

Astrobiology News July 2016: *Nightfall* Revisited

Seventy-five years ago, the 20th century writer and biochemist, Isaac Asimov, wrote a short story, *Nightfall*¹, about a fictional planet in a stellar system containing six suns. The inhabitants of this planet experience darkness roughly every 2,000 years. We learn that this stellar system is located in a globular cluster², so when night eventually falls, millions of stars are visible in the sky. In the story, the realization of just how vast the Universe is drives the inhabitants insane and brings about the recurring collapse of their civilization. Although hardly an uplifting message, this story is prophetic in envisioning the possible physical reality of such a bizarre world more than 50 years before the first exoplanet was discovered. A growing number of known exoplanets reside in systems with multiple stars, and just this month, UA News³ reported a graduate student's discovery⁴ of a world reminiscent of the planet depicted in *Nightfall*, at least in some respects.

HD 131399Ab is the first exoplanet discovered by SPHERE⁵, an instrument that uses an adaptive optics system, which removes the "twinkling" of starlight caused by Earth's atmosphere, and a coronagraph, which blocks the light from a star to reveal fainter orbiting planets. Because the contrast between the brightness of a star and its planet(s) is lower in infrared light, SPHERE operates in both the visible and near-infrared parts of the spectrum. It is sensitive to identifying young worlds that retain heat from their formation. At an estimated mere 16 million years old, HD 131399Ab is one of the youngest exoplanets discovered to date. Roughly four times as massive as Jupiter and at a temperature of slightly over 1,000 degrees Fahrenheit, it isn't likely to harbor life as we know it. Nevertheless, it is one of the "coldest" and smallest exoplanets that have been thus far imaged directly⁶.

HD 131399Ab may not be life-friendly, but its peculiar orbit makes it of great interest for studying how planets form and evolve in extreme scenarios. It takes HD 131399Ab roughly 550 Earth-years to orbit the brightest star in a trinary⁷ star system that is located about 340 light-years from Earth in the direction of the southern constellation, Centaurus. Because of its strange orbit, this exoplanet experiences near-constant daylight for roughly 140 Earth-years, and triple sunrises and sunsets for the remainder of its "year".

Further observations are necessary to investigate HD 131399Ab's unusual orbit, but computer simulations show that this type of orbit can be stable. One thing is clear – planetary systems are far more diverse than many would have thought possible! To re-quote several famous scientists, including J.B.S. Haldane, Arthur Eddington, and Werner Heisenberg, "Not only is the Universe stranger than we imagine, it is stranger than we can imagine." Undoubtedly this is true, but time and again, the creative individuals who write science fiction have demonstrated that human imagination knows few limits...

Until next month,

Grace

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¹ In *Astounding Science-Fiction* - 1941, Street & Smith Publications, Inc., ed. John W. Campbell, Jr.

² A densely packed spherical collection of ancient stars in orbit about a galaxy

³ <https://uanews.arizona.edu/story/newly-discovered-planet-has-three-suns?>

⁴ Wagner, K., *et al.*, *Science* 10.1126/science.aaf9671 (2016).

⁵ <https://www.eso.org/sci/facilities/paranal/instruments/sphere.html>

⁶ For a listing of ongoing and future programs using diverse methods to search for exoplanets see <http://exoplanet.eu/research/>

⁷ Three stars that orbit each other