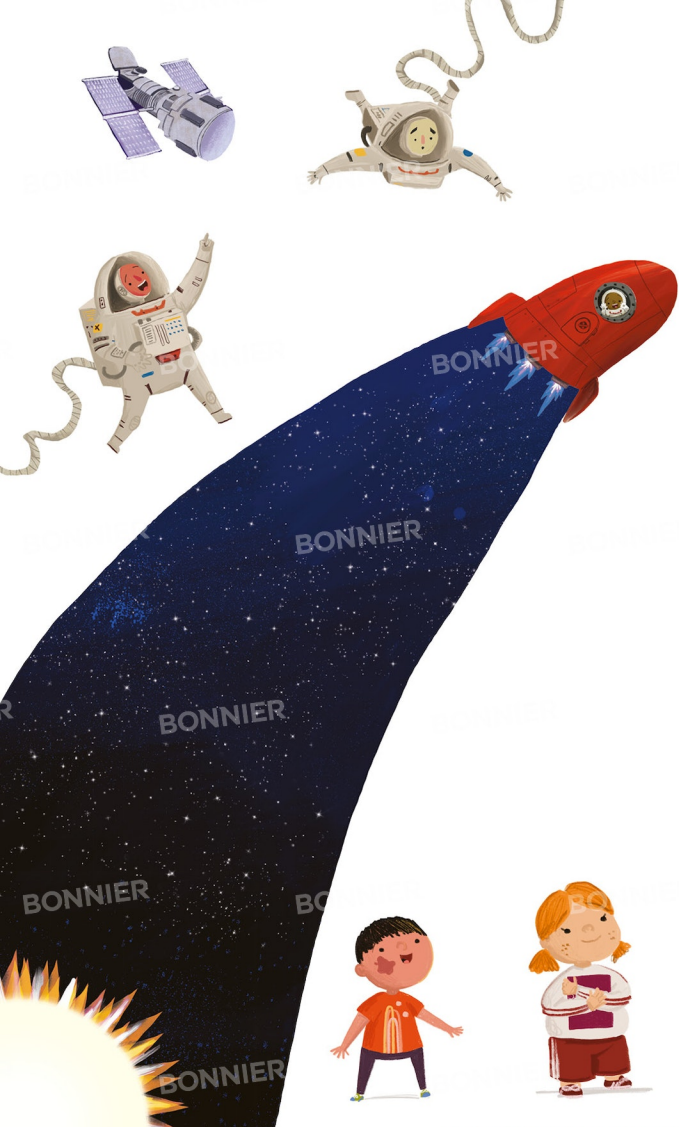
AARON  
CUSHLEY





# MY FIRST BOOK OF SPACE





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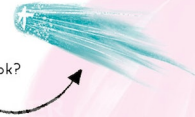
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## SHOOTING STAR SEARCH

Can you find the shooting stars hiding in this book?  
There is one in every scene, all except one.

Go to page 63 to find out.





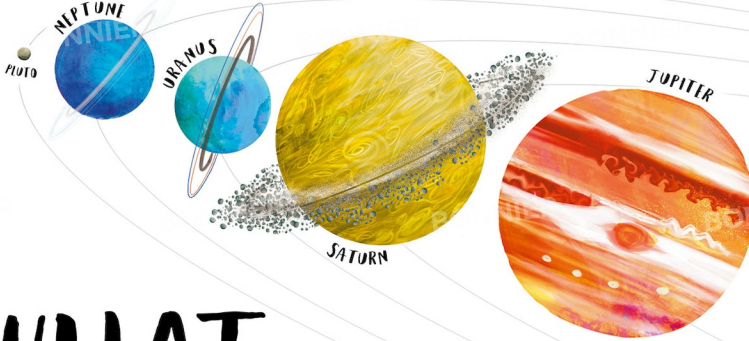
METEOR



SATELLITE



HUBBLE TELESCOPE



ASTEROID

# WHAT IS SPACE?



METEOR SHOWER



# THE UNIVERSE

Space is enormous! It starts way above Earth's surface, about 100 kilometres up. Planets, stars, asteroids and comets are some of the things found in outer space.



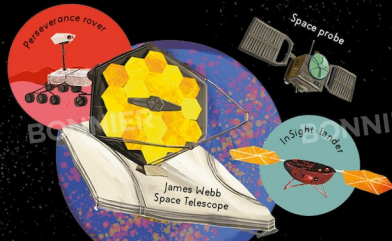
Everything in space is called the Universe. It was formed about 13.8 billion years ago.



The Solar System - all the planets, including Earth - formed about 4.5 billion years ago.



You are made of billions of particles, and all of them were created when the Universe first began.



The Universe is being explored by space agencies, with their astronauts, probes, landers and telescopes.



There is still so much for scientists to discover about the Universe. Ideas and technologies are changing all the time.

NASA (National Aeronautics and Space Administration) is one of the most famous space agencies in the world.



Scientists use how far light travels in one year - a light-year - to measure distances in space. One light-year is the same as 9.5 trillion kilometres!



From what we've seen, the Universe is 93 billion light-years across.

# THE BIG BANG

Long ago, everything in the Universe was in a tiny space. It started to stretch and expand into something much, much bigger. This is called the Big Bang.

1. In the beginning, a tiny space was full of energy and lots of small particles. Everything was incredibly hot.

2. Around 13.8 billion years ago, this tiny space started to grow. No one knows why!

3. The Universe began to expand. It looked like it was being stretched!

4. Then the Universe began to cool down. The tiny particles slowed down and joined together into groups called atoms.

5. A force called gravity made the atoms clump together. This created the first stars and galaxies.

6. As stars were born, grew and died, more things in the Universe were made, such as asteroids, planets and comets.

In 1990, a rocket took the Hubble Space Telescope into space. Hubble helps scientists work out what may have happened when the Universe began.

Seconds after the Big Bang, the new Universe's temperature was 1,000 trillion °C - that's 1,000,000,000,000,000 °C!

# SOLAR SYSTEM

The Solar System is made up of the Sun at its centre, eight planets that travel around the Sun, and thousands of moons, asteroids and meteors.



THE SUN

The Solar System formed more than 4 billion years ago, from clouds of dust and gas.



VENUS

The four planets that are closest to the Sun are Mercury, Venus, Earth and Mars. They are solid and mostly made of rock.

A moon orbits a planet. Mercury and Venus are the only planets without moons, but there are over 250 moons in the Solar System, with more being discovered.



EARTH  
Earth is the biggest rocky planet.

MERCURY



Planets spin as they orbit the Sun. The planets travel around the Sun because they are pulled towards it by the force of gravity.

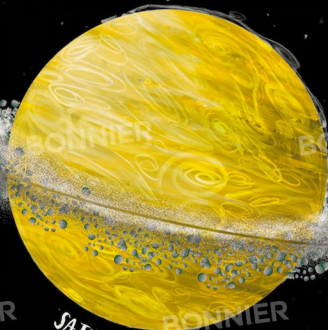
The path that each planet follows around the Sun is called its orbit. A planet's orbit is not a perfect circle. It looks more like an egg shape, or oval.

## ASTEROID BELT

MARS



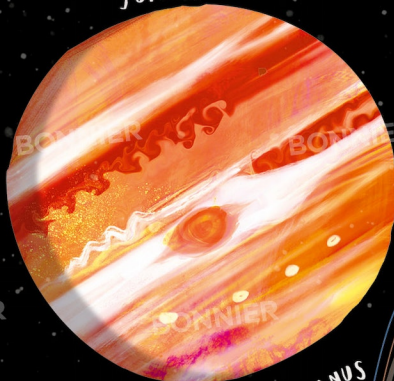
Jupiter, Saturn, Uranus and Neptune are huge balls of gas, known as gas giants.



SATURN

Jupiter and Saturn are the largest planets in the Solar System.

JUPITER



NEPTUNE



PLUTO

Uranus and Neptune are very far from the Sun's warmth, so they are also known as ice giants.

