XO-3b: Supersized planet or oasis in the 'brown dwarf desert'?

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Amateur, professional astronomers find one of the oddest planets on record

The latest find from an international planet-hunting team of amateur and professional astronomers is one of the oddest extrasolar planets ever cataloged -- a mammoth orb more than 13 times the mass of Jupiter that orbits its star in less than four days.

Researchers from the U.S.-based XO Project unveiled the planet, XO-3b, at today's American Astronomical Society meeting in Honolulu. Christopher Johns-Krull, a Rice University astronomer and presenter of the team's results, said, "This planet is really quite bizarre. It is also particularly appropriate to be announcing this find here, since the core of the XO project is two small telescopes operating here in Hawaii."

"Of the 200-plus exoplanets found so far, XO-3b is an oddity in several respects," said XO Project director Peter McCullough, an astronomer at the Space Telescope Science Institute in Baltimore. "It's the largest and most massive planet yet found in such a close orbit, and given the proximity of the orbit to the star, we were surprised to find that the orbit is not circular but significantly elliptical."

Given all its eccentricities, XO-3b is likely to pique the interest of astronomers who study planet formation, McCullough said.

"We are intrigued that its mass is on the boundary between planets and 'brown dwarfs,'" Johns-Krull said, "There's still a lively debate among

astronomers about how to classify brown dwarfs." Any stellar mass that's large enough to fuse hydrogen -- anything more than about 80 Jupiter masses -- is a star. Brown dwarfs are massive objects that fall short of being stars.

"The controversy lies at the lower end of the scale," said Johns-Krull, an assistant professor of physics and astronomy at Rice. "Some people believe anything capable of fusing deuterium, which in theory happens around 13 Jupiter masses, is a brown dwarf. Others say it's not the mass that matters, but whether the body forms on its own or as part of a planetary system."

By virtue of their mass, any planet big enough to contend for brown dwarf status should be easy for most planet hunters to spot. That's because astronomers don't actually look for planets when they scan the sky; they generally look for stars that wobble due to the gravitational pull of planets orbiting around them. The larger the planet, the more wobble it creates, so planet hunters using this "radial velocity" method expected to find a lot of brown dwarfs when they started scanning the sky for wobbling stars a decade ago. That hasn't happened, and the dearth of supersized objects has become known in the field as the "brown dwarf desert."

What also makes XO-3b intriguing is the fact that it's a "transiting planet," meaning it passes in front of its star during each orbit. Fewer than two dozen transiting planets have been identified, and XO-3b is the third found by the XO Project, which was designed specifically to look for them.

The XO Project benefits from its partnership between professional and amateur astronomers. The XO Project begins its search with a telescope located on Haleakala summit operated by the Institute for Astronomy of the University of Hawaii. The telescope is created from two

commercially available 200-millimeter telephoto camera lenses. Using the Haleakala telescope, XO's professional team first identifies candidate stars that dim ever so slightly from time to time. XO's amateur astronomers observe these candidates over time and look for further evidence that the dimming is due to a transiting planet. Once enough evidence is in place, the professional team uses large telescopes -- the 2.7-meter Harlan J. Smith Telescope and the 11-meter Hobby-Ebberly Telescope, both at the University of Texas McDonald Observatory in West Texas -- to confirm the presence of a transiting planet.

"There are many astrophysical systems out there that mimic transiting planets," McCullough said. "The only way to sort out the real planets from the rest is to observe the stars more carefully. Observation time on big telescopes is scarce, and that's where our amateur partners come in, culling our long lists of candidates down to more manageable size to observe with the big telescopes. The XO Project benefits enormously from the clear skies of Haleakala and the availability of telescopes such as the Hobby-Ebberly, Spitzer, and Hubble and their capable staffs that operate them. The global reach and dedication of our amateur collaborators is especially noteworthy.

"I like to point out that Olympic athletes are amateurs too," McCullough said.

Source: Rice University