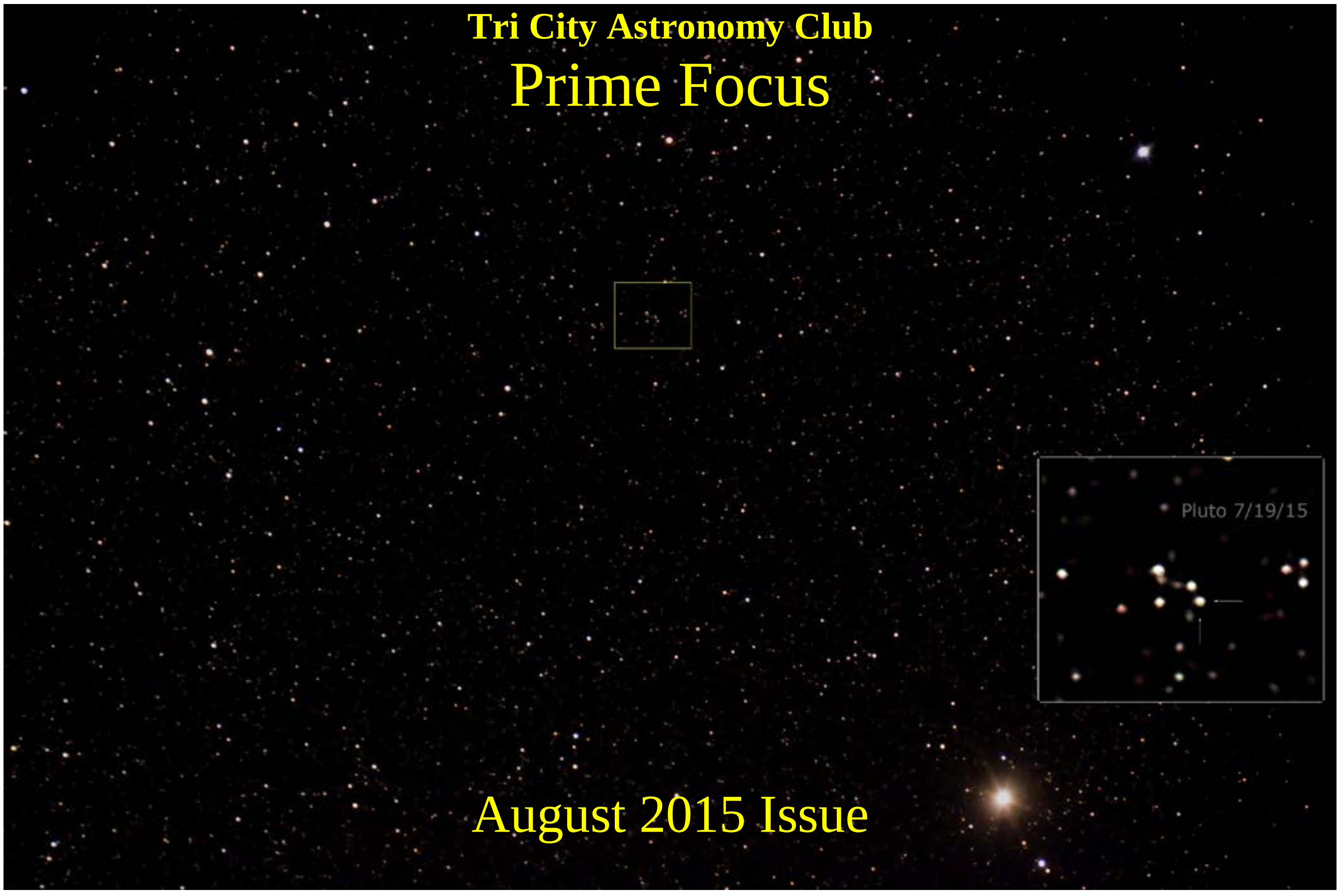


Pluto – Phil Holt

Next Meeting: August 20th, 2015, 7:30 pm, ***at the All Saints Episcopal Church, 1322 Kimball, Richland, WA***

Club News

The monthly club meeting was held on June 16th. It was a nice, pleasant evening, so the club decided to hold the meeting outside. (The fact that no one had a key to the church had nothing to do with the decision.) Club members discussed supporting upcoming astronomy events at the Hanford Reach Interpretive Center. Event dates are August 15th, September 18th, September 19th, and October 16th. A planning meeting for the first event will be held at 4:00 PM on August 7th at the Hanford Reach Center. Please let Garrett or Brian know if you can support these events.

