Have you ever looked up at the sky on a dark, clear night and wondered about all those beautiful, shining stars above you? How many are there? What would they look like if we were able to see them up close? Is there another form of life somewhere out there, also looking at the night sky and asking the same questions?

We were once children too, standing outside on a cold night, marveling at the sky and all the secrets out there still left to uncover. And now, we are the first scientists to discover a planet that is not in our solar system, not even in the Milky Way – but in another galaxy!

The star in our neighboring solar system is called Proxima Centauri. It is around 4.25 light-years away from us. This is roughly 270,000 times the distance between the Sun and the Earth. And this is just our nearest neighbor!

Most of the other stars you see in the night sky are part of the Milky Way, the galaxy in which we live. The Milky Way is a spiral galaxy. Its center is a black hole and the spiral arms form a flat disc – a bit like a ninja star. In those arms are hundreds of billions of stars like our sun. At this point, it gets quite hard to imagine how far away from us some of those stars must be if they are at the other end of our home galaxy.

But this is nowhere near the greatest possible distance in the Universe!

There are hundreds of billions of galaxies like the Milky Way in the Universe. The one we looked at is called M51, often referred to as the Whirlpool Galaxy. It is also known as Messier 51 and was discovered by Charles Messier in 1773. It is around 31 million light-years away from us! Despite being so far away from Earth, we wanted to know if we could discover another planet in the Whirlpool Galaxy.

M51 contains very bright sources that give off X-rays as well as visible light. We studied all the bright X-rays in the Whirlpool Galaxy. Among these, we found one special source: M51-ULS-1. You can compare M51-ULS-1 to our...
Sun because it is also a source of light, as well as X-rays.

We used two telescopes that were able to measure X-rays coming from M51-ULS-1 over several years (Figure 1). Looking at the data, we found that there was a short time frame of around 3 hours in which the X-rays from M51-ULS-1 did not get through to our telescopes. This means that something must have blocked the X-rays during this time – just like your bones block X-rays during an examination to check if your arm is broken.

We got really excited because it was very possible that the signal blockage was due to a planet orbiting M51-ULS-1 (like Earth orbits the Sun). We believe that it blocked the signal by passing between M51-ULS-1 and our telescopes! But as we had no way to prove it, we had to first rule out other possible causes of the signal blockage.

Results

After comparing our data with that from other established X-ray sources, we found that:

1. The signal blockage was not due to dust found in the Universe. By going through dust (or gas), the X-rays would not have been completely blocked but instead would have changed in color.

2. The signal blockage was not due to a change of M51-ULS-1 itself. We were able to measure the heat of M51-ULS-1 and it did not change significantly. To the best of our knowledge, it is not possible for an energy source to change one of its radiation forms without affecting the other in only three hours. So if the heat did not change, it is very likely that the X-rays also did not change.

3. We would expect the data to look exactly like it does if the signal blockage really was due to a transiting planet. We calculated that it is probably the size of Saturn by comparing existing data for planets of different sizes with our new planet’s data.

So, we cannot prove that we found a planet in another galaxy – this is just not possible with the techniques we have right now! However, we can show that it is the most likely explanation for the observed event. We called the candidate extroplanet M51-1 (Figure 2).

Why is the candidate M51-1 called an extroplanet?
**Discussion**

Isn’t it amazing that we found such a small thing as a planet (on an astronomical scale of course!) in another galaxy that is so far away from us? The countless lights you see in the night sky are the visible stars in our galaxy, like our Sun. Each of them could have planets orbiting them, as the Earth orbits the Sun. Imagine, there are so many other galaxies out there that are just as full of stars and planets as the Milky Way! And we were the first to discover a potential planet in one of them.

Thanks to the teamwork of X-ray astronomers and a lot of hard work, we discovered evidence of the first planet found in another galaxy. But we also created a new discovery method. With this new method of analyzing X-ray sources, we might discover many more exoplanets over the next few years!

**Conclusion**

If you look up at the stars and feel excited about all the wonders that are still out there, why not start learning more about the Universe we live in?

- Visit the nearest observatory and have a look through a telescope.
- Ask your teacher to organize a trip with the whole class so you can share your excitement with your friends!

- Download the official NASA app and/or visit their website for stargazing information and much more.

Maybe you can even become an astronomer and discover something new about our Universe!

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**Check your understanding**

1. What is the name of the galaxy in which our potentially discovered planet belongs?

2. Why did we compare our data from the telescopes to other data about known X-ray sources?

3. Why can you see a picture of your bones with an X-ray examination?

4. Imagine you are standing on the Moon. What kind of transit would you likely observe if you observed the Sun for a while?

5. Can you find out the names of the other planets in our solar system? What are they made of?
Glossary of Key Terms

**Black hole** – A black hole is a very dense region in space with more mass packed into a smaller volume than any other object. Because of this incredible density, there is an imaginary surface around each black hole called the event horizon. If matter or light falls through the event horizon toward the black hole, it can never emerge again. Nothing can escape from a black hole.

**Extroplanet** – First, we have to understand the term “exoplanet”. This is a name for a planet that belongs to a star other than our Sun. So, it is part of a different stellar system to our solar system. Now, an extroplanet is a planet that is not only orbiting a different star, but in another galaxy!

**Galaxy** – A large group of stars, each of them with its own solar system. A galaxy is held together by gravity, which is controlled by the combined mass of the many stars and gas clouds near the center of the galaxy.

**Light-year** – Although the name suggests that a light-year measures passing time, it is actually just a term to measure big distances. One light-year is defined as the distance that light travels during one year (which is around 9.5 trillion kilometers). The distance between the Earth and the Sun is around 1/63,000 of one light-year, while the Whirlpool Galaxy is around 31 million light-years away from us.

**Solar system** – A term to describe everything that is gravitationally bound to our central star, the Sun. The higher the mass of something is, the more gravitational pull it has – meaning that other objects around it are attracted to it. The Earth has enough gravitational pull to keep us on its surface although it is a globe. If gravitation didn’t exist, we would just drift off into outer space. The Sun is so big that its gravitational pull affects the planets around it. So everything that stays near the Sun because of its gravitational pull (like planets, their moons, dwarf planets or even smaller objects like asteroids) belongs to our Sun’s system – the solar system.

**Transit** – A transit is when an object passes between a source of radiation and an observer. For example, sometimes our Moon (which orbits the Earth, like Earth orbits the Sun) passes through at exactly the right position to be temporarily between the Earth and the Sun. The light from the Sun is blocked by the Moon, making the Moon visible as a shadow on the Sun. This specific transit is called a (partial) solar eclipse.

**X-rays** – X-rays are a form of radiation with high energy. They can pass through matter, but they get weaker or even blocked depending on the material they try to go through. Denser materials (e.g. our bones) block the X-rays, which creates a shadow like a tree. But because X-rays are barely visible to the human eye, we have to use certain detectors to be able to see the shadows, like the film you get after having your bones scanned.

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