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SPACE

‘That’s one small step for a man,’ said the American astronaut Neil Armstrong, and he walked into history – one of the first two men to walk on the Moon. More than forty years later, people still remember this exciting moment.

But our adventures in space have not stopped. Wonderful pictures come to us from millions of kilometres across the universe, and scientists find new planets, new stars, and even new galaxies. We learn more and more about the past, and how the universe began. At the same time, our spacecraft and telescopes travel further and further into space. Will it be in our lifetime that people say, ‘I remember when the first astronauts landed on Mars’?

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1

Earthrise

The three men were alone. Nobody could see them, nobody could talk to them. No one had ever been here before.

It was 24 December 1968. American astronauts Frank Borman, James Lovell and William Anders were behind the Moon in a spacecraft called *Apollo 8*.

The sky above them was black and full of stars, millions and millions of stars – too many to count. But the men were not watching the stars. They were watching the Moon as it moved below them.

Everything that they saw on the Moon was grey and dusty and dead. There were no rivers or seas, no lights or colours – no life at all. Just hills and rocks, dust and stones. But they were studying these hills and rocks carefully, because no one had ever seen them before. Then they saw something new.

As they watched, the Earth came out from behind the Moon like the Sun rising in the morning. But it was more beautiful than the Sun. They saw the blue of the seas and the white of the clouds. As they watched, the Earth rose into the black sky in front of them.

No one had ever seen the Earth like this before. Frank Borman took a photo, but it was in black and white. William Anders quickly put a colour film into the camera and took a colour photograph.

This photo, 'Earthrise', is one of the most famous photos ever made. It shows the Earth as a beautiful blue and white ball against the blackness of space. It is not a big ball; it is really quite small. To the three men in *Apollo 8*, the Earth

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looked no bigger than a man's hand.

But it is our home. The Earth is the planet that we all live on. We cannot live in any other place.

The observatory at Socorro,
New Mexico



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2 In the beginning

How many stars can you see in the night sky? In a city, you probably cannot see very many. But on a clear night, far from city lights, you can see hundreds, perhaps several thousand. With a telescope, you can see many thousands. With a really good telescope, scientists can see hundreds of millions.

But look closer: as well as stars, there are galaxies out there. What is a galaxy? It is a group of stars – millions, billions, or even hundreds of billions, all in the same part of space.

If you try to count all these stars and galaxies, you reach an impossible number. The scientist Carl Sagan said, ‘The total number of stars in the universe is larger than all the grains of sand on all the beaches of the planet Earth.’

So where did all these stars and galaxies come from? How were they made? Today, space is very big – enormously big – but scientists say that between 12 and 14 billion years ago, space was really small, impossibly small. Everything in the universe was pushed together in a space smaller than a full stop.

Then there was a BIG BANG and everything in the universe began to move away from the explosion at enormous speed. (This idea about the beginning of the universe is often called the Big Bang.) There were clouds of hot gas – hydrogen and helium. As they flew through space, over millions of years, these gases began to move around in spirals, like water going out of a bath. Many pictures of galaxies have this spiral shape.

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Inside the big spirals of each galaxy there were millions of smaller spirals, which formed into huge burning balls, and each burning ball was a star. And all these galaxies are still moving away from each other at enormous speed, so space is getting bigger and bigger all the time.

So how big is space? Well, it is much bigger than we can easily understand. But, amazingly, we can use our eyes to see how big it is.

Look at the group of stars called Orion. On a clear night, you can see these easily without a telescope. The star at the top left is a red star called Betelgeuse. The star at the bottom right is a blue star called Rigel. Both of these stars are much bigger and hotter than our own Sun. But they look small because they are a very long way away.

The light from the red star – Betelgeuse – has taken 643 years to travel to your eye. And the light from the blue star – Rigel – has taken even longer: 773 years. Light travels at about 300,000 kilometres every *second*, which is 9,460,730 million kilometres a year (we call that distance a light year). So that blue star, Rigel, is 7,313,144 billion kilometres away. But you can still see it – with your own eyes, without a telescope. That is amazing.

Of course, you cannot see what Rigel looks like today – nobody can. You can only see what the star looked like 773 years ago. So when you look at a star like Rigel or Betelgeuse, you are not just looking at something an enormous distance away; you are also looking back in time.

With a really good telescope, you can see much further, in space and in time. The Hubble Space Telescope has taken pictures of galaxies that are nearly 13 billion light years away. Light left these stars soon after the Big Bang, so we are seeing back in time to the beginning of the universe.

Space is really very, very big.

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A picture of galaxies from
the Hubble Space Telescope

YOU HAVE REACHED THE END OF THE SAMPLE.

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