LIGO will be having its annual Perseid meteor shower and star gazing event on Friday, August 14th. Andrea Dobson from Whitman College will give a lecture in the auditorium on Pluto. LIGO is inviting club members to bring their telescopes. The event starts at 8:00 pm, but club members who are bringing telescopes should arrive 30 to 45 minutes early. Please let Dale Ingram know if you will be bringing a telescope.

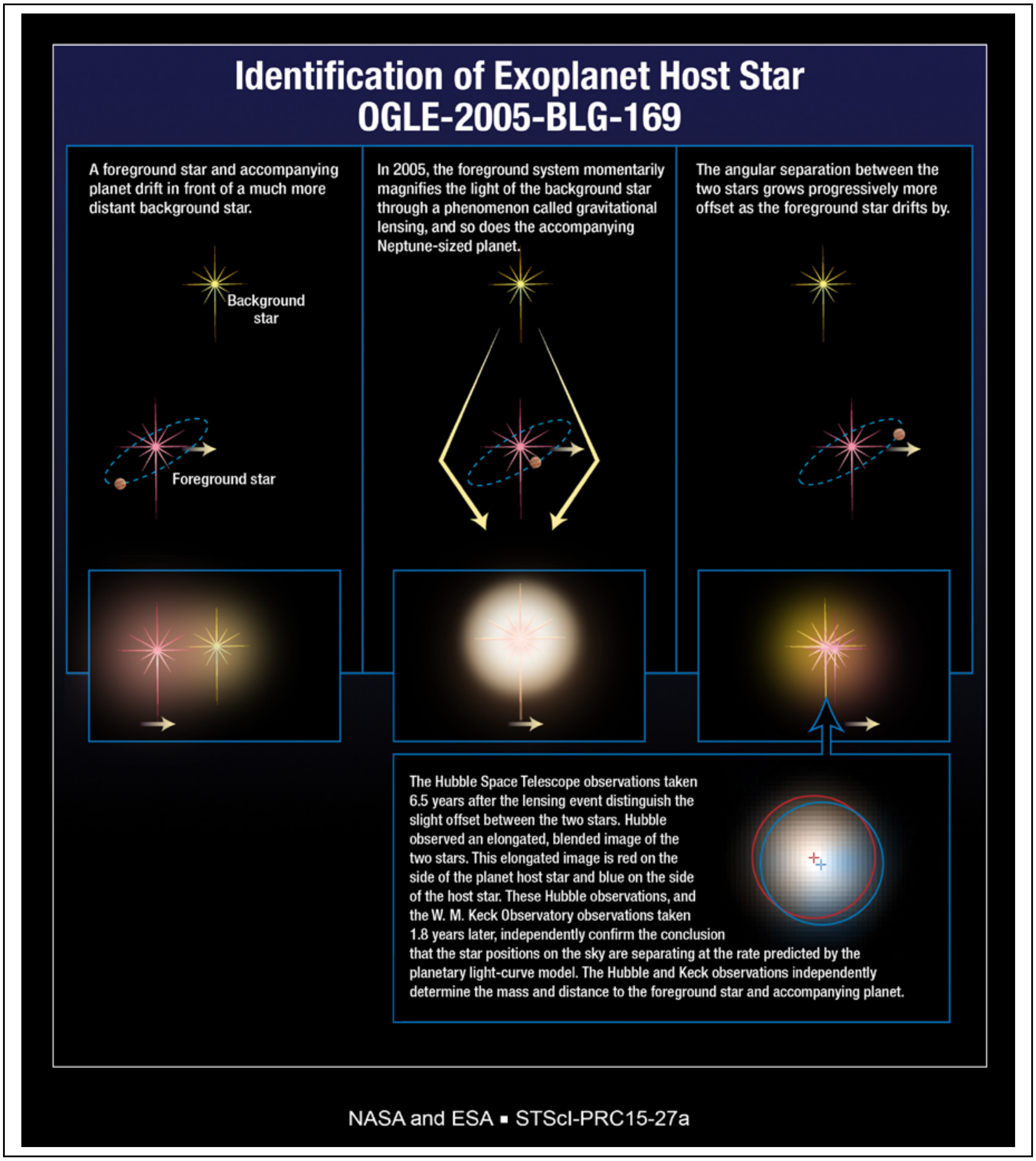
Astronomy News

Telescopes Team Up to Find Distant Uranus-Sized Planet Through Microlensing

NASA's Hubble Space Telescope and the W. M. Keck Observatory in Hawaii have made independent confirmations of an exoplanet orbiting far from its central star. The planet was discovered through a technique called gravitational microlensing.

