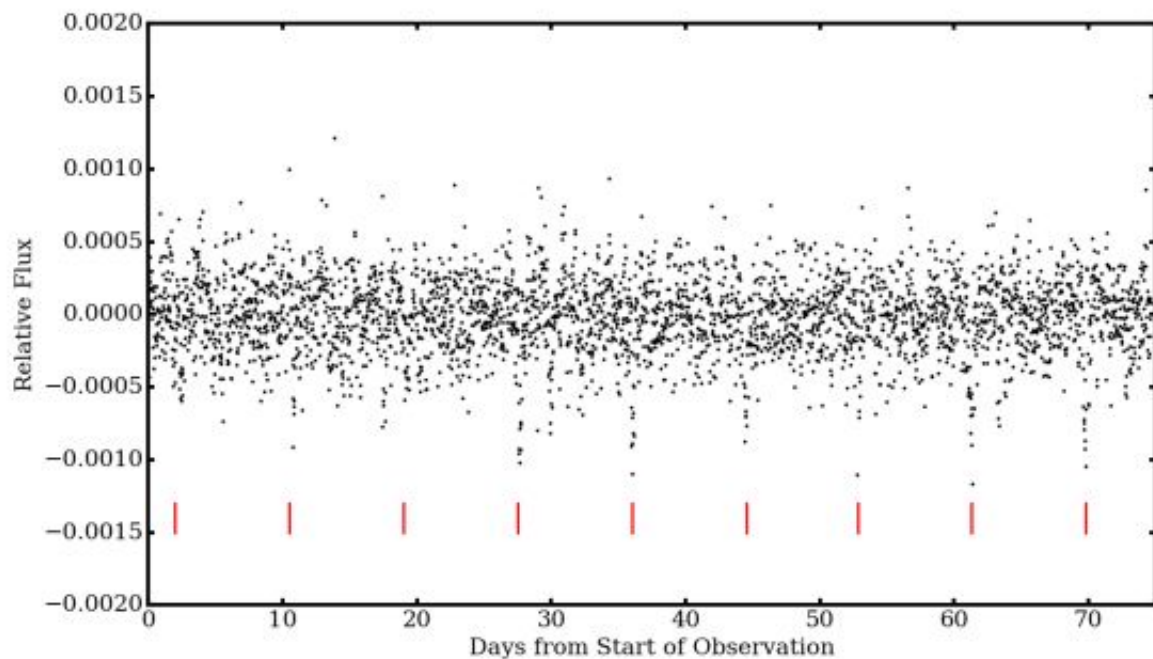


Astronomers discover a giant inflated exoplanet orbiting a distant star

June 22 2016, by Tomasz Nowakowski



Detrended K2 lightcurve of EPIC 211351816. Credit: arXiv:1606.05818 [astro-ph.EP]

(Phys.org)—An international team of astronomers has discovered a giant extrasolar planet that appears to be larger than it should be. According to a new research paper published on June 19 on *arXiv.org*, the newly detected alien world, designated EPIC 211351816.01, is an inflated planet, orbiting a distant red giant star. Moreover, the researchers suggest, that this exoplanet could be the first example of a new class of

"re-inflated" planets.

Some [giant planets](#) expand in size when their parent stars are at the end of their lives. These so-called inflated planets have been known to astronomers for almost two decades, but it is still unclear what causes the inflation processes. In general, the possible explanations could be assigned to two different theories—scientists believe that the inflation is caused by deposition of energy from the host star, or due to inhibited cooling of the planet.

Re-inflated planets are born large, but they shrink due to gravity like other gas giants. However, they balloon in size when their stars turn into red giants and grow hotter. Therefore, they appear to observers as giant planets, bigger than they should be, and also farther from their star than usual Jupiter-sized exoplanets. Finding a re-inflated planet could reveal the real cause of inflation mechanisms. It could be essential to improving our knowledge about the evolution of giant planets.

According to a team of astronomers led by Samuel Grunblatt of the University of Hawaii, EPIC 211351816.01 could be the first known re-inflated planet. The scientists found this alien world by analyzing the data from NASA's K2 extension of the Kepler mission and spectroscopic observations together with radial velocity measurements provided by various telescopes at the Manua Kea Observatory in Hawaii. This set of data combined with asteroseismology, spectroscopy, and granulation noise modeling allowed the researchers to constrain stellar and planetary parameters of the system.

The study reveals that EPIC 211351816.01 has a radius of 1.27 times that of Jupiter and is about 10 percent more massive. It orbits an eight-billion-year-old red giant star with a radius of 4.2 solar radii and with a mass of approximately 1.16 solar masses, every 8.4 days.

The team's calculations suggest the incident flux on EPIC 211351816.01 was about 200 times the flux on Earth during the star's main sequence, comparable to the suggested threshold flux for planet inflation.

Observing the planet inflated today indicates that planet inflation is due to stellar irradiation rather than an effect of delayed planet cooling after formation.

"We determine that, assuming a stable planetary orbit for the range of acceptable stellar parameters, EPIC 211351816.01 requires approximately 0.2 percent of the current incident stellar flux to be deposited into the planet's deep convective interior to explain its radius. The planet radius is inconsistent with a scenario where no heating is currently occurring. Thus, EPIC 211351816.01 is likely the first known re-inflated planet," the researchers wrote in the paper.

The scientists concluded that further studies of planets around evolved stars would be necessary to confirm the planet re-inflation hypothesis. They noted that future observations should focus on possible inflated [planets](#) around giant stars, with an orbital period of about 20 days. According to them, these exoworlds must be outside the inflated planet regime around a main sequence star, and thus could provide better evidence for the re-inflation hypothesis.

More information: EPIC 211351816.01: A (Re-?)Inflated Planet Orbiting a Red Giant Star, arXiv:1606.05818 [astro-ph.EP]
arxiv.org/abs/1606.05818

Abstract

Giant planets with high incident fluxes have been observed with radii larger than thermal evolution models would allow. Although these inflated planets have been known for almost two decades, it is unclear whether their inflation is caused by deposition of energy from the host star, or inhibited cooling of the planet. These processes can be

distinguished if the planet becomes highly irradiated only when the host star evolves onto the red giant branch. We report the discovery of EPIC 211351816.01, a 1.27 ± 0.09 RJ, 1.10 ± 0.11 MJ planet orbiting a 4.20 ± 0.14 R_{sun} , 1.16 ± 0.12 M_{sun} red giant star with an orbital period of 8.4 days. We precisely constrained stellar and planetary parameters by combining asteroseismology, spectroscopy, and granulation noise modeling along with transit and radial velocity measurements. Our calculations suggest the incident flux on this planet was $\sim 200 \pm 100$ times the flux on Earth while the star was on the main sequence, comparable to the suggested threshold flux for planet inflation. This suggests the planet was significantly less inflated in the past, and its current measured planet radius is inconsistent with delayed cooling since formation. Thus, this system provides the first clear evidence that planets are inflated directly from a process dependent on the incident stellar radiation rather than by delayed loss of heat from formation. Further studies of planets around red giant branch stars will confirm or contradict this inflation hypothesis, and may reveal a new class of re-inflated planets.

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Citation: Astronomers discover a giant inflated exoplanet orbiting a distant star (2016, June 22) retrieved 19 April 2024 from

<https://phys.org/news/2016-06-astronomers-giant-inflated-exoplanet-orbiting.html>

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