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# Nearest Star System May Have a Second Planet



An artist's impression of Proxima b in orbit around the flaring red dwarf star Proxima Centauri, with two other stars in the background. Scientists suspect that there is also a larger, colder planet in this solar system. Credit: Ricardo Ramirez and James Jenkins, Department of Astronomy, Universidad de Chile

In 2016, astronomers announced the discovery of a rocky, habitable, Earth-sized planet orbiting Proxima Centauri, the closest star beyond our solar system. A recent analysis now suggests that Proxima might also host a larger, colder planet.

"We call it Proxima c," Mario Damasso, an astrophysicist at the Astrophysical Observatory in Torino, Italy, said about the potential discovery at a forum in April. "But it's only a candidate. That's very important to underline."

If confirmed, this planet would make Proxima Centauri our nearest multiplanet system and challenge our understanding of how rocky planets larger than Earth form. Damasso discussed Proxima c on 19 August at the Extreme Solar Systems IV conference in Reykjavík, Iceland. This discovery is currently under peer review in *Science Advances*.

## Bigger, Colder, Farther Away

Astronomers found the 2016 planet, Proxima b, using radial velocity (RV) measurements

of the host star, which showed a characteristic wobble from the planet's gravitational influence. Damasso and his team sought to validate Proxima b's existence by analyzing the same data using a different method. They took particular care when accounting for Proxima's stellar flares and spots.

"Stellar activity can hamper the radial velocity [analysis] because there can easily be present some signal from the stellar activity in the data," Damasso said.

After accounting for Proxima's stellar activity and Proxima b's radial velocity signal, the team noticed a periodic signal left over in the data. That signal suggested that a second planet was tugging on Proxima. To make the signal, a planet would need to be at least 6 times Earth's mass and orbit at about the same distance as Mars is from the Sun.

"This detection is quite challenging, particularly because it's made with only one technique," Damasso said. "And the orbital period is very long, so it takes a long time to collect more data."

"Is this planet habitable? Well, not really. It's quite cold," said team member Fabio Del Sordo, an astrophysicist at the University of Crete in Greece. "We estimated a surface equilibrium temperature of only 40 kelvins," which is  $-233^{\circ}\text{C}$ . "So, clearly not habitable."

## A Long Road to Confirmation

At the April forum, University of Hawai'i astronomer Lauren Weiss voiced concerns that a second Proxima planet might not be where or what the team thinks it is.

"In any system, you don't know what planets there are [that] you haven't found yet until you find them," Weiss said. "They are an unknown unknown, which makes it very challenging to accurately model and fit radial velocities."

She explained that the signal attributed to Proxima c could very well be a combination of other, weaker signals. "That maybe means that there are additional planets but not at the period at which [they're] announcing the candidate," she said.

Weiss recently told *Eos*, "I have seen no additional data supporting or falsifying the proposed orbit and minimum mass of the planet candidate Proxima Cen c" since the initial announcement in April.

With its currently calculated orbit, Proxima c would challenge our understanding of how planets that size form, Del Sordo said.

"Since low-mass stars are expected to host multiplanet low-mass systems, Proxima could certainly host other terrestrial planets we could not detect," Damasso told *Eos* about his presentation in Iceland. "Analyzing the available RV data with methods different from that



Proxima Centauri is only slightly larger than Jupiter and is much smaller, cooler, and dimmer than the other two stars in that system (Alpha Centauri A and B). Credit: European Southern Observatory, CC BY 4.0 ([bit.ly/ccby4-0](http://bit.ly/ccby4-0))

we used could reveal additional signals worthy of attention.”

“Models tell us that super-Earths tend to form around the snow line, but Proxima c at the moment is quite distant from the snow line,” he said. “It’s possible that this planet migrated from somewhere else in the system.”

“We plan to go on with radial velocity follow-up” as well as direct imaging with ground-based instruments, Damasso said. “This is a necessary step to do since the orbital period of the candidate is [about] 5 years long.”

And with future astrometry data from the European Space Agency’s Gaia mission, “we should be able to measure the mass with 5% accuracy, which is great news for us,” Del Sordo said. “This will take place in a couple of years with the end-of-mission data.”

When it comes to confirming Proxima c’s existence, “it’s going to be a long road,” Weiss said.

## Murders of Environmentalists Have Doubled in 15 Years

**E**nvironmental activists and defenders are killed at twice the rate that they were 15 years ago, according to a new study. Researchers found that more environmental defenders were murdered in countries with a weaker rule of law and where more land area was harvested.

“Environmental defenders help protect land, forests, water and other natural resources,” Nathalie Butt, lead author of the study, said in a statement. “They can be anyone—community activists, lawyers, journalists, members of social movements, [nongovernmental organization] staff, and indigenous people—anyone who resists violence.”

“As consumers in wealthy countries—who are effectively outsourcing our resource consumption—we share responsibility for what’s happening,” said Butt, who studies the ecological impacts of climate change at the University of Queensland in St. Lucia, Australia. “Businesses, investors, and national governments at both ends of the chain of violence need to be more accountable.”

### Environmentalists Dying Around the World

The study, which was published in *Nature Sustainability* on 5 August, analyzes reports of environmentalists’ deaths around the world

from the international environmental organization Global Witness ([bit.ly/chain-of-violence](http://bit.ly/chain-of-violence)).

The researchers found that 1,558 people in 50 countries around the world were killed defending the environment between 2002 and 2017. “This is more than double the number of United Kingdom and Australian armed service people killed on active duty in war zones over the same period...and almost half as many as the number of U.S. soldiers killed in Iraq and Afghanistan since 2001,” the study says.

During those 15 years, the rate at which environmental activists were murdered increased from two murders per week to four per week. The death toll in Brazil, the Philippines, Colombia, and Honduras represented about 71% of all environmentalists killed during that time period.

One particularly concerning finding is that about 40% of the murders in 2015 and 2016, and about 30% of the killings in 2017, were of indigenous persons. More indigenous people were killed defending their land and environment than were people of any other group.

“This is a phenomenon seen around the world: land and environmental defenders are declared terrorists, locked up or hit with paralyzing legal attacks, for defending their rights, or simply for living on lands that are coveted



Mundurucu people hold signs with slogans like “Dam Kills!” during a protest of the Belo Monte hydroelectric dam in Brasilia, Brazil, in 2013. Mundurucu and other indigenous Brazilian people argue that the dam will disrupt their way of living through deforestation and flooding and protested attacks against and murders of natives. Credit: EVARISTO SA/ AFP/Getty Images