

# How do we find a planet in another galaxy?

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## Abstract

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!

## Introduction

To find a planet in a different **galaxy**, we first have to understand some basics about the galaxy we live in. So, what do you know about the Milky Way?

You surely know that the planet we live on is called Earth and that it is one of eight planets orbiting the Sun. The Sun (the central star in our **solar system**) gives off energy, mainly in the form of light. Without this energy, life on Earth would not be possible.

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.

## Methods

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.



**Figure 1:**

An artist illustration of the Chandra spacecraft in orbit.

**Photo credit:** NASA/CXC

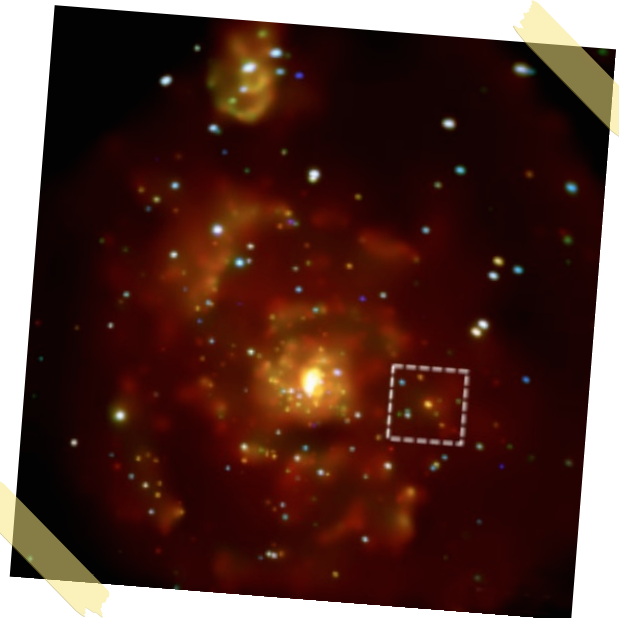
## Results

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?



**Figure 2:**

Here you can see an image of the Whirlpool Galaxy. That's where we may have found the extroplanet M51-1. We think the planet is orbiting M51-ULS-1 (the orange source in the white box) like Earth orbits the Sun.

## 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!

