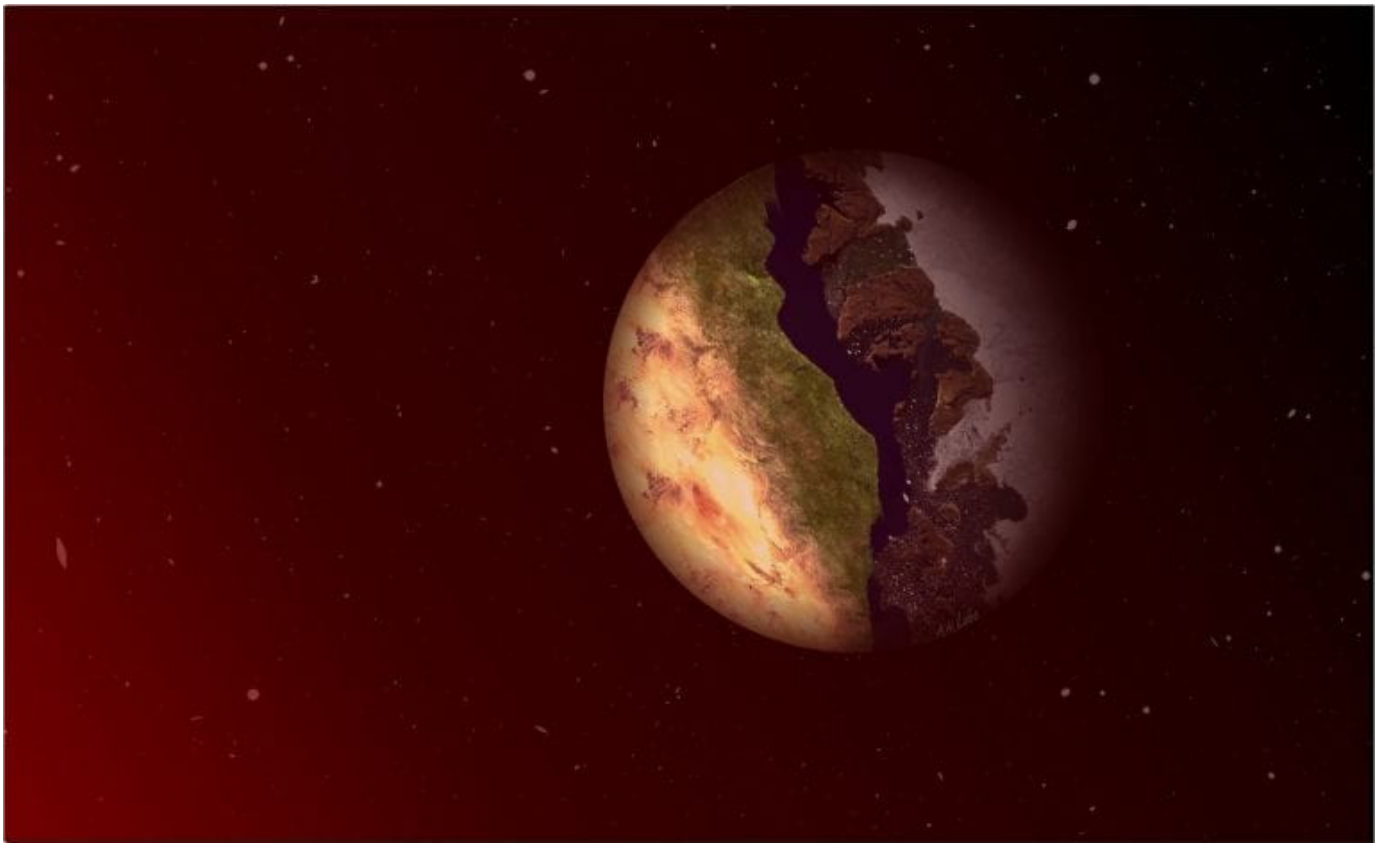
‘Terminator zones’ on distant planets could harbor life, UC Irvine astronomers say

These in-between regions could be prime sites for liquid water
Thursday, March 16, 2023
Lucas Van Wyk Joel
UCI News



Some exoplanets have one side permanently facing their star while the other side is in perpetual darkness. The ring-shaped border between these permanent day and night regions is called a “terminator zone.” In a new paper in The Astrophysical Journal, physics and astronomy researchers at UC Irvine say this area has the potential to support extraterrestrial life.

