Ars Technica

Exoplanet found right next door in Alpha Centauri

May be roughly Earth-sized, but blazingly hot.

by John Timmer - Oct 16 2012, 7:16pm EDT

Today, planet hunters announced evidence that there's a planet orbiting one of our closest stellar neighbors. One of the three stars of the α Centauri star system shows the sort of periodic changes in brightness that are a hallmark of the presence of an orbiting planet. And, even though the new world would be far too hot to support liquid water, the astronomers who discovered it point out small planets tend to form in groups. Odds are good that there are additional planets lurking further out from the host star.

Rapid advances in planet-hunting have led to an ever-increasing catalog of exoplanets, but most of these orbit distant stars. In contrast, the a Centauri system "is a household name," as Greg Laughlin of UC Santa Cruz put it. Just over four light years from Earth, the system includes two bright stars, Centauri A and B orbiting each other with an 80 year period, along with a red dwarf called Proxima Centauri. Centauri B has a Sun-like mass, but is quite a bit dimmer.

The planet was detected using the radial velocity method. As a massive body orbits its host star, it exerts a gravitational pull on it, pulling the star in slightly different directions as its position shifts. These create a small acceleration in the star itself, usually on the order of a few meters per second. That, in turn, shows up in the light emitted by the star as Doppler shifts in the light it emits, which vary with the orbital period of the planet.

Detecting these, however, can be a challenge, as a long catalog of factors can also cause periodic changes in the star's output. The authors of the paper describing the find list them as, "instrumental noise, stellar oscillation modes, granulation at the surface of the star, rotational activity, long-term activity induced by a magnetic cycle, the orbital motion of the binary composed of a Centauri A and B, light contamination from a Centauri A, and imprecise stellar coordinates."

To get around these, the authors relied on a massive catalog of observations, made using the HARPS instrument on a 3.6 meter telescope at the European Southern Observatory. Over a span of nearly four years, the authors made multiple observations of Centauri B, often several observations a night, spaced two hours apart. This let them average out short-term variability on the span of hours, and reconstruct that star's equivalent of the solar cycle, in which its activity increased over the course of their observations.

One by one, they factored out all of the periodicities they could account for. What was left was a hint of a signal with a periodicity of 3.3 days. This was incredibly weak—in fact, the smallest yet detected—at only 0.8 meters/second acceleration. But, even though this signal was much smaller than some of the noise they filtered out, the authors calculated there was a "false alarm probability" of less than one percent. In other words, it's *probably* a planet. As scientist told a press conference earlier today, if it was any place other than Alpha Centauri, there would be nothing extraordinary about the claims.

But don't start building the colony ship just yet. With a 3.3 day orbit, the planet is only 0.04 Astronomical Units (1 AU is the typical distance from the Earth to the Sun). That makes this planet blazingly hot, at about 1,500 Kelvin. One of its discoverers indicated this would ensure the surface is "not solid, more like lava." The radial velocity method lets you estimate the lower bound on the mass of the planet. Assuming it's orbiting roughly in a plane that faces edge-on to Earth, it has a mass roughly equivalent to our home planet.

Even though the new planet is likely well outside the habitable zone, we shouldn't give up on α Centauri. The plane of the two large stars of α Centauri is oriented nearly face on to Earth, and forces that govern star formation would make it likely that any planetary disks would form in this same plane. That means the planet is more likely to be on the low end of the mass estimates—in other words, close to Earth-sized. As the discoverers noted, about 70 percent of the small planets we've discovered have been in systems with multiple planets. So, the chances of finding something else further out are much higher than you might otherwise expect.

The HARPS team (which was represented by Stéphane Udry and Xavier Dumusque of the Geneva Observatory) estimate that, based on Centauri B's habitable zone (which is roughly centered on distance that's equivalent to Venus' orbit) they should be able to spot a Super-Earth (having five to 10 times Earth's mass) in the habitable zone. And, given the probability that the system's plane is oriented towards Earth, we could also use an orbiting observatory to watch for planets transiting in front of Centauri B.

We may have to wait a bit, though. The team told the press conference the orbit of the system's two large stars could be problematic; they were coming very close to each other over the next four years. This would make observations extremely challenging. It'll be eight years or more before we'll have good conditions for observations again. But, on the plus side, telescope tech is advancing dramatically these days, and a decade's worth of progress will put us in a much better position to learn something about our neighbors.

What about visiting? Laughlin estimates that, given our current technologies, any probe we sent wouldn't arrive for about 40,000 years. So that's probably a no-go, "given our propensity for instant gratification." But there are some unproven propulsion ideas that could get us there much more quickly, and Laughlin said that, should this find ignite enough interest, we may look into those more seriously.

