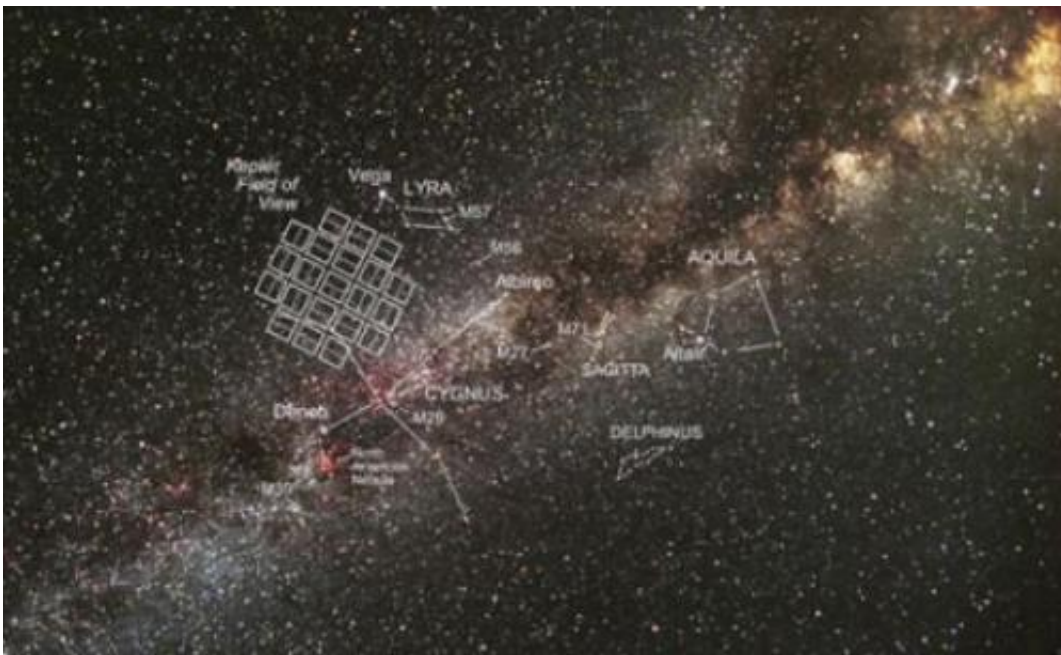


Hunt for distant planets intensifies (w/ Video)

February 19 2013



The Kepler spacecraft's field of view is superimposed on the night sky in the image above. Launched in 2009, Kepler so far has 105 confirmed planet discoveries to its credit, and has identified 2,740 additional planet candidates. Credit: Carter Roberts.

(Phys.org)—When astronomers discovered planet GJ 1214b circling a star more than 47 light-years from Earth in 2009, their data presented two possibilities: Either it was a mini-Neptune shrouded in a thick atmosphere of hydrogen and helium, or it was a water world nearly three times the size of Earth.

Along came Jacob Bean, now an assistant professor in [astronomy](#) & astrophysics at the University of Chicago, who used a new method called multi-object spectroscopy to analyze the planet's atmosphere from large, ground-based telescopes. Aided by technology, Bean and his colleagues are surmounting the challenge of inferring the atmospheric composition of planets that were invisible to humans just a few years ago.

"We're trying to distinguish whether it's like the gas giants we know about, or something fundamentally different from what we've seen in our solar system—an atmosphere predominantly composed of water," Bean says.

The search for exoplanets—planets beyond our own solar system—has taken off over the last decade, and is now a growing component of UChicago's research agenda in astronomy. One estimate published in January calculated that our Milky Way galaxy alone contains at least 17 billion Earth-sized planets, with a vast potential for life-sustaining worlds. Pursuing the exoplanet search via complementary methods are Bean and Daniel Fabrycky, another assistant professor in astronomy & astrophysics.

