First extra-solar planetary system discovered

Chris Talbot
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The first discovery of a planetary system around a star similar to our sun was announced on April 15. Three planets the size of Jupiter are now known to be circling around the star Upsilon Andromedae, which lies in the Milky Way galaxy. Because of the unusual size and orbits of the planets, one of the researchers involved, Debra Fischer of San Francisco State University (SFSU), said, "It implies that planets can form more easily than we ever imagined, and that our Milky Way is teeming with planetary systems."

In 1996, SFSU astronomers Geoffrey Marcy and R. Paul Butler detected the planet closest to the Upsilon Andromedae. Continuing to observe the star at the Lick Observatory near San Jose, California, they have now observed the signals from two other planets in their data. Independently, over the last four years, researchers from Harvard-Smithsonian Centre for Astrophysics, Cambridge, Massachusetts, and the High Altitude Observatory, Boulder, Colorado--using the Smithsonian's Whipple Observatory near Tucson, Arizona--also discovered the outer two planets around Upsilon Andromedae. Fischer commented, "This is an extraordinary finding and it demands extraordinary evidence. Having two completely independent sets of observations gives us confidence in this detection."

Upsilon Andromedae is 44 light years (four hundred thousand billion kilometres) away from earth, but is easily visible to the naked eye. The planets are not visible with presently available telescopes, but are detected by the regular wobbles they create in the star as they orbit around it. This technique has been used to find the existence of Jupiter-like planets for several other stars over the last four years--one list gives 22 such confirmed planets, though many are around stars not similar to our sun-- but so far, only single planets had been detected.

Light from the parent star produces a so-called "Doppler effect" as it wobbles. By analysing the light into its component colours and examining the unique dark bands produced by different atomic elements in the star's spectrum, astronomers measure the speed at which the star moves relative to the earth. If the dark lines are seen to shift to redder colours, the star is moving away from us; if they shift to bluer colours, the star is moving towards us. A periodic pattern of red shifts and blue shifts is a sign that a planet may be present.

The innermost of the three planets is at least three-quarters the mass of Jupiter and orbits Upsilon Andromedae every 4.6 days at a distance of only about 8 million kilometres from the star (the distance from the earth to the sun is 150 million kilometres, and from Mercury, the nearest planet to the sun, the distance is 58 million kilometres). The second planet has a mass of about two Jupiters and takes 242 days to complete its elliptical orbit about the star, at a distance of about 129 million kilometres. The third has a larger mass of four times that of Jupiter, orbiting about every four years at a distance of 400 million kilometres.

One aspect of this historic discovery is that it challenges all accepted theories of how planetary systems form. Traditionally, it was thought that giant planets, such as Jupiter, Saturn, Uranus or Neptune, would form in the outskirts of a flat spinning disk of gas and dust orbiting around a star. How a Jupiter-sized planet can form so close to a star is still not understood, and was the subject of controversy when only single large planets orbiting close to stars were known about. "I am mystified at how such a system of Jupiter-like planets might have been created," commented Marcy.

The discovery makes the confirmation of the existence of much smaller earth-type planets highly probable in the near future. Such smaller planets only perturb the star they orbit by an extremely small amount, which has so far been beyond the power of even the most sophisticated measuring equipment.

Several attempts, using both optical and infrared telescopes, have been made to detect earth-like planets in the disks surrounding stars that are in the early stages of development. Such disks are difficult to study because the glare of the central star overpowers the feeble light reflected from the disk.

The National Aeronautics and Space Administration (NASA) is expected to launch its Space Interferometry Mission (SIM) in 2005, which will spend five years probing nearby stars to search for earth-type planets. This will be combined with ground-based observatories, such as the Keck Interferometer, as part of NASA's Terrestrial Planet Finder (TPF) project.

Such an amazing discovery would be expected to justify resources being made available to develop TPF and other projects, given its huge significance for the understanding of humanity's place in the universe. Instead, NASA has seen its budget trimmed once again, following six successive years of cutbacks.

See Also:

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