URANUS



The time it takes for a planet to spin once is called a day. A day on Earth lasts 24 hours; a day on Jupiter is nearly 10 Earth-hours long.

The asteroid belt lies between Mars and Jupiter. This is where millions of rocky objects orbit the Sun. One of the largest asteroids is called Vesta. It measures 530 kilometres across.

The time it takes for a planet to orbit the Sun is called a year. A year on Earth lasts 365 days.



# EARTH AND MOON

Our home planet is called *Earth* and it is special because life can survive. From space, Earth appears mostly blue because most of it is covered in water.

Earth is about 4.5 billion years old. For a long time, it was a hot, dry, lifeless place that was blasted by asteroids and comets.

Earth is slightly tilted on its side. This gives our planet seasons, such as winter and summer.

3.8 billion years ago, the oceans had formed and the first living things appeared. Earth is the only place in space that has life, as far as we know.

Earth's atmosphere traps the Sun's heat like a blanket. It keeps the planet warm and makes the weather, bringing rain to the land where plants grow.

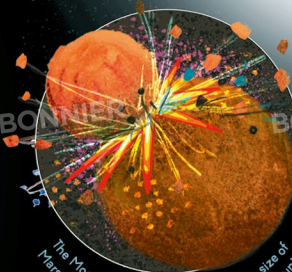
The Earth's temperature is not too hot or cold, so living things can survive. Our atmosphere also contains the air that animals and plants need to breathe.

There are seven large areas of land on Earth's surface called continents. The large areas of salty water are called oceans.

The Moon is about 384,400 kilometres away from Earth. It orbits Earth once every 27-28 days. It is a dry, rocky place with no lifeforms.



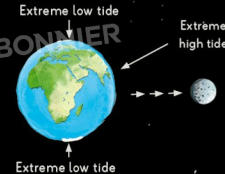
The Moon's surface has craters that were created when comets and asteroids hit it. It also has mountains, valleys and large plains.



The Moon was formed when a rock the size of Mars crashed into Earth, blasting off a giant chunk.



Earth's gravity stops the Moon from flying off into space. The Moon's gravity also pulls Earth towards it. It is not a strong force, but it is enough to pull the oceans towards it. This is what makes the tide go in and out.



# THE NIGHT SKY

When we look up into the inky darkness of the night sky, we catch a glimpse of the wonders of the Universe. Twinkling stars glow alongside the Moon and rocky visitors from space zoom past on their long distance travels.

Dust and space rocks called meteors fly towards Earth all the time. As they zoom through the atmosphere, meteors heat up and burn - we can sometimes see this glow from Earth. Most meteors burn up before they hit the ground, but if they do make touchdown, they are called meteorites.

The top half of Earth is called the Northern Hemisphere. The bottom half is called the Southern Hemisphere. What we can see in the night sky depends on where we are on Earth.

The Moon looks bright in the night sky because it reflects sunlight towards us.



We cannot see the Sun in the night sky because Earth completes one spin every 24 hours. It is night-time in places that face away from the Sun, and day-time in places that face towards the Sun.

Satellites are machines sent into space to help with research, track Earth's weather and transmit messages. They can also measure the size of forests and the temperature of the oceans.

The largest artificial satellite that orbits Earth is a giant space station, where scientists work for months at a time.

In the morning, the Sun rises in the east. At the end of the day, it disappears below the horizon in the west.



There are eight phases of the Moon.

On a clear night, we can see the Moon in the night sky, but its shape seems to change. It takes almost a month for the Moon to go through all its shapes, or 'phases'.

Cassiopeia is a group of five bright stars that make the shape of a W.

Some planets can be seen from Earth. Venus is the brightest object in the night sky, after the Moon, and can be seen without a telescope.



# ASTRONOMY

Astronomers study space to find out more about the galaxies, stars, planets and comets.

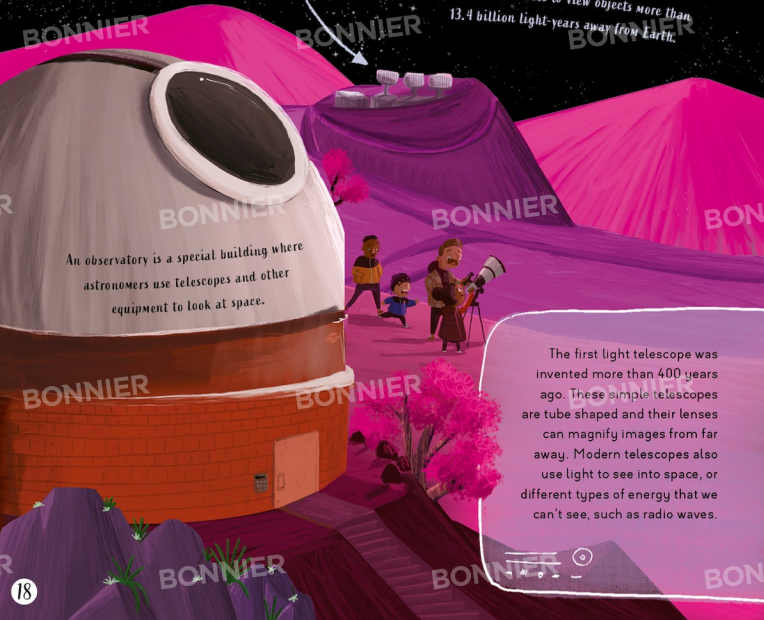
Modern astronomers have special equipment, from simple binoculars to huge telescopes on mountains or in deserts. Space telescopes have been sent beyond Earth's atmosphere to get the best view.

A giant telescope in the Atacama Desert, in South America, is one of the largest and highest telescopes on Earth. It has very sensitive cameras and can detect new stars, black holes and energy left over from the Big Bang.

As the Hubble telescope orbits Earth, it takes pictures of distant stars, planets and galaxies. It is able to view objects more than 13.4 billion light-years away from Earth.

An observatory is a special building where astronomers use telescopes and other equipment to look at space.

The first light telescope was invented more than 400 years ago. These simple telescopes are tube shaped and their lenses can magnify images from far away. Modern telescopes also use light to see into space, or different types of energy that we can't see, such as radio waves.

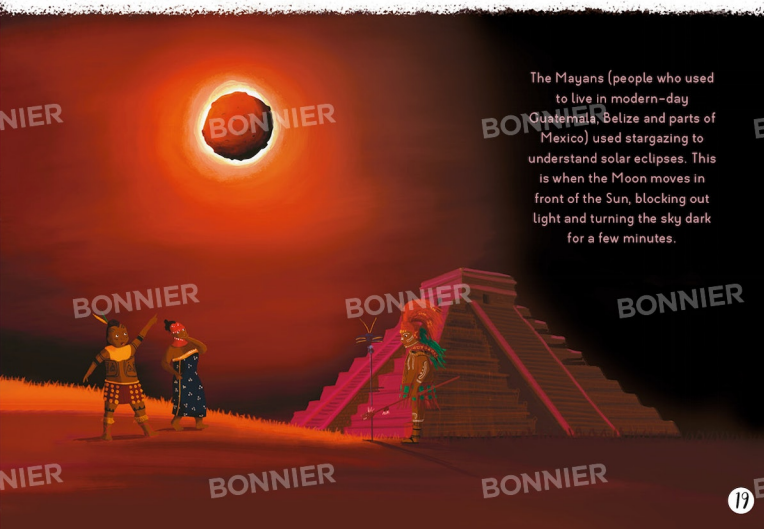


The first astronomers loved stars and maths – they worked out the size of Earth and its distance from the Sun, without the use of telescopes.



Ancient people of Greece, Babylon (now Iraq) and China were some of the first astronomers. They followed star movements in the sky to work out their calendars, and created 'sky maps' to show star positions throughout the year.

The Mayans (people who used to live in modern-day Guatemala, Belize and parts of Mexico) used stargazing to understand solar eclipses. This is when the Moon moves in front of the Sun, blocking out light and turning the sky dark for a few minutes.