This finding opens a new piece of discovery space in the extrasolar planet hunt: to uncover planets as far from their central stars as Jupiter and Saturn are from our sun. The Hubble and Keck Observatory results will appear in two papers in the July 30 edition of The Astrophysical Journal.

The large majority of exoplanets cataloged so far are very close to their host stars because several current planet-hunting techniques favor finding planets in short-period orbits. But this is not the case with the microlensing technique, which can find more distant and colder planets in long-period orbits that other methods cannot detect.



Microlensing occurs when a foreground star amplifies the light of a background star that momentarily aligns with it. If the foreground star has planets, then the planets may also amplify the light of the background star, but for a much shorter period of time than their host star. The exact timing and amount of light amplification can reveal clues to the nature of the foreground star and its accompanying planets.

The system, cataloged as OGLE-2005-BLG-169, was discovered in 2005 by the Optical Gravitational Lensing Experiment (OGLE), the Microlensing Follow-Up Network (MicroFUN), and members of the Microlensing Observations in Astrophysics (MOA) collaborations — groups that search for extrasolar planets through gravitational microlensing.

Without conclusively identifying and characterizing the foreground star, however, astronomers have had a difficult time determining the properties of the accompanying planet. Using Hubble and the Keck Observatory, two teams of astronomers have now found that the system consists of a Uranus-sized planet orbiting about 370 million miles from its parent star, slightly less than the distance between Jupiter and the sun. The host star, however, is about 70 percent as massive as our sun.

"These chance alignments are rare, occurring only about once every 1 million years for a given planet, so it was thought that a very long wait would be required before the planetary microlensing signal could be confirmed," said David Bennett of the University of Notre Dame, Indiana, the lead of the team that analyzed the Hubble data. "Fortunately, the planetary signal predicts how fast the apparent positions of the background star and planetary host star will separate, and our observations have confirmed this prediction. The Hubble and Keck Observatory data, therefore, provide the first confirmation of a planetary microlensing signal."

In fact, microlensing is such a powerful tool that it can uncover planets whose host stars cannot be seen by most telescopes. "It is remarkable that we can detect planets orbiting unseen stars, but we'd really like to know something about the stars that these planets orbit," explained Virginie Batista of the Institut d'Astrophysique de Paris, France, leader of the Keck Observatory analysis. "The Keck and Hubble telescopes allow us to detect these faint planetary host stars and determine their properties."

Planets are small and faint compared to their host stars; only a few have been observed directly outside our solar system. Astronomers often rely on two indirect techniques to hunt for extrasolar planets. The first method detects planets by the subtle gravitational tug they give to their host stars. In another method, astronomers watch for small dips in the amount of light from a star as a planet passes in front of it.

Both of these techniques work best when the planets are either extremely massive or when they orbit very close to their parent stars. In these cases, astronomers can reliably determine their short orbital periods, ranging from hours to days to a couple years.

But to fully understand the architecture of distant planetary systems, astronomers must map the entire distribution of planets around a star. Astronomers, therefore, need to look farther away from the star-from about the distance of Jupiter is from our sun, and beyond.

"It's important to understand how these systems compare with our solar system," said team member Jay Anderson of the Space Telescope Science Institute in Baltimore, Maryland. "So we need a complete census of planets in these systems. Gravitational microlensing is critical in helping astronomers gain insights into planetary formation theories."

The planet in the OGLE system is probably an example of a "failed-Jupiter" planet, an object that begins to form a Jupiter-like core of rock and ice weighing around 10 Earth masses, but it doesn't grow fast enough to accrete a significant mass of hydrogen and helium. So it ends up with a mass more than 20 times smaller than that of Jupiter. "Failed-Jupiter planets, like OGLE-2005-BLG-169Lb, are predicted to be more common than Jupiters, especially around stars less massive than the sun, according to the preferred theory of planet formation. So this type of planet is thought to be quite common," Bennett said.

Microlensing takes advantage of the random motion of stars, which are generally too small to be noticed without precise measurements. If one star, however, passes nearly precisely in front of a farther background star, the gravity of the foreground star acts like a giant lens, magnifying the light from the background star.