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Alaska Times

Astronomers discover rocky Earth-sized planet just 4.4 light years away

Pete Spotts | The Christian Science Monitor | Oct 18, 2012

Alaska News & Features

Astronomers have discovered a rocky, Earth-mass planet right in our own sun's galactic neighborhood. The planet is orbiting a star a mere 4.4 light-years away in the multiple-star Alpha Centauri system, which may well turn out to be a cosmic condo, hosting additional planets.

A habitable planet could well be among them, some astronomers speculate.

The planet, with an estimated mass 1.13 times higher than Earth's, is orbiting Alpha Centauri B, which forms a binary pair with Alpha Centauri A. Both essentially share the sun's mass and are only slightly older than the sun. The system includes a smaller, dimmer star called Proxima Centauri.

With a "year" that corresponds to 3.2 Earth days, the newfound planet is too close to the star to be habitable, notes Xavier Dumusque, a PhD student in astrophysics at the University of Porto in Portugal. He led the team reporting the discovery in Thursday's issue of the journal Nature.

The planet is gravitationally bound to the star in such a way that it presents the same face to Alpha Centauri B all the time. This sets up temperatures on the day side that could top 2,200 degrees Fahrenheit, melting rock – a sharp contrast with the night side, perpetually facing the cold of space.

Still, researchers point out that rocky planets tend to have siblings.

Evidence from 17 years of hunting planets, especially evidence that NASA's Kepler spacecraft is amassing, "shows us where there's one rocky planet, there's more," says Debra Fischer, a Yale University astronomer who has been deeply involved in hunting for extrasolar planets for most of this period.

Snagging a rocky planet with an Earth-like mass one solar system over from ours suggests that "it's a good bet there are other planets there as well," she adds, including planets orbiting Alpha Centauri A.

Detecting an Earth-mass, rocky planet in the habitable zone of either star will be extremely difficult. The notion that one of these lies a cosmically scant 4 light-years away remains speculation, but "it is not a crazy speculation anymore," says Dr. Fischer, who was not part of the research team reporting the results.

The team, which included 11 researchers from Switzerland, Portugal, and France, used the European Southern Observatory's 3.6-meter telescope high in the Chilean desert.

The researchers observed the system on and off for four years using an approach that measures the slight to-and-fro tug a planet imparts to its host star as the planet orbits. Using a highly stable spectrograph bolted to the back of the telescope, the team detected this movement as subtle changes in the star's spectrum – which shifted toward red when the planet tugged the star away from Earth, and to blue when it pulled the star toward observers.

The effect was tiny, amounting to a change in the star's velocity of about 1 mile an hour as the planet tugged it back and forth. Indeed, the planet orbiting Alpha Centauri B represents the lightest planet yet found using this "radial velocity" detection approach. The achievement required an intimate knowledge of the star's behavior – tracking periods of increased and decreased star-spot activity on the surface, which can trigger changes in the star's spectrum that can be mistaken for planet-induced changes.

For Alpha Centauri B, those faux changes are far larger than the planet's effect, requiring sophisticated computer models to filter out the star's natural spectral shifts.

This has prompted some researchers to dub the discovery a "planet candidate" until other teams used their own models of the star's behavior, combined with the European data, to try to confirm the discovery.

Even better would be additional, independent observations that confirm the results, notes Artie Hatzes, an astronomer at the University of Jena in Germany and another planet hunter.

The spectrograph the European team used is the best at what it does, Dr. Hatzes notes in an e-mail exchange. Still, he says, other, less-capable instruments could be used if they spent more time than the Europeans did making observations.

Meanwhile, Fischer is leading a team that has been observing the system as well, but over a shorter time. Using a 1.5-meter telescope at the Cerro Tololo Inter-American Observatory, also in Chile, her team has recently added a souped-up spectrograph to the telescope and began using it in June – improving one avenue for confirmation.

Still, the quality and quantity of the European team's data is "quite extraordinary," says Greg Laughlin, an astronomer at the University of California at Santa Cruz and another extrasolar-planet researcher.

If this planet had been discovered in any system other than Alpha Centauri, "this object would have been completely run-of-the-mill," Dr. Laughlin says.

