

Wonders of the Solar System

(Countdown...)

A space shuttle blasts off from the Kennedy Space Centre in America, carrying a team of astronauts to work in space. What might these astronauts do when they get there? Their job might be to carry out a daring space walk to repair a damaged satellite. Or maybe they will be doing experiments on board the shuttle.

Just imagine how it would feel to be an astronaut, to work and live in space.

Instead of standing on the floor, you would float around in your spacecraft. Food and water would also float around with you. This astronaut is trying to have a drink, but the juice floats around like a big bubble and I bet you've never eaten a banana like this before!

The view from your bedroom window would be quite spectacular – it's our home, the Earth, looking like a big ball turning in space. Here's the blue sea, and the brown and green land. And if we look really carefully, we can even see forests, rivers and mountains below us.

But we can't see all of the Earth. We only see the half that is lit up by the Sun – here it's daytime. The other half is in darkness, and there it is night. By using special cameras, we can see the cities of the world lit up brightly at night-time. If we take a close look at our country, we can see the bright lights of Liverpool and other big cities, like Manchester and London. As the Earth turns once every 24 hours, the people of the world are carried into day, into night, then back into day again.

As the Earth turns in space once a day, it also travels around the Sun. The Earth takes 365 days to go once around the Sun, and this is the planet's year.

The Earth isn't the only planet we know of. You probably know the names of some of the others. In order, the planets are Mercury, Venus, then the Earth, then Mars, Jupiter and Saturn. And even further away from the Sun are Uranus, Neptune and Pluto. All the planets travel around the Sun, which lies at the very centre. This is the Solar System.

What might it be like to explore the planets and their moons? Let's take a journey into space, and see some of the wonders of the Solar System for ourselves.

First stop, the Moon. The Moon is only three days away from the Earth by spacecraft, and is the only world that people have visited. The first person to walk on the moon was Neil Armstrong, in 1969.

The Moon is covered in lots of holes called craters. These were made long ago, when huge rocks crashed down onto the surface. The Moon is very different from the Earth. It's quite a bit smaller, and there is no water here to drink, or air to breathe. These footprints left behind by the astronauts will remain here for millions of years, because there is no wind or rain to wear them away. During the day, it's extremely hot on the Moon, and at night, it's very cold.

The astronauts carried out experiments to find out what the Moon was like. They took rock samples from the Moon, and brought them back to Earth. You can see some Moon rock on the gallery after the show. On later missions, the astronauts took a Moon buggy with them, so that they could travel long distances on the Moon. But for us, it's time to leave, and begin our exploration of the planets.

The first planet to visit is the planet Mercury, the closest planet to the Sun. In real life, it might take up to a year to get here, but in the Planetarium, we arrive at super-quick speed.

Mercury is covered in craters, and looks rather like the Moon. The big difference is that down on the surface, Mercury is much hotter. Around us we can see a rocky landscape scorched by the heat of the Sun. We'd like to explore, but it's so hot here that we simply can't stay any longer, and we move quickly on.

The second planet from the Sun is mysterious Venus. It's about the same size as the Earth, but it is always covered in thick clouds, and we can't see down to the surface. Instead, we can use radar to see right through the clouds, just as if they weren't there. A spacecraft called Magellan used radar to take these amazing pictures of Venus back in 1990. Venus has craters and volcanoes, and these streaks are dust that has been blown by the wind.

Down on the surface, Venus is even hotter than Mercury. This is because the thick atmosphere keeps the heat in, a bit like a blanket. The air here contains no oxygen, so we wouldn't be able to breathe. And even worse, the clouds here are not made of water, but of acid. Spacecraft that have landed on Venus lasted only a short while before they were destroyed by the terrible conditions here. It could be a very long time before people visit Venus for real, and for us, it's time for us to move on.

We're not stopping at the next planet, because we already know it so well. What planet is this? Of course, it's the Earth. We leave our home behind, as we journey to the Red Planet, Mars.