A planetary companion around the foreground star can produce a variation in the brightening of the background star. This brightening fluctuation can reveal the planet, which can be too faint, in some cases, to be seen by telescopes. The duration of an entire microlensing event is several months, while the variation in brightening due to a planet lasts a few hours to a couple of days.

The initial microlensing data of OGLE-2005-BLG-169 had indicated a combined system of foreground and background stars plus a planet. But due to the blurring effects of our atmosphere, a number of unrelated stars are also blended with the foreground and background stars in the very crowded star field in the direction of our galaxy's center.

The sharp Hubble and Keck Observatory images allowed the research teams to separate out the background source star from its neighbors in the very crowded star field in the direction of our galaxy's center. Although the Hubble images were taken 6.5 years after the lensing event, the source and lens star were still so close together on the sky that their images merged into what looked like an elongated stellar image.

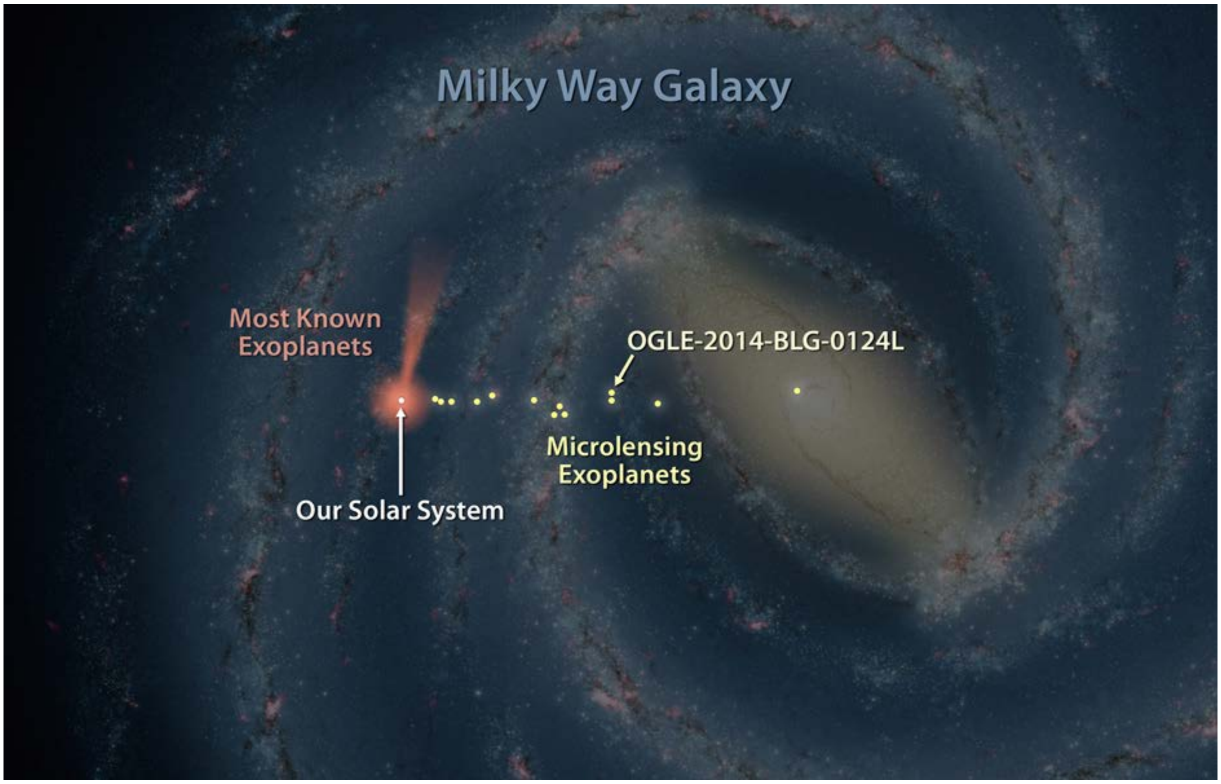
Astronomers can measure the brightness of both the source and planetary host stars from the elongated image. When combined with the information from the microlensing light curve, the lens brightness reveals the masses and orbital separation of the planet and its host star, as well as the distance of the planetary system from Earth. The foreground and background stars were observed in several different colors with Hubble's Wide Field Camera 3 (WFC3), allowing independent confirmations of the mass and distance determinations.

The observations, taken with the Near Infrared Camera 2 (NIRC2) on the Keck 2 telescope more than eight years after the microlensing event, provided a precise measurement of the foreground and background stars' relative motion. "It is the first time we were able to completely resolve the source star and the lensing star after a microlensing event. This enabled us to discriminate between two models that fit the data of the microlensing light curve," Batista said.