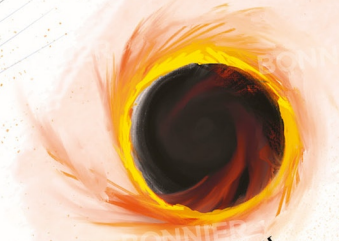
SUPERNOVA



THE SUN



ASTEROID



BLACK HOLE

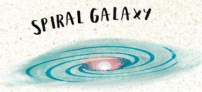
# OUTER SPACE



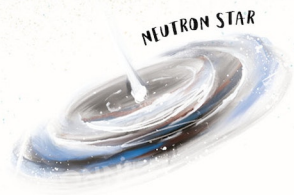
RED SUPERGIANT



RED GIANT



SPIRAL GALAXY



NEUTRON STAR



# LIFE OF A STAR

A star is born when gas and dust are pulled together by gravity. Some stars glow for billions of years but, as they get older, they change and eventually die.



A star begins with a cloud of gas and dust, called a nebula.



NEBULA

Start here!



Gravity pulls the dust and gas into the nebula's centre. The nebula collapses and becomes a protostar. It gets hotter and hotter until it becomes a star. Stars shine because they release huge amounts of light energy.



PROTOSTAR

VERY LOW MASS STAR



RED DWARF

Red dwarf stars are the most common type of star in the universe. They are smaller than high mass stars because they use up their fuel - hydrogen and helium gases - more slowly.



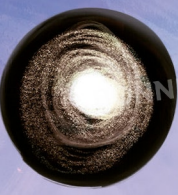
LOW MASS STAR

The amount of material that makes up an object is called its mass. Some stars have a very high mass but most of them have a low mass, or very low mass.

HIGH MASS STAR



MASSIVE STAR



Massive stars live for only a few million years before they expand to become supergiant stars, which are usually red or blue, and shine very brightly.

Red dwarf stars live for trillions of years and slowly fade away to become white dwarfs.



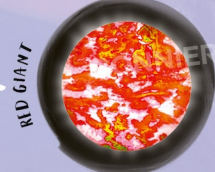
SUN-LIKE STAR

Our sun is about five billion years old. It will live for a total of about 10 billion years, glowing with heat and light.



RED SUPERGIANT

A supergiant star uses up its fuel quickly and ends its short life in an enormous explosion called a supernova. It shines more brightly than a whole galaxy of stars and collapses to become a neutron star or a black hole.



RED GIANT

Near the end of its life, our sun will expand and get hotter and bigger. It turns into a red giant star.

Dust and gas can speed away from an exploding supernova at more than 10,000 kilometres a second!



SUPERNOVA



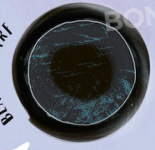
PLANETARY NEBULA

As the red giant dies, an expanding cloud of gas is shed from its outer layers, revealing a white dwarf behind it. This is called a planetary nebula.



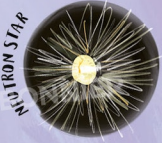
WHITE DWARF

With its fuel used up, the white dwarf shrinks and collapses and becomes a white dwarf. It is still very hot, but very small.



BLACK DWARF

A white dwarf cools to become a black dwarf. This takes so long that the universe is too young to have any black dwarfs yet!



NEUTRON STAR

A neutron star is small, but it still has the same mass as a much larger star. This makes it spin very fast.



BLACK HOLE

The stars with the greatest mass collapse into a black hole, where gravity is so strong even light cannot escape.

# THE SUN

The Sun is a star, a huge ball of glowing gas that gives off lots of energy, such as heat and light. We can see about 6,000 stars twinkling in the night sky, but there are trillions more.

The Sun is the nearest star to Earth, and without it there would be no life. It's almost five billion years old and so big that 1.3 million Earths would fit inside it.



Sunlight travels at 300,000 kilometres a second, which means it takes eight minutes and 20 seconds to reach Earth.



The Sun makes other types of energy, such as X-ray radiation and ultraviolet radiation. Radiation can be harmful, which is why we protect our skin and eyes in strong sunlight.

The Sun is 150 million kilometres from Earth. It's packed with superheated hydrogen and helium gases that glow at 5,500°C at the surface.

The surface of the Sun is called the photosphere. It is made of a superhot mixture of gases called plasma, which is always moving.

The Sun is the biggest object in the Solar System.

At its centre, the Sun's heat rockets to an incredible 15 million °C!

Just above the Sun's surface, there is a thin layer of gases called the chromosphere and the corona. They make up the Sun's atmosphere and spread millions of kilometres into space.

'Corona' means crown. The Sun's corona looks like a crown because jets of hot gas shoot out of it. They are called solar flares.

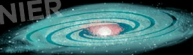
# GALAXIES

A galaxy is an enormous group of stars, planets, gas and dust. Our galaxy is called the Milky Way and on a clear night, you can see it without using a telescope.

There are three main types of galaxy: spiral, elliptical and irregular. They are all different shapes and sizes.

## SPIRAL GALAXY

Spiral galaxies look flat, like a disc, and have long spiral arms.



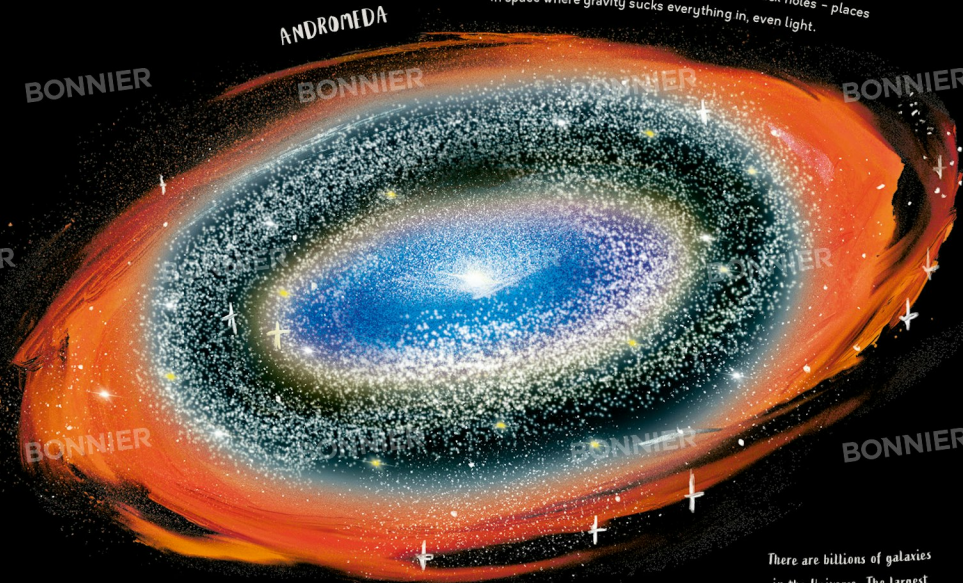
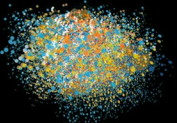
## ELLIPTICAL GALAXY

Elliptical galaxies are smooth and oval shaped, with lots of stars near the centre.

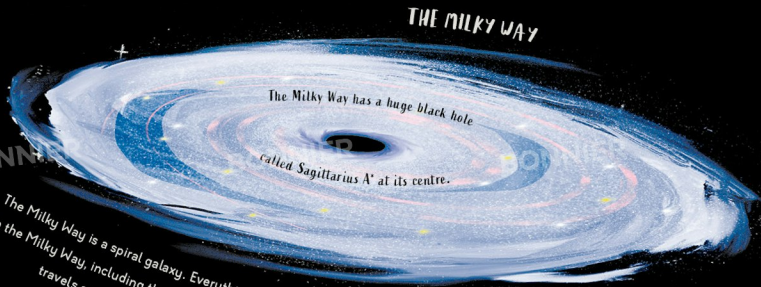


## IRREGULAR GALAXY

Irregular galaxies look like starry blobs. They form when other galaxies crash into each other.