Mars is smaller than the Earth. It has two tiny moons, called Phobos and Deimos. The spacecraft Mars Global Surveyor took these pictures of Mars from orbit a few years ago. Here is Olympus Mons, a huge volcano three times the height of Mount Everest, with an area the size of England. We can also see craters on the surface, old, dry riverbeds, and deep valleys on this fascinating world.

Down on the surface, Mars is a bitterly cold desert planet, with rocks and red dust as far as the eye can see. These pictures were taken by a robot spacecraft called Viking, which landed on Mars over twenty years ago.

This spacecraft, called Pathfinder, explored Mars more recently. It landed in 1997, and took these pictures of its surroundings. It even brought with it a tiny robot car, to drive over the surface and explore.

More missions to Mars are planned in the next few years, and one day, people will walk on this strange desert world. But our look at Mars is over. Onward and outward, we travel at speeds far faster than light on our way to the cold, giant worlds of the outer Solar System.

On our way to Jupiter, the next planet, we have to cross the asteroid belt. Asteroids are huge rocks that orbit the Sun, but they are too small to be called planets. These pictures of asteroids were taken by spacecraft from Earth. There are thousands of asteroids, big ones and little ones. They can be a real danger to our spacecraft as we travel through.

We approach Jupiter, largest of all the Planets. Just look at how much bigger this giant world is than the Earth. If Jupiter were hollow, over 1000 Earths would fit inside it. Jupiter has no solid surface to walk on like the Earth; if we tried to land here, we'd just carry on sinking into the clouds.

A spacecraft called Voyager took these pictures back in the 1970's, but recently, the Galileo spacecraft has done even better. Galileo took this picture of Jupiter's Great Red Spot, a huge storm larger than the Earth.

Jupiter has four large moons that are the size of small planets. Here is a picture of volcanoes on a moon called Io, and flows of ice on another moon, called Europa. Ganymede is the largest moon in the Solar System, and Callisto is covered in craters. Jupiter has many smaller moons as well, but we haven't got time to visit them today.

Our next destination is the ringed planet, Saturn. The closer we get, the more fascinating our view of this beautiful world becomes. There are thousands of rings around Saturn. The rings are not solid, but are

made up of a multitude of icy rocks orbiting the planet, some as small as footballs, others as big as motorcars.

The planet itself is a little smaller than Jupiter, but still many times larger than the Earth. If we look closer, we can see that Saturn, like Jupiter, has no surface where we can land. Instead, all we can see are thick clouds that travel around the planet at great speeds. Saturn is the sixth planet in the Solar System, and here, a billion kilometres from the Sun, it's bitterly cold.

On our way to the next planet, we pass by something coming the other way, falling towards the Sun. This mountain-sized chunk of ice and dust is the centre of a comet. When it gets closer to the Sun the ice starts to warm and melt, and streams away into space, forming a beautiful tail. A few years ago, people back on Earth were amazed by the beautiful comet Hale-Bopp, which was visible in the sky for several months.

The planet Uranus comes into view; a blue, featureless world that looks as if it's been tipped over on its side. Some people think that it was caused by the impact of a huge comet or asteroid in the past, but no one is really sure. The planet has at least fifteen moons, but we have to move on now, to the last of the giant planets – Neptune.

Neptune has a few faint rings, and stormy weather features such as the Great Dark Spot. It also has several moons, and the largest of them is called Triton. Triton was discovered from Liverpool over 150 years ago by this man, William Lassell, an astronomer who lived in West Derby.

Finally, standing guard at the edge of the Solar System, is tiny Pluto, which is even smaller than Earth's Moon. Here, the temperature is colder than we can imagine, two hundred and fifty degrees below zero. Pluto has one moon of its own, called Charon. This is our best picture of Pluto, taken from Earth orbit by the powerful Hubble Space Telescope. Even in this picture, we can only just make out markings on the surface, and it might be a while before we have close-up pictures of this, the most distant planet of all.

