Faraway, so close

Jonathan Freundlich

An artist's impression of a sunset on Gliese 667 Cc. The planet orbits around the brightest star, but two other suns are visible in the sky. CREDIT: ESO/L. CALCADA

ASTROPHYSICAL SERIES: PART- 2

Have you ever tried to count the stars in the night sky? Have you ever wondered how many worlds like our Solar System could exist in the vastness of the Universe?

Most shining dots you see in the night sky are stars like our Sun. Some are bigger, some are smaller. But they are all part of our Galaxy, the Milky Way. A galaxy is a group of many stars, dust and gas held together by the gravitational force. The same force that holds you to the ground and prevent Earth to escape from the vicinity of the Sun. There are more than hundred billion stars in the Milky Way!

Earth and the other planets of our Solar System, like Mars or Jupiter, orbit around the Sun. Similarly, there could also be planets around other stars. A planet orbiting around a star which is not our Sun is called an exoplanet, and the first one was discovered in 1995 from a telescope in the South of France. We have now detected over 1800 exoplanets, and we are yet only looking at nearby stars. As there are billions and billions of stars in the Milky Way, there could also be billions and billions of exoplanets.

Detections are indirect

But detecting exoplanets is not easy. Planets don't emit visible light on their own, and we are blinded by the extreme brightness of the stars around which they orbit. Observing an exoplanet is like spotting a firefly in the direction of the sun during a bright sunny day.

This is why most detections of exoplanets are indirect. For example, when a planet passes in front of its parent star, the luminosity of the star slightly decreases, and as the planet continues its orbit, this is due to happen at regular intervals. Detecting periodical drops of the star luminosity thus indicates the presence of a planet, and also enables to calculate its size. Moreover, the parent star is attracted to the planet in the same way that the planet is attracted to the star. So, as the planet turns around the star, the star also moves a little. As the star is much more massive than the planet, the movement is very faint, but still detectable, and it even permits to determine the mass of the planet.

Gaseous 51 Pegasi B

51 Pegasi B is the first exoplanet that was ever detected. It is a gaseous planet like Jupiter, but it is much closer to its parent star. Since it therefore receives more light from the star, it is very hot and the temperature reaches around 1000°C. But like Jupiter, you wouldn't be able to set foot on this planet, as it is entirely made of gas!

Gliese 667 Cc is a rocky exoplanet that is much more similar to Earth. It is just slightly smaller than our planet, and its surface temperature might be very close to Earth's. There could even be liquid water on the surface! But there are also major differences: the full round of seasons only last 28 days instead of a year, and three suns should be visible in the day sky. This definitively changes the vista!

We will surely discover more exoplanets in the future, and one of the key questions is whether life happened in other planets than Earth. As we expect to find many more exoplanets, that is quite possible! Besides, we are yet only probing a small area of our Milky Way. What about other galaxies? There are many more galaxies in the Universe, and thus even more stars. So many that the thought makes me dizzy!

(Jonathan Freundlich is a PhD student at the Paris Observatory, in France, working on star formation and galaxy evolution)

Did you know?

- Ancient Greeks named our Galaxy the Milky Way because it appears as a milky white glowing band across the night sky, and "galaxy" actually means "milky" in ancient Greek.
- Seen from outside, our Milky Way looks like a flat disk made of stars, whose diameter is about 100,000 light-years: light itself takes 100,000 years to travel from one side to the other!
- As most other stars, our Sun rotates around the center of the Milky Way. The nearest star to our Sun is named Proxima Centauri and is already 4 light-years away from us.
- 51 Pegasi B is named after its host constellation, Pegasus, while Gliese 667 Cc bears the name of the German astronomer Wilhelm Gliese, who catalogued the planet's parent stars in 1957.
- While Earth takes a full year to complete its revolution around the Sun, 51 Pegasi B circles around its star in just a few days