The Hubble and Keck Observatory data are providing proof of concept for the primary method of exoplanet detection that will be used by NASA's planned, space-based Wide-Field Infrared Survey Telescope (WFIRST), which will allow astronomers to determine the masses of planets found with microlensing. WFIRST will have Hubble's sharpness to search for exoplanets using the microlensing technique. The telescope will be able to observe foreground, planetary host stars approaching the background source stars prior to the microlensing events, and receding from the background source stars after the microlensing events.

"WFIRST will make measurements like we have made for OGLE-2005-BLG-169 for virtually all the planetary microlensing events it observes. We'll know the masses and distances for the thousands of planets discovered by WFIRST," Bennett explained.

Map of Exoplanets Found in Our Galaxy (Artist's Concept)



This artist's map of the Milky Way shows the location of one of the farthest known exoplanets, lying 13,000 light-years away. Most of the thousands of exoplanets discovered to date are closer to our solar system, as indicated by the pink/orange areas.

Astronomers have discovered one of the most distant planets known, a gas giant about 13,000 light-years from Earth, called OGLE-2014-BLG-0124L. The planet was discovered using a technique called microlensing, and the help of NASA's Spitzer Space Telescope and the Optical Gravitational Lensing Experiment, or OGLE. In this artist's illustration, planets discovered with microlensing are shown in yellow. The farthest lies in the center of our galaxy, 25,000 light-years away.

Most of the known exoplanets, numbering in the thousands, have been discovered by NASA's Kepler space telescope, which uses a different strategy called the transit method. Kepler's cone-shaped field of view is shown in pink/orange. Ground-based telescopes, which use the transit and other planet-hunting methods, have discovered many exoplanets close to home, as shown by the pink/orange circle around the sun.

NASA's Jet Propulsion Laboratory, Pasadena, California, manages the Spitzer Space Telescope mission for NASA's Science Mission Directorate, Washington. Science operations are conducted at the Spitzer Science Center at the California Institute of Technology in Pasadena. Spacecraft operations are based at Lockheed Martin Space Systems Company, Littleton, Colorado. Data are archived at the Infrared Science Archive housed at the Infrared Processing and Analysis Center at Caltech. Caltech manages JPL for NASA.

For more information about Spitzer, visit http://spitzer.caltech.edu and http://www.nasa.gov/spitzer.

Club Info

Club Meetings: on the 3rd Thursday of each month, 7:30pm – 9:00 pm usually at All Saints Episcopal Church, 1322 Kimball, Richland, WA. You do not have to be a member to attend.

Tri-City Astronomy Club
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www.tricityastronomyclub.org

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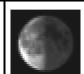
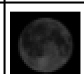
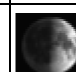
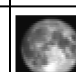
TCAC Sky Events Calendar

August 2015

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
26	27	28	29	30	31	1 Venus 21.5° E
2 Moon Perigee 03:11	3 Moon D Node 19:53	4	5	 6 Last Quarter 19:03	7 Mercury-Reg. 10:25	8 Moon-Aldeb 16:22
9	10 Moon N Dec 04:11	11	12 Perseids 23:17	13	 14 **Night Sky at LIGO** New Moon 07:54	15 Venus Infer 12:19 **Hanford Reach Events**
16 Moon-Mercury 07:34	17 Moon A Node 16:05 Moon Apogee 19:33	18	19 Mars-M44 20:35	20 **Club Meeting**	21	 22 Moon-Saturn 10:21 First Quarter 12:31
23	24 Moon S Dec 20:44	25	26 Jupiter Sun 14:04	27	28	 29 Full Moon 11:35
30 Moon Perigee 08:24	31 Moon D Node 03:16 Neptune Opp 19:12	1	2	3	4	5

Sky Events Calendar by Fred Espenak and Sumit Dutta (NASA's GSFC)

All event times are given for UTC-8:00: Pacific Standard Time (PST) or UTC-7:00, Pacific Daylight Time (PDT), as applicable.

On the Website Calendar of Events, all dates for 1st Quarter Moon public viewing sessions will be held from March until October. The viewing sessions will normally be held on the Friday closest to the first quarter Moon unless otherwise noted, with Saturday as an alternate day if the weather on Friday is bad. Other public viewing events maybe also scheduled at LIGO. New moon dates will be announced at monthly club meetings and locations are optional as we have several to choose from.