The spiral galaxy Andromeda is the nearest galaxy to the Milky Way, but it is bigger with twice as many stars. Andromeda has black holes - places in space where gravity sucks everything in, even light.



The Milky Way has a huge black hole called Sagittarius A\* at its centre.

The Milky Way is a spiral galaxy. Everything in the Milky Way, including the Solar System, travels around its centre.

The Solar System takes about 250 million years to travel around the Milky Way.

Andromeda can be seen with the naked eye, even though it is 2.5 million light-years away.

There are billions of galaxies in the Universe. The largest galaxies contain trillions of stars.



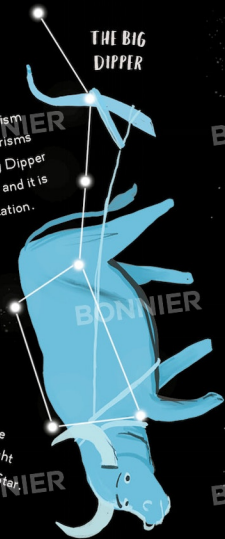
# STARGAZING NORTH

Some stars appear to make patterns in the sky. This is called a constellation. 36 out of 88 officially recognised constellations can be seen from the Northern Hemisphere.

Constellations are often named after characters or animals that people thought they looked like.

A pattern of stars is called an asterism (the word 'aster' means star). Asterisms can be part of a constellation. The Big Dipper asterism is also known as the Plough and it is found within Ursa Major's constellation.

THE BIG  
DIPPER



The Little Bear constellation contains one of the most famous stars: Polaris. This bright star is also known as the North Star, or Pole Star. It appears above the North Pole, so you can use it like a compass.

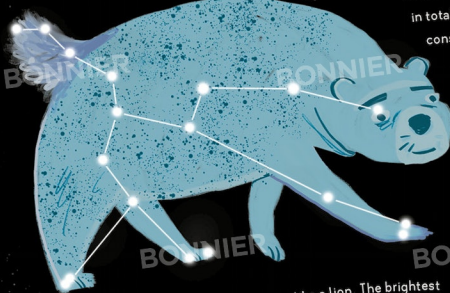
URSA MINOR

Polaris is the bright star at the end of the Little Bear constellation, which is also sometimes called the Little Dipper.



Constellations appear to move across the sky at night. Polaris doesn't move so it can't be seen from the Southern Hemisphere.

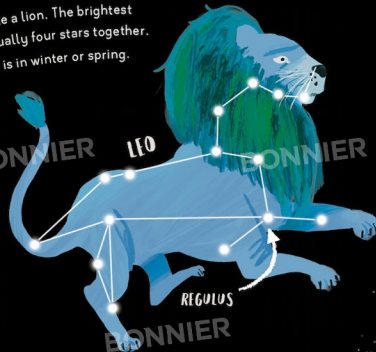
URSA MAJOR



There are 20 main stars in the Great Bear constellation, and 135 in total. It is one of the largest constellations in the sky.

The constellation of Leo looks like a lion. The brightest star is called Regulus but it is actually four stars together. The best time to see Regulus is in winter or spring.

LEO



REGULUS

Apart from Regulus, there appear to be 14 stars in the constellation of Leo, but some of them are pairs.

ORION



ORION'S  
BELT

RIGEL

Orion is also called the Hunter. Orion's belt is made up of three bright stars, and its foot is a supergiant star, called Rigel.

When you look for Orion in the Northern Hemisphere, you will always find it in the southern part of the sky.



# STARGAZING SOUTH

Stargazers see different constellations in the night sky, depending on where they are and the time of year. In the Southern Hemisphere, there are some constellations that are rarely, or never, seen in the north – while others look a little different.

52 of the 88 officially recognised constellations can be seen in the Southern Hemisphere.

CRUX

Crux is the smallest constellation in the sky. It includes the famous Southern Cross – an asterism of four bright stars. It can be used to help locate the South Pole.

The brightest star in the Crux constellation is called Acrux and it points towards the South Pole.

Centaurus is the ninth largest constellation in the sky.

The constellation Centaurus is named after a centaur – a mythical creature that is half human, half horse. It includes one of the brightest stars in the night sky, Alpha Centauri A, which is 4.4 light-years away – that's about 40 trillion kilometres!

Alpha Centauri is the star closest to the Solar System and it is seen best in the Southern Hemisphere.

The stars in the constellation of Scorpius create a shape that looks like a scorpion. It can sometimes be seen in the Northern Hemisphere in summer, near the horizon.

SCORPIUS

Antares is a red supergiant star, and the brightest star in Scorpius. It appears orange and is about 550 light-years from Earth.

Shaula is the second brightest star in Scorpius. It is actually a cluster of stars and makes up part of the scorpion's raised tail.

In Greek mythology, Scorpius is sent to kill Orion, the hunter, but can never catch him. Scorpius only rises in the east after the constellation of Orion has already set in the west.

Orion can be seen in both the Northern and Southern hemispheres, but in the south the hunter appears upside-down!



# COMETS

When a giant cosmic snowball swishes past Earth, it gets heated up and glows, creating a startling sight in the sky. This snowball is a comet, and just one of many flying visitors from space.

Comets are made of frozen gas, ice, rock and dust. The largest ones are the size of towns, but the smallest ones are just a few kilometres wide.

When comets move closer to the Sun, they heat up and the frozen gases melt. This creates an enormous glowing cloud that can be wider than a planet.

The glowing gas and dust form into a tail that can be millions of kilometres long. The tail always stretches away from the direction of the Sun.

The most famous comet is called Halley's comet. It flies past Earth about once every 76 years and its next visit will be in 2061.



# ASTERIODS

Asteroids are rocky objects that orbit the Sun. Millions of them can be found in the Asteroid Belt, between Mars and Jupiter.

Asteroids are smaller than planets.

Many measure one kilometre or more in diameter – that's nearly 10 football pitches across!



In 2021, the DART (Double Asteroid Redirection Test) spacecraft was sent into outer space to crash into an asteroid called Didymos. In 2022, DART successfully knocked Didymos off its path.

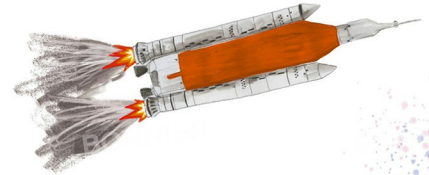
Being able to change an asteroid's direction could be helpful if a big asteroid headed towards Earth.



Around 66 million years ago, a giant asteroid crashed into Earth, starting fires, storms and volcanic eruptions that pumped toxic gases into the air. Scientists think this event caused the dinosaurs to die out.



# THE SOLAR SYSTEM



# MERCURY AND VENUS

Mercury is the smallest planet in the Solar System, and closest to the Sun. Both Mercury and Venus are best seen at dawn or dusk, when the Sun is below the horizon. After the Moon, Venus is the brightest object in the night sky.

Mercury has the shortest year of any planet. It takes just 88 Earth-days to orbit the Sun. That means an eight-year-old Earthling would have celebrated 33 birthdays on Mercury!



Mercury is the fastest planet in the Solar System, zooming round the Sun at 47 kilometres a second.

The Caloris Basin measures 1,600 kilometres across, making it the largest crater on Mercury and one of the largest craters in the Solar System.

Mercury has no moons and almost no atmosphere.

The surface of Mercury is dry, rocky and spattered with huge craters, just like our Moon.

Mercury is so close to the Sun that it can reach a blistering 427°C in the day, which is hot enough to melt metal. At night the temperature drops to -180°C.

Long ago, Venus may have been covered in oceans, just like Earth. The oceans disappeared with the heat, and volcanoes released toxic gases to make thick clouds.

Venus is wrapped in a thick blanket of gases, making it even hotter than Mercury.

There are thousands of volcanoes on Venus and at least 167 of them are bigger than the largest volcano on Earth.