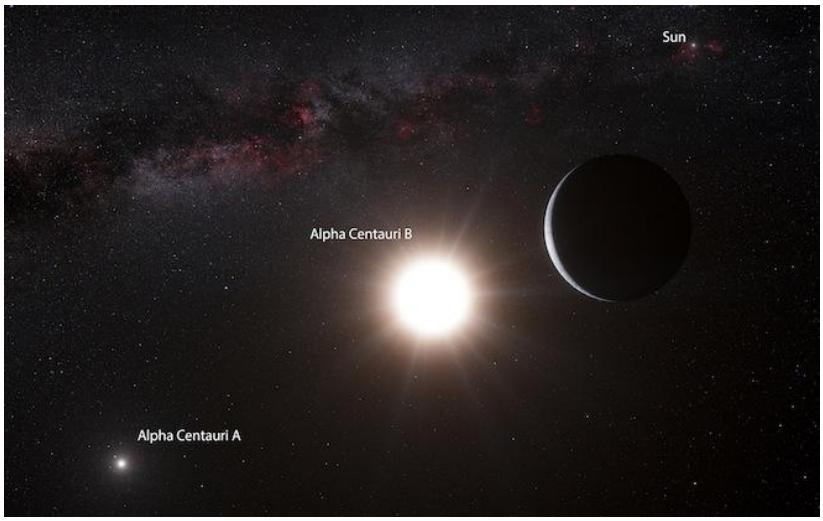
But the prospect of finding more planets – and especially if one turns out to be the Holy Grail, an Earth-like planet in a habitable zone – could lead to humanity's first mission to another planetary system.

Current rocket engines won't cut it, he notes, adding that at the travel speeds current technologies can achieve, it would take 40,000 years to drop in on the solar system's nearest neighbor.

If, however, planet hunters find a potentially habitable planet in the Alpha Centauri system, "you might see a groundswell of excitement to look at new kinds of propulsion technologies" that would allow a robotic mission to reach the planet within a human lifetime.

"It really comes down to what the [planetary] inventory of these stars looks like," he says.

Wired Science
Earth-Sized Planet Discovered Orbiting Around Nearest Star
•By Adam Mann Email Author



Astronomers have discovered an exoplanet roughly the size of Earth orbiting Alpha Centauri B, the star nearest our sun.

The Alpha Centauri system — composed of three stars orbiting one another — is only 4.4 light-years away, a cosmic stone's throw from us. Though the newly discovered planet has about the same mass as our own, its orbit is 25 times smaller, so a year on this planet passes in just 3.2 days. This means the planet is sitting up against its star, roasting at perhaps 2,200 degrees Fahrenheit with a surface likely composed of molten lava.

While the new planet is probably devoid of life, many scientists see the discovery as a hopeful sign. It proves that at least one planet formed in the system, and perhaps other small planets exist there at the right distance to host life.

"Finding in our closest neighbor a one-Earth-mass planet really opens up the prospect for finding planets there in the habitable zone," said astronomer Stephane Udry of the University of Geneva, one of the co-authors of the paper, which will appear in *Nature* on Oct. 17.

Because it is so close, the Alpha Centauri system has been a fertile place in authors' imaginations, serving as the setting for the Transformer's homeworld of Cybertron as well as the blue-skinned Na'vi's homeworld of Pandora in *Avatar*. Though these science-fiction creations are, well, fiction, the system also has long drawn scientists searching for exoplanets. This one evaded detection because it is so small and its effect is so slight.

The team watched the Alpha Centauri system very carefully, looking for a characteristic wobble that indicated a planet was gravitationally tugging on one of the stars. The planet's tiny perturbation caused the star to wobble at roughly one mile per hour. You walk faster than that.

Training their telescope at Alpha Centauri B, the team logged more than 450 days of observation. Their data was so precise, they could see sunspots on the star as well as the effects from giant solar flares. They had to rule out all these other possibilities and look for a repeated pattern indicating the existence of a planet.

"The amount of effort they've devoted to this star is pretty much unprecedented," said astronomer Greg Laughlin of the University of California, Santa Cruz, who was not involved with the work. The team was lucky since Alpha Centauri B is a relatively quiet star and they eventually found a tiny signal in all the noise.

That Alpha Centauri B is so close is exciting to astronomers, said Laughlin. It means they can make follow-up observations to determine further characteristics of the new exoplanet. Though it would take 40,000 years to travel to the Alpha Centauri system using modern-day rockets, future means of propulsion might one day take probes to the distant world.

So what would it look like if we sent a rocket to Alpha Centauri? The triple star system is made up of two sun-like stars, Alpha Centauri A and Alpha Centauri B, as well as the dwarf star Alpha Centauri C. Compared to our sun, Alpha Centauri A is slightly larger and brighter while Alpha Centauri B is just a little smaller and half as bright.

Days on a planet orbiting Alpha Centauri A or B would follow a weird alien cycle. When the surface pointed toward the parent star, it would have daytime much like our own and when it turned away from both stars it would experience an Earth-like nighttime. But when the planet was between the two stars, it would have a third option: a twilight-like evening lit by a bright star. Everything would appear as if outside a floodlit stadium at night.