Picture Credit:
Ana Lobo / UCI

Irvine, Calif., March 16, 2023 — In a new study, University of California, Irvine astronomers describe how extraterrestrial life has the potential to exist on distant exoplanets inside a special area called the “terminator zone,” which is a ring on planets that have one side that always faces its star and one side that is always dark.

“These planets have a permanent day side and a permanent night side,” said Ana Lobo, a postdoctoral researcher in the UCI Department of Physics & Astronomy who led the new work, which just published in *The Astrophysical Journal*. Lobo added that such planets are particularly common because they exist around stars that make up about 70 percent of the stars seen in the night sky – so-called M-dwarf stars, which are relatively dimmer than our sun.

The terminator is the dividing line between the day and night sides of the planet. Terminator zones could exist in that “just right” temperature zone between too hot and too cold.

“You want a planet that’s in the sweet spot of just the right temperature for having liquid water,” said Lobo, because liquid water, as far as scientists know, is an essential ingredient for life.

On the dark sides of terminator planets, perpetual night would yield plummeting temperatures that could cause any water to be frozen in ice. The side of the planet always facing its star could be too hot for water to remain in the open for long.

“This is a planet where the dayside can be scorching hot, well beyond habitability, and the night side is going to be freezing, potentially covered in ice. You could have large glaciers on the night side,” Lobo said.

Lobo, alongside Aomawa Shields, UCI associate professor of physics & astronomy, modeled the climate of terminator planets using software typically used to model our own planet’s climate, but with a few adjustments, including slowing down planetary rotation.

It’s believed to be the first time astronomers have been able to show that such planets can sustain habitable climates confined to this terminator region. Historically, researchers have mostly studied ocean-covered exoplanets in their search for candidates for habitability. But now that Lobo and her team have shown

that terminator planets are also viable refuges for life, it increases the options life-hunting astronomers have to choose from.

“We are trying to draw attention to more water-limited planets, which despite not having widespread oceans, could have lakes or other smaller bodies of liquid water, and these climates could actually be very promising,” Lobo said.

One key to the finding, Lobo added, was pinpointing exactly what kind of terminator zone planet can retain liquid water. If the planet is mostly covered in water, then the water facing the star, the team found, would likely evaporate and cover the entire planet in a thick layer of vapor.

But if there’s land, this effect shouldn’t occur.

“Ana has shown if there’s a lot of land on the planet, the scenario we call ‘terminator habitability’ can exist a lot more easily,” said Shields. “These new and exotic habitability states our team is uncovering are no longer the stuff of science fiction – Ana has done the work to show that such states can be climatically stable.”

Recognizing terminator zones as potential harbors for life also means that astronomers will need to adjust the way they study exoplanet climates for signs of life, because the biosignatures life creates may only be present in specific parts of the planet’s atmosphere.

The work will also help inform future efforts by teams using telescopes like the James Webb Space Telescope or the Large Ultraviolet Optical Infrared Surveyor telescope currently in development at NASA as they search for planets that may host extraterrestrial life.

“By exploring these exotic climate states, we increase our chances of finding and properly identifying a habitable planet in the near future,” said Lobo.

About UCI’s Brilliant Future campaign: Publicly launched on Oct. 4, 2019, the Brilliant Future campaign aims to raise awareness and support for UCI. By engaging 75,000 alumni and garnering $2 billion in philanthropic investment, UCI seeks to reach new heights of excellence in student success, health and wellness, research and more. The School of Physical Sciences plays a vital role in the success of the campaign. Learn more by visiting https://brilliantfuture.uci.edu/uci-school-of-physical-sciences/.

About the University of California, Irvine: Founded in 1965, UCI is a member of the prestigious Association of American Universities and is ranked among the nation's top 10 public universities by *U.S. News & World Report*. The campus has produced five Nobel laureates and is known for its academic achievement, premier research, innovation and anteater mascot. Led by Chancellor Howard Gillman, UCI has more than 36,000 students and offers 224 degree programs. It's located in one of the world's safest and most economically vibrant communities and is Orange County's second-largest employer, contributing $7 billion annually to the local economy and $8 billion statewide. For more on UCI, visit www.uci.edu.

Media access: Radio programs/stations may, for a fee, use an on-campus ISDN line to interview UCI faculty and experts, subject to availability and university approval. For more UCI news, visit news.uci.edu. Additional resources for journalists may be found at communications.uci.edu/for-journalists.

Original Source
Press Releases
In the Media
Physics & Astronomy
The Future of Fundamental Science
View PDF