Space probes have flown beneath Venus' clouds to get a better view. Some of them have been crushed by the atmosphere or burnt up in the heat.



The air on Venus is much heavier than on Earth - in fact, it's so heavy that a puff of wind wouldn't cool you down, but it could knock you over!

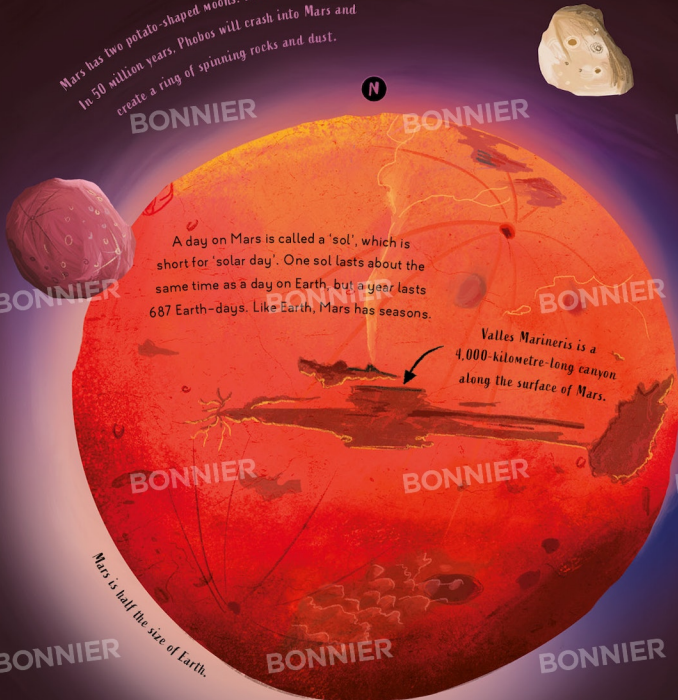
Venus has long days because it spins very slowly - it takes 243 Earth-days for Venus to spin once. It also spins in the opposite direction to other planets.

The wind on Venus can whoosh across the surface faster than any winds on Earth - up to 724 kilometres an hour.

# MARS

Mars is named after the Roman god of war and it appears as a bright-red dot in the sky, making it easy to find on a clear night. It is often called the Red Planet.

Mars has two potato-shaped moons: Phobos and Deimos. In 50 million years, Phobos will crash into Mars and create a ring of spinning rocks and dust.



A day on Mars is called a 'sol', which is short for 'solar day'. One sol lasts about the same time as a day on Earth, but a year lasts 687 Earth-days. Like Earth, Mars has seasons.

Valles Marineris is a 4,000-kilometre-long canyon along the surface of Mars.

Mars is half the size of Earth.

Mars has a North Pole and a South Pole, which are cold and icy. The ice on Mars is made of carbon dioxide and water.



Enormous dust clouds and red sandstorms are whipped up by the wind.

Mars is home to the largest mountain in the Solar System, Olympus Mons, which is 25 kilometres high, which makes it 2.5 times taller than Mount Everest, the tallest volcano on Earth.

Olympus Mons is a volcano that has been dormant for 25 million years.

It would take astronauts about seven months to get to Mars, but on arrival they would find a freezing cold, red desert under a pink sky. Its surface is peppered with volcanoes, huge plains, deep canyons and enormous sand dunes.



Billions of years ago, Mars was warmer, wetter and had a thicker atmosphere than today. There are signs that Mars might still have some liquid water, hidden under the surface.

Astronauts haven't landed on Mars yet, but in the future Martian astronauts would need to wear special spacesuits to protect them from the harsh conditions.

# JUPITER

Jupiter is an enormous gas giant. It has 95 moons and colourful stripes that swirl and speed across its surface.

Jupiter is massive – 2.5 times heavier than all the other planets in the Solar System put together! That's why it is named after the Roman king of all gods. Some of its moons are named after Jupiter's children.

Io



EUROPA



GANYMEDE



If Ganymede orbited the Sun, instead of Jupiter, it would be a planet, not a moon.

The four largest moons of Jupiter are Io, Europa, Ganymede and Callisto. Io is covered in volcanoes. Europa has lots of ice on its surface, and oceans of liquid water below. Ganymede is the largest moon in the Solar System – bigger than Mercury! The surface of Callisto is covered in ice and craters.

CALLISTO



The colours on Jupiter's surface are caused by cold, windy clouds of gas.

The Great Red Spot is a storm that has been raging for hundreds of years. It is bigger than Earth!

The Pearls are storms that spin anticlockwise and appear as white ovals on the planet's southern half.

Jupiter may be mostly gas, but you couldn't fly a spacecraft through it and come out the other side! It's extremely hot and the weight of the gas pushing down on you would squash your spacecraft.



ABORT MISSION!

There are very faint rings around Jupiter. They are made of dust.

A day on Jupiter is shorter than anywhere else in the Solar System, lasting just under 10 Earth-hours. A year is nearly 12 Earth-years long.



# SATURN

Saturn is a huge spinning ball of gas, surrounded by beautiful rings made of ice. Colourful clouds float above Saturn, making it appear many shades of gold, brown, yellow and grey.



It takes four years for spacecraft to reach Saturn.

The Great White Spot is a giant storm that appears on Saturn's surface once every 30 Earth-years.

Saturn's surface is made of swirling gases, with liquid gases below.

Saturn spins fast – at more than 36,800 kilometres an hour. A Saturn day lasts just 11 Earth-hours.

Saturn's winds can reach speeds of 1,800 kilometres an hour.

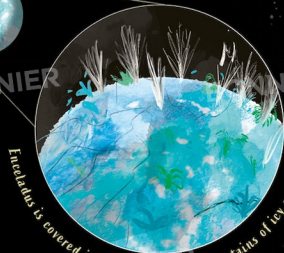
Saturn's seven groups of sparkling rings of ice shimmer in the Sun's light. The pieces of ice vary in size, from flecks of dust to huge mountains.

It takes 29 Earth-years for Saturn to orbit the Sun.

Saturn has more than 146 moons, including Enceladus and Titan. Titan, Saturn's largest moon, has a thick orange atmosphere, which blocks out much of the sunlight.



ENCELADUS



Enceladus is covered in ice and there are fountains of icy crystals on its surface.



TITAN

# URANUS AND NEPTUNE

Uranus and Neptune are the mysterious ice giants of the Solar System because they are so far away. Neptune is not visible from Earth without a telescope, and Uranus can only be seen occasionally. In fact, Uranus wasn't discovered until 1781, and Neptune in 1846.

Neptune is so far from the Sun that we know very little about it. It's a cold, dark planet, with freezing windstorms racing across its surface.

Neptune is four times larger than Earth.

Uranus is mostly made up of icy materials that move like a liquid around a small, rocky core. It is tilted so far over that it spins on its side.

Uranus has at least 27 moons, including Titania, Miranda and Ariel. These are named after story characters from William Shakespeare's plays and Alexander Pope's poems.

Uranus also spins clockwise, like Venus.

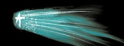
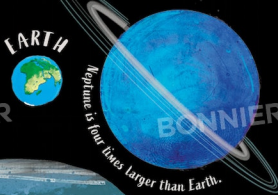
The atmosphere on Uranus absorbs red light, making it appear blue-green.

Uranus' inner rings are dark and narrow, and the outer ones are bright colours.

It takes a long time for Uranus to journey around the Sun. There are 30,687 Earth-days in one year - that's about 84 Earth-years!

One year on Neptune lasts about 165 Earth-years and one day lasts 16 Earth-hours.

Neptune appears blue in colour. It has 14 moons and five faint rings circling it.





# BEYOND PLANETS

The Solar System does not end at Neptune. It stretches out far into space. Astronomers have found many other objects there that orbit the Sun, including dwarf planets such as Pluto.

About a hundred years ago, astronomers guessed there was something else beyond Neptune – they called the mystery object 'Planet X'. In 1930, they finally discovered a planet-like object and named it Pluto.

