<u>Planet Hunting – Paul Withers</u>

On a clear night, countless stars and, usually, a few planets can be seen in the sky. For centuries, the only planets known to exist anywhere in the entire universe were those in our solar system. Since Aristotle, astronomers have speculated as to whether there are any extrasolar planets, that is, planets orbiting stars other than our Sun, travelling the night sky. Until recently, none had been found, as the light from a large, bright star makes it nearly impossible to see any small, dark planets lurking beside it.

In 1995, a new astronomical technique discovered the first extrasolar planet. The gravitational attraction between an extrasolar planet and its parent star causes the parent star to move in its own tiny orbit. The periodic motion of the star affects the colour of its starlight, which can be detected here on Earth. Using this indirect technique, planet hunter Geoffrey Marcy of the University of California, Berkeley has discovered many of the nearly 30 extrasolar planets known to orbit Sun-like stars. He can only use it to reveal the barest details about an extrasolar planet, including its orbital radius, shape of its orbit, and a lower limit on its mass. It doesn’t tell him anything whatsoever about the planet’s composition, temperature, radius, surface geology, colour, atmosphere, weather, magnetic fields, ring system, inhabitants, or moons. Compared to the understanding of planets in our solar system provided by spacecraft missions, next to nothing is known about these extrasolar planets. But the few details that are known are tantalizing.

“All the theories to explain planet formation were designed to reproduce the orbits and masses of our solar system’s planets,” says Marcy. Discoveries of extrasolar planets as heavy as Jupiter 100 times closer to their parent star than Jupiter is to our Sun with orbits which are far from circular “sent astronomers back to the blackboards to revise their theories.”

Without an understanding of how and why planets form, we cannot begin to speculate on the chances of extraterrestrial life on extrasolar planets. This understanding can only come with more information - and some sceptical scientists wanted more direct proof of the very existence of extrasolar planets.

In the last months of the 20th century, astronomers found ways to obtain this much-needed information about a handful of extrasolar planets. One extrasolar planet was seen to pass directly between its parent star and the Earth, partially eclipsing the parent star and silencing the sceptics. For Marcy, “This is what we’ve been waiting for.”

This revealed the extrasolar planet’s mass and radius. In a separate development, the light from another extrasolar planet has been directly detected for the first time. Using a sophisticated technique, British astronomers, led by Andrew Cameron of the University of St. Andrews, managed to separate starlight from the light of its extrasolar planet. They were then able to calculate the extrasolar planet’s mass, radius, and colour - blue-green.

These masses and radii have shown that these two extrasolar planets are about as heavy as Jupiter, with a density far less than that of water. A planet with such a density “has to be gaseous,” says Marcy. Jupiter-like gaseous, not Earth-like rocky, planets were expected, but the precise mass-radius relationship is just what astronomers had needed to develop their understanding of these new planets. Where possible, these two new techniques will be used on other extrasolar planets and will reveal some of their secrets as well.

In the next few decades, more extrasolar planets will be found, and detection techniques will move closer and closer to being able to find small, rocky, potentially habitable planets like our Earth. More precise studies of the light from these extrasolar planets will reveal details about their atmospheric composition and temperature, vital for understanding their potential for life.

It has been said that we are currently living in the spacecraft age, which has provided a flood of data about the planets in our solar system. For those studying extrasolar planets, the spacecraft age is in the future. For now, they must interpret fortuitous eclipses and tiny changes in the colour of starlight, rather than breath-taking pictures. In this respect, they have returned to the 1950s and the early days of planetary science, but this time with many, many solar systems to explore. Who knows what they will discover?

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