It's time for us to return home, to planet Earth. Travelling at incredible speed we rush past the planets; Pluto, Neptune, Uranus, beautiful Saturn, giant Jupiter, the red planet, Mars, and finally, we approach our home once more. We're back where we started, on planet Earth, in the Planetarium at Liverpool Museum.

As the Earth turns in space once a day, so everything appears to turn around us. It's a bit like being on a roundabout. During the day, the Sun appears to move across the sky. It rises in the East every morning, and climbs higher and higher in the sky. At midday, the Sun is at its highest point in the sky, towards the south.

As the Sun moves across the sky, so the shadows it casts also change position. Long ago, before the invention of clocks and watches, people used Sundials to tell the time. The pointer on a sundial casts a shadow, and this points to the right time. Some sundials are more complicated, but they all work in a similar way, telling the time by using the movement of the Sun across the sky.

As the day draws to an end, the Sun sets below the western horizon. Our part of the Earth has turned away from the Sun. The sky grows dark, and now we can see the stars. As the Earth continues to turn, so the stars, like the Sun, seem to rise in the east and set in the west.

Let's stop the Earth turning for a while, and look at the night sky.

The brightest object in the night sky is the Earth's nearest neighbour in space. Can anyone guess what it is? That's right, it's the Moon.

The Moon appears to change its shape in the sky from night to night. Some nights, the Moon is a crescent shape, then a few days later, it is a 'half moon', then a few days after that, it is a round, 'full moon'. These different shapes are called the phases of the moon.

The Moon isn't really changing shape. Like the Earth, the Moon is round like a ball. Only half of the Moon is lit up at any one time. As the Moon goes round the Earth, so we see different amounts of this sunlit half. Look out for these changes if you can.

Thousands of years ago, people had strange ideas about the sky. The Egyptians thought that the sky was the starry body of the sky goddess, Nut, as she arched over the gods of the air and the Earth. The Greeks thought that the stars and planets were attached to crystal globes that slowly turned around us, here on Earth.

We don't believe these stories any more, but one idea from long ago, we do carry on today. This is the idea of star patterns, or constellations. These are pictures of heroes and heroines, and fabulous animals traced out in the stars. It's rather like a giant game of join the dots, in the sky above us.

We can always see this star pattern in the night sky. Some people think it looks like a starry question mark. Others think it looks more like a spoon, or even a saucepan. Here's the curved handle, and here's the pan. The proper name for this pattern is the Plough. If we find the two end stars of the plough, and use them as pointers, we come to one of the most famous stars of all. This is the North Star. It's not very bright, but it always points the direction North. Once we've found north, we can find our other directions. Here is the west, the east, and here is the south.

Another star pattern that we can always see is Cassiopeia. In Greek mythology, Cassiopeia was a powerful queen who was placed in the heavens by the gods. To us though, it looks more like a starry letter 'w' in the night sky.

Many star patterns can only be seen at certain times of the year. In the winter, we can see a lot of bright stars in the south. This group of seven bright stars marks out the shape of a person – a mighty hunter called Orion. These stars make up his shoulders, these are his feet, and these three stars in a line mark his belt.

Charging towards Orion is Taurus the Bull. This 'v' shaped cluster of stars makes up his face, and this bright star is his eye.

The Earth turns again, and new stars and star patterns rise in the east. The sky begins to get lighter – the turning Earth has brought us round once more to face our daytime star, the Sun, and it's the start of a new day.

Back at the Kennedy Space Centre, the astronauts on board the space shuttle are returning home. Like an aeroplane, the shuttle glides back down to Earth, where it will be prepared for another mission at some time in the future. Touchdown, and the astronauts' journey into space is over, for the time being, at least.

It's also the end of our brief look at the Universe around us. The journey that we have made today was just pretend, but in the future, people will make these journeys for real. Already, a new space station has been built in orbit around the Earth, where people can live and work. And there are already plans to send people to the planet Mars. Who knows, perhaps when you are older, you might get a chance to go into space for real, and see some of the wonders of the Solar System for yourselves.