Pluto has five moons. Charon, the largest moon, is half the size of Pluto. The other moons are Styx, Nix, Kerberos and Hydra.

Pluto and its moons may have been created when a meteorite smashed into it long ago.

Astronomers expected Pluto to be another gas giant planet. Instead, it's small, rocky and covered in ice. Now scientists call Pluto a dwarf planet.

There are five dwarf planets: Pluto, Eris, Haumea, Makemake and Ceres.



ERIS



Eris is the heaviest dwarf planet.

HAUMEA



Haumea is shaped like a potato.

MAKEMAKE



It takes Makemake 306 Earth-years to orbit the Sun.

CERES

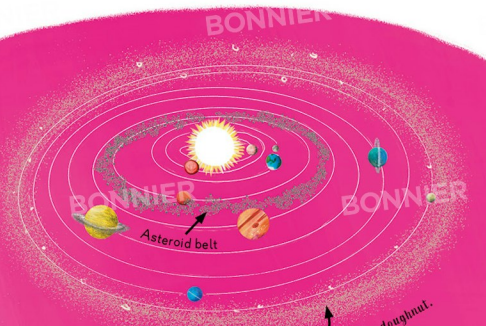


Ceres' surface is full of craters.



PLUTO

The Kuiper Belt is an area beyond Neptune where millions of rocky objects orbit the Sun. All the dwarf planets are found here, except for Ceres, which is found in the asteroid belt.



Kuiper Belt

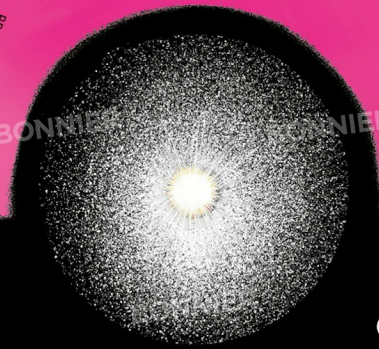


Oort Cloud

The Oort Cloud lies beyond the Kuiper Belt. We know very little about it because it would take a spacecraft 300 years to get there.

The Kuiper Belt is shaped like a ring doughnut.

The Oort Cloud probably contains trillions of icy objects left over from when the Solar System was formed.



ROMAN SPACE TELESCOPE

BONNIER

INTERNATIONAL SPACE STATION

LAIKA

EAGLE (APOLLO 11 LUNAR MODULE)

SPUTNIK 2

# THE SPACE AGE

PERSEVERANCE ROVER

SOLAR ORBITER

MOON

TESS SPACECRAFT

NEW HORIZONS SPACE PROBE

JAMES WEBB TELESCOPE

COLUMBIA (APOLLO 11 COMMAND MODULE)

ROCKET

# SPACE EXPLORERS

We live in the Space Age – the time in which humans left Earth to explore beyond. These exciting times need the very best machines that engineers can design and build.

Rockets are powerful machines that carry people and equipment out of Earth's atmosphere and into space.

Rockets carry a payload – an object being taken into space. It could be a space shuttle, satellite, space probe or people.

We have lift-off!

1. Rocket engines burn fuel. This makes gas, which expands and pushes the rocket up.
2. Extra rockets, called boosters, are also attached to a rocket's side. They fall away when their fuel is used up.
3. A rocket's engine propels the rocket into space.
4. The guidance system makes sure the rocket stays on course and goes where it's supposed to.
5. The payload is carried into space.

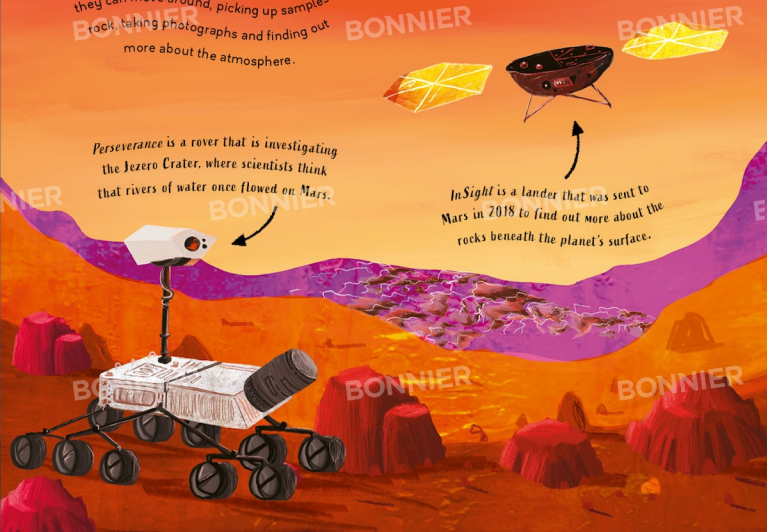


Rovers are robot vehicles that explore planets and moons. They can go to places where humans cannot survive. Rovers have wheels so they can move around, picking up samples of rock, taking photographs and finding out more about the atmosphere.

Landers are spacecraft that land. They have gone to many places, including Venus, a comet and even Saturn's moon Titan.

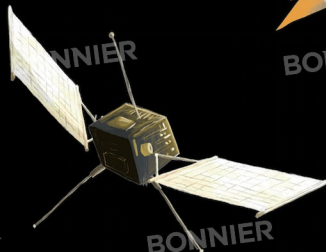
Perseverance is a rover that is investigating the Jezero Crater, where scientists think that rivers of water once flowed on Mars.

InSight is a lander that was sent to Mars in 2018 to find out more about the rocks beneath the planet's surface.



Orbiters travel around a space object, but do not land on it. Solar Orbiter is travelling around the Sun, finding out more about our star.

Solar Orbiter is taking the first close-up images of the Sun scientists have ever seen.



# FIRST JOURNEYS INTO SPACE

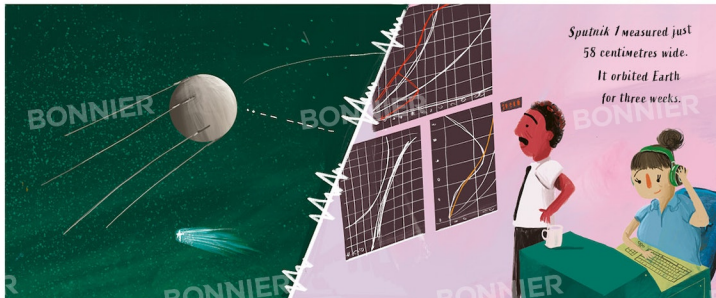
The first journeys into space began more than 70 years ago. Since then, many more space missions have taught scientists how humans can survive in space, and given lots of information to help us understand the Universe.



Fruit flies travelled to space on board a V2 rocket and returned with the help of a parachute.



**1947** The first animals in space were tiny fruit flies. They were taken 100 kilometres above Earth. Scientists wanted to know if they would be damaged by going into space, but they returned unharmed.



Sputnik 1 measured just 58 centimetres wide. It orbited Earth for three weeks.

**1957** The first satellite, Sputnik 1, was launched into space. It looked like a small silvery ball and sent radio messages back to Earth.

Sputnik 1 took about 98 minutes to orbit Earth. It helped scientists learn more about Earth's atmosphere as well as what conditions are like in space.



Laika orbited Earth several times.

**1957** Laika became the first animal to orbit Earth on the spacecraft Sputnik 2. Laika helped scientists understand the effects of spaceflight on a living creature.



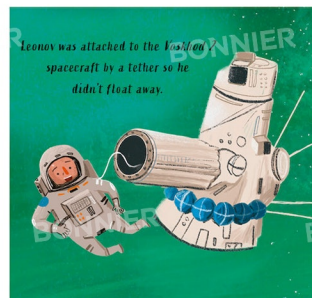
Gagarin orbited Earth in a capsule. He returned by parachute, after a journey that lasted just 108 minutes.