Image: ESO

USA Today

Nearest star boasts Earth-sized roaster planet

Dan Vergano, USA TODAY

Our nearest star-system neighbor, Alpha Centauri, may have an Earth-sized planet orbiting one of its three stars. If confirmed, the planet orbits too close to the star for life.

THIS ARTIST'S IMPRESSION SHOWS THE PLANET ORBITING THE STAR ALPHA CENTAURI B, A MEMBER OF THE TRIPLE STAR SYSTEM THAT IS THE CLOSEST TO EARTH. (PHOTO: ESO/L. CALÇADA/N. RISINGER (SKYSURVEY.ORG))

Story Highlights

12:07AM EDT OCTOBER 18. 2012 - **OUR NEAREST STELLAR NEIGHBOR POSSESSES AN EARTH-SIZED PLANET, REPORT EUROPEAN ASTRONOMERS. BUT NOBODY LIKELY LIVES ON ITS FURNACE-HOT SURFACE.**

ALPHA CENTAURI, A TRIPLE-STAR SYSTEM, RESIDES SOME 4.3 FOUR LIGHT-YEARS AWAY, ABOUT 25.4 TRILLION MILES. IN A STUDY LED BY XAVIER DUMUSQUE OF SWITZERLAND'S GENEVA OBSERVATORY AND RELEASED TUESDAY BY THE JOURNAL *NATURE*, ASTRONOMERS HAVE ANNOUNCED THE DISCOVERY OF THE FIRST PLANET DETECTED ORBITING ONE OF THE STARS IN THIS SYSTEM.

DUBBED ALPHA CENTAURI BB, THE PLANET ORBITS THE SUN-LIKE STAR ALPHA CENTAURI B, CIRCLING SO CLOSELY -- ONCE EVERY 3.2 DAYS -- THAT ITS SURFACE LIKELY ROASTS AT TEMPERATURES ABOVE 2,200 DEGREES FAHRENHEIT, DUMUSQUE SAYS.

THE OBSERVATION IS BASED ON FOUR YEARS OF TELESCOPE OBSERVATIONS OF WOBBLES IN THE STAR INDUCED BY ITS CLOSE-ORBITING COMPANION. THE CHANCE OF A FALSE-DETECTION OF THE PLANET IN THE DATA IS 1-IN-1,000, THE RESEARCHERS SUGGEST.

ASTRONOMERS ESTIMATE THAT ABOUT 30% OF STARS POSSESS EARTH-LIKE ROCKY PLANETS, BASED ON THE ROUGHLY 800 PLANETS DETECTED ORBITING NEARBY STARS IN THE LAST TWO DECADES. THE NEW PLANET IS THE CLOSEST YET FOUND TO OUR SOLAR SYSTEM, IF CONFIRMED, AND ORBITS A STAR VISIBLE TO THE NAKED EYE.

"THAT IS A REAL WOW FACTOR," SAYS PLANETARY THEORIST ALAN BOSS, AUTHOR OF *THE CROWDED UNIVERSE: THE SEARCH FOR LIVING PLANETS*, WHO WAS NOT ON THE DISCOVERY TEAM. "HUMANS HAVE BEEN STARING AT THIS STELLAR SYSTEM FOR MANY THOUSANDS OF YEARS WITHOUT KNOWING THAT THERE WAS ANOTHER EARTH-MASS PLANET THERE ALL THE TIME."

HOWEVER, ASTRONOMER ARTIE HATZES OF GERMANY'S THURINGIAN STATE OBSERVATORY IS MORE CAUTIOUS ABOUT THE PLANET DETECTION CLAIM IN A COMMENTARY ACCOMPANYING THE STUDY. "IT IS A WEAK SIGNAL IN THE PRESENCE OF A LARGER, MORE COMPLICATED SIGNAL," HATZES SAYS. "IN MY OPINION, THE MATTER IS STILL OPEN TO DEBATE."

DUMUSQUE SAYS THAT MORE LOOKS AT THE STAR SHOULD STRENGTHEN THE FINDING AND NOTES THAT THERE IS A POSSIBILITY THAT THE PLANET MAY SLIGHTLY ECLIPSE, OR TRANSIT, IN FRONT OF THE STAR, ANOTHER TELL-TALE SIGN OF ITS EXISTENCE MEASURABLE BY ASTRONOMERS. HE ADDS THAT MORE PLANETS MAY AWAIT DISCOVERY AT ALPHA CENTAURI, INCLUDING ONES AT HABITABLE DISTANCES FROM THE STARS THERE.