Bean has received a 60-orbit allocation on the Hubble Space Telescope to continue his observations on GJ 1214b, a sign of the work's importance. Previous HST studies of planetary atmospheres encompassed 10 to 20 orbits. Bean will use a technique called transmission spectroscopy to measure the chemical composition of the planet's atmosphere with unprecedented precision.

A big prize

A definitive assessment of the planet's atmosphere could lead to a larger prize: learning how to detect potential signs of alien life on more Earthlike worlds. The atmospheric signature of life on an exoplanet

presumably would contain some mixture of oxygen and various other gases. Planetary scientists are conducting theoretical studies to narrow the range of possibilities.

"It's interesting to note that all the instruments astronomers have used to study exoplanet atmospheres so far were never designed for that," Bean says. "We're using them in very unusual ways. We do what we can with what we have."

But now Bean aims to build a system that is optimized to study exoplanet atmospheres, including that of GJ 1214b.

"The current data suggest an atmosphere predominately composed of water, but it's not a definitive result yet," Bean says. "There could be even more exotic scenarios possible that we're not able to rule out."

If GJ 1214b is a water world, "It would be very different than anything in our own solar system," says Harvard University astronomy Professor David Charbonneau, whose team discovered the planet.

Deep questions

The search taps into some of modern science's deepest questions: Are humans alone in the cosmos, and is our life-sustaining world unique? One of the earliest writers to speculate about exoplanets was the Italian philosopher and scientist Giordano Bruno, who was burned at the stake in 1600 for espousing beliefs that the Catholic Church deemed heretical.

In one prescient passage, Bruno wrote, "In space there are countless constellations, suns and planets; we see only the suns because they give light; the planets remain invisible, for they are small and dark. There are also numberless earths circling around their suns, no worse and no less than this globe of ours."

Discoveries of new exoplanets have flowed like oil from a gushing wellhead in recent years. The number has topped 850 and continues to climb.

Starting in the 1990s, exoplanet hunters initially were only able to find giant, Jupiter-like gas planets because they were bigger and thus easier to find. "They were closer to their stars than Jupiter is from the sun, so we nicknamed them 'hot Jupiters,'" Charbonneau says.

But in recent years, scientists have refined their techniques to find smaller planets like Earth. One major push along that front was the \$600 million Kepler mission, launched in 2009. This mission, encompassing a 100-member science team, is conducting a survey of planets orbiting other sun-like stars.

"Kepler is on the cusp of finding small planets in the habitable zone around both sun-like and small stars," Fabrycky says. "This is the goal of the mission, and it's almost there."

New research frontiers at UChicago

A Kepler research veteran, Fabrycky began his UChicago faculty appointment last October. Fabrycky precisely measures the timing of transits, the mini eclipses that planets cause as they pass in front of their stars. Variations in the timing of transits often result from the gravitational influence of other planets. Such data allow Fabrycky to infer the structure of distant solar systems.

So far Kepler has 105 confirmed planet discoveries to its credit, and has identified 2,740 planet candidates. As a postdoctoral scientist at the University of California, Santa Cruz, two years ago, Fabrycky was a member of a team that discovered six planets orbiting a single star called Kepler-11. "Kepler-11 is hanging on—for the moment—as the one with

the most number of planet signals" among exoplanetary systems, Fabrycky says.

Bean and his colleagues have made the best observations of planetary atmospheres so far using the Hubble Telescope, the Spitzer Space Telescope, and, in Chile, the Very Large Telescope array and the twin Magellan Telescopes. But the planned Giant Magellan Telescope, of which UChicago is a founding partner, and the forthcoming James Webb Space Telescope should eclipse the capabilities of today's observatories when they go into service late this decade.

The new telescopes will be able to do the same sort of exoplanetary atmospheric studies underway now, "but actually do it for the smaller [planets](#) that might even be habitable," Charbonneau says.

Provided by University of Chicago

Citation: Hunt for distant planets intensifies (w/ Video) (2013, February 19) retrieved 27 April 2024 from <https://phys.org/news/2013-02-distant-planets.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.