**1961** Yuri Gagarin was the first human to travel into space. He flew on board Vostok 1 to orbit Earth once.



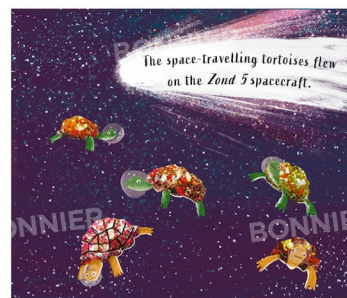
The Vostok 6 rocket took Tereshkova into space. She flew around Earth 48 times.

**1963** An engineer called Valentina Tereshkova became the first woman in space when she orbited Earth. She is the only woman to travel alone in space so far...



Leonov was attached to the Voskhod 2 spacecraft by a tether so he didn't float away.

**1965** Alexei Leonov was the first person to walk - or float - in space! With a backpack containing air to breathe Leonov spent 12 minutes and nine seconds outside the spacecraft.



The space-travelling tortoises flew on the Zond 5 spacecraft.

**1968** After a three-day journey, the first living things to fly to the Moon were tortoises. The Zond 5 successfully returned to Earth, with images of the Earth and the Moon.

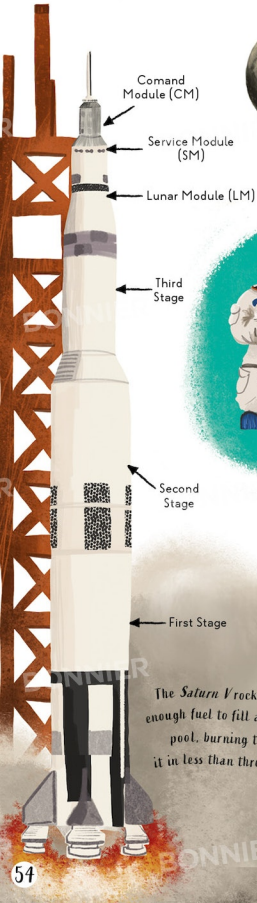


# WALKING ON THE MOON

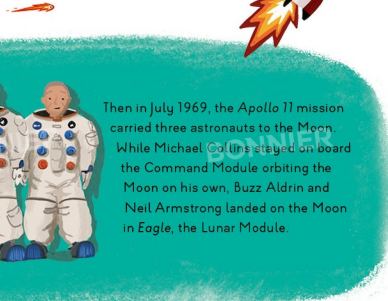
On a historic day in 1969, the first humans landed on the Moon. In total, the Apollo Moon missions took 12 astronauts to the surface of our nearest neighbour.



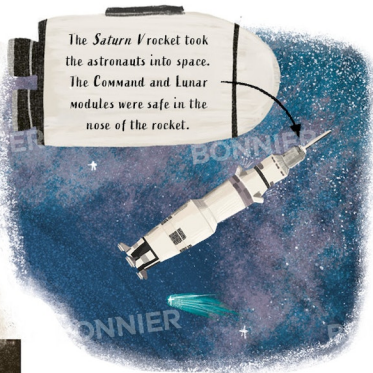
Before the famous Moon landing, many other spacecraft and crews, such as the Apollo 10 mission, visited the Moon with the important job of testing everything to make sure that a landing would be safe.



The Saturn V rocket used enough fuel to fill a swimming pool, burning through it in less than three minutes!



Then in July 1969, the Apollo 11 mission carried three astronauts to the Moon. While Michael Collins stayed on board the Command Module orbiting the Moon on his own, Buzz Aldrin and Neil Armstrong landed on the Moon in Eagle, the Lunar Module.

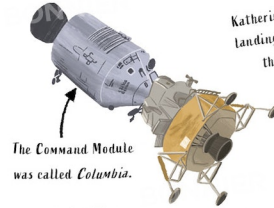


The Saturn V rocket took the astronauts into space. The Command and Lunar modules were safe in the nose of the rocket.

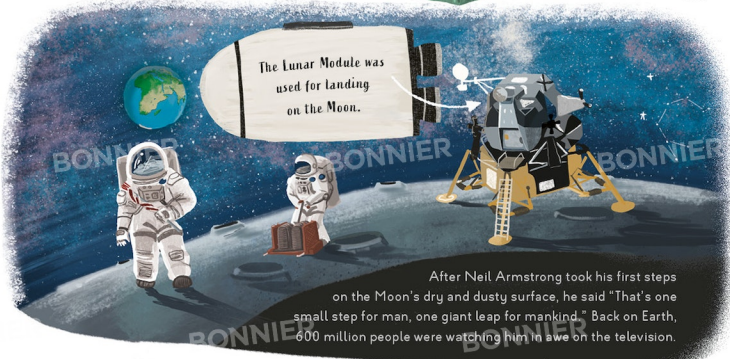
When Eagle safely touched down on a smooth stretch of land called the Sea of Tranquility, it only had 20 seconds' worth of fuel left! Back at base, a maths expert called Katherine Johnson was doing the sums needed to get the astronauts back again safely.



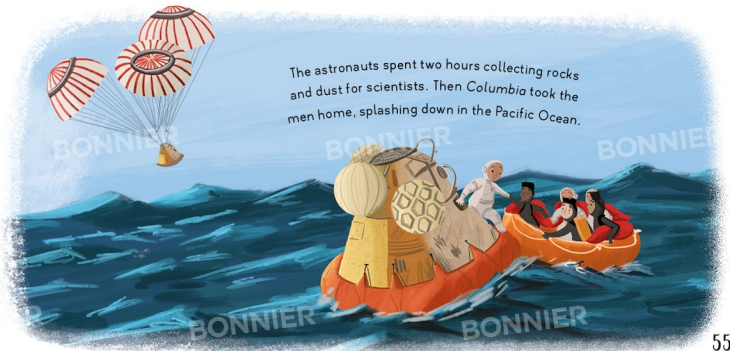
Katherine was vital to the whole Moon landing mission. Her sums helped get the rocket to the Moon, too.



The Command Module was called Columbia.



After Neil Armstrong took his first steps on the Moon's dry and dusty surface, he said "That's one small step for man, one giant leap for mankind." Back on Earth, 600 million people were watching him in awe on the television.



The astronauts spent two hours collecting rocks and dust for scientists. Then Columbia took the men home, splashing down in the Pacific Ocean.

# LIVING IN SPACE

Living in space can be difficult – there is no air, food or water. With the help of spacesuits and space stations, astronauts can now survive in space for months at a time.

The International Space Station (ISS) has been in space since 1998. The ISS is a science laboratory that helps scientists understand how humans could live in space.

The ISS orbits Earth 16 times a day – once every 93 minutes. It travels at a height of 408 kilometres and at a speed of 27,700 kilometres an hour.

The first space station, called Salyut 1, was launched in 1971.

In the ISS science lab, scientists are looking at the effect of low gravity on plants, animals and humans. They photograph Earth and keep a check on the health of the oceans and forests.

When astronauts go outside the ISS, they need to be tethered (attached) to the spacecraft, and wear spacesuits. The helmets allow the astronauts to speak to and hear each other, using microphones and speakers hidden inside.

Solar panels on the ISS turn the Sun's energy into power, such as electricity.

Spacesuits need to protect astronauts from harmful sunlight, which is much stronger in space than on Earth. Tubes of cooled water run through the spacesuit to stop astronauts getting too hot.

A machine makes oxygen gas for the astronauts to breathe.

Astronauts travel to and from the ISS in a spacecraft, such as the SpaceX Dragon.

Astronauts feel weightless on the ISS. Everything floats around the space station, so must be strapped down!

Water would just float away, so there are no showers. Everyone washes with a damp cloth and soap.

Dry food is stored in pouches and hot water is added at mealtimes.

# EXPLORING DEEP SPACE

Space is an enormous place and travelling across the Solar System takes a long time. A one-way trip to Neptune would take 12 years! Instead of risking human lives on these faraway journeys, machines are sent instead.

## VOYAGER

Voyager 1 and 2 left Earth's orbit in 1977. They are now exploring interstellar space – the area between the stars. The Voyager spacecrafts have explored Jupiter, Saturn, Uranus, Neptune and 48 moons.

The Voyager spacecraft carry a message in case they should meet any other living thing that might want to learn about life on Earth.

## NEW HORIZONS

New Horizons was the first spacecraft to explore Pluto and its moons. It discovered a heart-shaped area of ice on Pluto.

After Pluto, *New Horizons* went on to explore the Kuiper Belt.

## ARTEMIS

The Artemis missions will return humans to the Moon. The plan is to build a base camp on the Moon for astronauts to live and work there.

Using the base camp, scientists will be able to explore and investigate more and for longer.

*Juno* orbited Jupiter 35 times.

## JUNO

In 2011, the *Juno* spacecraft started its five-year journey to orbit Jupiter. It has helped scientists work out how Jupiter formed and is now exploring Jupiter's moons.

## CASSINI-HUYGENS

Cassini spent 20 years in space, studying Saturn and its rings. It even landed a small spacecraft on Titan, one of Saturn's moons. It discovered that Titan has many ingredients needed to support life – all except warmth.

*Cassini* travelled 7.9 billion kilometres, orbited Saturn 294 times and discovered six moons.

## PARKER SOLAR PROBE

The *Parker Solar Probe* flies through space at about 700,000 kilometres an hour. It has got closer to the Sun than any other probe to collect information on our star.

The *Parker Solar Probe* is the fastest object ever made.

# LIFE IN OUTER SPACE

The Universe is so huge that scientists believe there may be other planets and moons in the Solar System – and beyond – where life could exist.



Earth is called the Goldilocks planet because, like Baby Bear's porridge, it is 'just right'. It has air, liquid water and the chemicals needed for living things. Space missions are searching for more Goldilocks planets.

Exoplanets are planets outside the Solar System. They are a good place to start looking for life in outer space. Space telescopes, such as the James Webb Space Telescope, have found thousands of them so far. If they have atmospheres and liquid water, exoplanets may have living things on them.

No alien life forms have been discovered yet.



The Roman Space Telescope is able to search a billion galaxies and look closely at the Milky Way to try to find thousands of exoplanets.

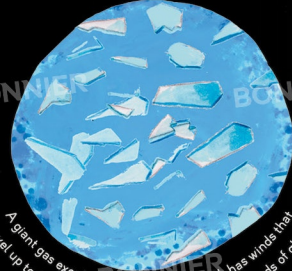


The James Webb Telescope is the most powerful telescope ever sent into space.

It uses a type of light called infrared to learn about the history of the Universe.



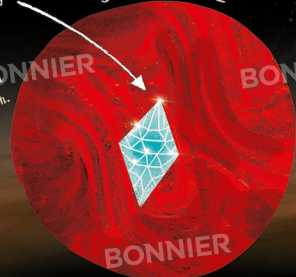
HD 189773b



A giant gas exoplanet called HD 189773b has winds that travel up to 8,700 kilometres an hour and it rains shards of glass.

Scientists believe that exoplanet 55 Cancri e may have a solid diamond at its centre.

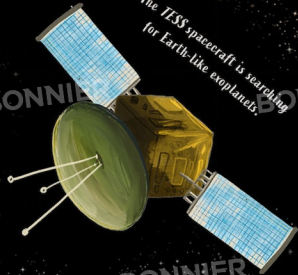
55 CANCRI E



Exoplanet 55 Cancri e is a super-Earth – a rocky planet, twice the size of Earth.



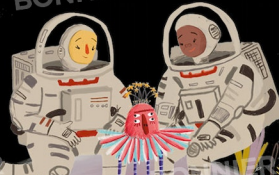
The TESS spacecraft is searching for Earth-like exoplanets.



The James Webb Space Telescope has a huge metal mirror made of 18 parts. The massive sunshield is the size of a tennis court. Its instruments can look at hundreds of objects at once.



Enceladus is one of Saturn's moons. It appears icy, but there is warmth and watery oceans beneath the layers of ice. It's possible that living things are in those oceans.



ENCELADUS



Enceladus is the 17th largest moon in the Solar System.





# SPACE WORDS

## ASTEROID

A small, rocky object in space.

## ASTRONAUT

A person who travels in space.

## ASTRONOMER

A person who studies space.

## ASTRONOMY

The study of space.

## ATMOSPHERE

The layer of gases that surrounds the Earth or other planets or moons.

## BILLION

= 1,000,000,000

## BLACK HOLE

An area in space where gravity is so strong that anything close to it cannot escape.

## COMET

An object in space that is made of rock, dust and icy gases. A comet has a 'tail' which points away from the sun.

## COMMAND MODULE

The control section of a spacecraft.

## CONSTELLATION

One of 88 groups of stars that make an imaginary picture.

## CONTINENT

One of the world's main large areas of land.

## DORMANT

Something that hasn't been active for a very long time.

## DWARF PLANET

An object that orbits the Sun but is smaller than a planet.

## EQUATOR

An invisible line that circles the world around its middle.

## GALAXY

A huge group of stars, gas and dust that are all held together by gravity.

## GAS GIANT

A large planet made mostly of hydrogen and helium and other gases.

## GRAVITY

A force that pulls things towards the centre of a planet or other object in space, such as a moon or sun.

## HEMISPHERE

Half of a sphere.

## HORIZON

The line we see in the distance where land appears to meet the sky.

## LIGHT-YEAR

The distance that light travels in one year in the vacuum of space.

## LUNAR MODULE

The part of a spacecraft that lands on the Moon.

## SHOOTING STAR SEARCH

Shooting stars, or meteors, are caused by tiny specks of dust from space. Did you find them all? There is one missing on pages 24–25.



## METEOR / METEORITE

A meteor is a rocky object that flies through Earth's atmosphere, burning as it travels. If it reaches Earth's surface it is called a meteorite.

## MILLION

= 1,000,000

## MOON

A natural object that orbits a planet.

## NEBULA

A cloud of gas and dust in space.

## NEUTRON STAR

A type of star that forms after a supernova explosion.

## OBSERVATORY

A place where equipment, such as telescopes, is kept for studying space.

## ORBIT

The path that something follows around a planet or a star.

## PARTICLES

Very small objects.

## PAYLOAD

The objects or people that a spacecraft is carrying.

## PLANET

A large, round object in space that orbits a star.

## SATELLITE

An artificial object that follows an orbit around a planet.

## SHOOTING STAR

Another name for a meteor as it burns in Earth's atmosphere.

## SOLAR SYSTEM

A star and the objects, such as planets, that orbit it.

## STAR

A bright ball of gases in space. The Sun is a star.

## SUN

The Sun is the star at the centre of our Solar System.

## SUPERNOVA

A star that is exploding and becomes much brighter.

## TRILLION

= 1,000,000,000,000

## ULTRAVIOLET RADIATION

A type of energy that exists in sunlight.

## UNIVERSE

Space and everything in it.

## X-RAY RADIATION

A type of energy that passes through many materials that light cannot pass through.





A TEMPLAR BOOK

FIRST PUBLISHED IN THE UK IN 2024 BY TEMPLAR BOOKS,  
AN IMPRINT OF BONNIER BOOKS UK,  
4TH FLOOR, VICTORIA HOUSE,  
BLOOMSBURY SQUARE, LONDON WC1B 4DA  
OWNED BY BONNIER BOOKS  
SVEAVÄGEN 56, STOCKHOLM, SWEDEN  
WWW.BONNIERBOOKS.CO.UK

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ISBN 978-1-80078-474-1

ASTRONOMY EXPERTISE PROVIDED BY JAKE FOSTER OF ROYAL  
OBSERVATORY GREENWICH, PART OF ROYAL MUSEUMS GREENWICH  
EDITED BY AMANDA ASKEW AND TAYABAH KHAN  
DESIGNED BY CHRIS STANLEY  
PRODUCTION BY NICK READ

PRINTED IN CHINA

