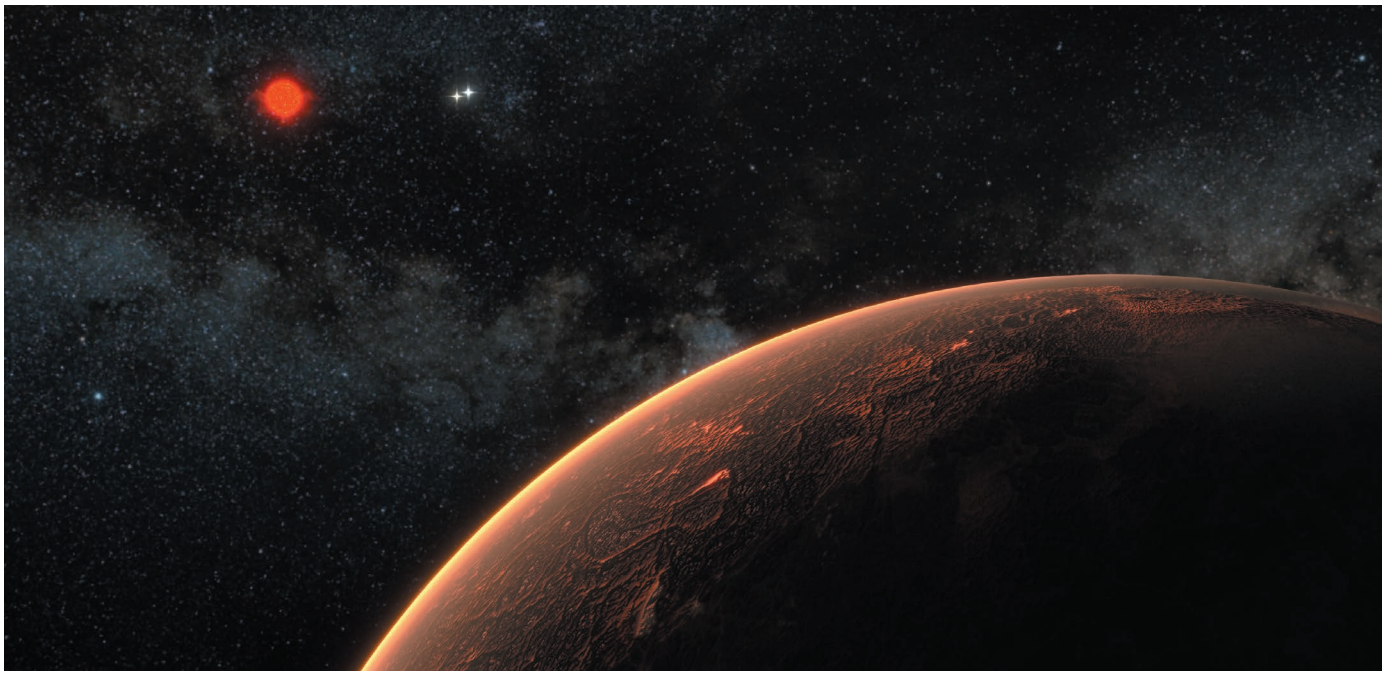
NEWS IN FOCUS



RICARDO RAMIREZ

The newly discovered planet orbits Proxima Centauri every 11.2 days.

ASTRONOMY

Nearby star hosts planet

Earth-sized world orbiting Proxima Centauri could harbour water — and life.

BY ALEXANDRA WITZE

Proxima Centauri, the star closest to the Sun, has an Earth-sized planet orbiting it at the right distance for liquid water to exist. The discovery, reported this week in *Nature*[1], fulfils a longstanding dream of science-fiction writers — a potentially habitable world that is close enough for humans to send their first interstellar spacecraft to.

"The search for life starts now," says Guillem Anglada-Escudé, an astronomer at Queen Mary University of London and leader of the team that made the discovery.

Humanity's first chance to explore this nearby world may come from the recently announced Breakthrough Starshot initiative, which plans to build fleets of tiny laser-propelled interstellar probes in the coming decades. Travelling at 20% of the speed of light, they would take about 20 years to cover the 1.3 parsecs from Earth to Proxima Centauri.

Proxima's planet is at least 1.3 times the mass of Earth. The planet orbits its red-dwarf star — much smaller and dimmer than the Sun — every 11.2 days. "If you tried to pick the type of planet you'd most want around the type of star you'd most want, it would be this," says David Kipping, an astronomer at Columbia University in New York City. "It's thrilling."

GRAVITATIONAL HINTS

Earlier studies had hinted at the existence of a planet around Proxima. Starting in 2000, a spectrograph at the European Southern Observatory (ESO) in Chile looked for shifts in starlight caused by the gravitational tug of an orbiting planet. The measurements suggested that something was happening to the star every 11.2 days. But astronomers could not rule out whether the signal was caused by an orbiting planet or another type of activity, such as stellar flares.

In January 2016, Anglada-Escudé and his colleagues launched a campaign to nail down the suspected Proxima planet. ESO granted their request to observe using a second planet-hunting instrument, on a different telescope, for 20 minutes almost every night between 19 January and 31 March. "As soon as we had 10 nights it was obvious," Anglada-Escudé says.

The team dubbed the work the 'pale red dot' campaign, after the famous 'pale blue dot' photograph taken of Earth by the Voyager 1 spacecraft in 1990. Because Proxima is a red-dwarf star, the planet would appear reddish or orangeish, perhaps bathed in light similar to the warm evening tints of Earth.

Although the planet orbits at a distance that would permit liquid water, other factors ▶

might render it unlivable. It might be tidally locked — meaning that the same hemisphere always faces the star, which scorches one side of the planet while the other remains cool. The active star might occasionally zap the planet with destructive X-ray flares. And it's unclear whether the planet has a protective, life-friendly atmosphere.

Proxima belongs to the triple-star system Alpha Centauri. In 2012, a *Nature* paper reported that an Earth-mass planet orbited another member of that stellar trio, Alpha Centauri B[2]. That result has now mostly been dismissed[3,4], but exoplanet specialists say that the Proxima claim is more likely to hold up. "People call me Mr Sceptical, and I think this result is more robust," says Artie Hatzes, an astronomer at the Thuringian State Observatory in Tautenburg, Germany.

This time, the combination of new observations and older measurements dating back to 2000 increases confidence in the finding, Anglada-Escudé's team argues. "It's stayed there robustly in phase and amplitude over a very long time," says team member Michael Endl, an astronomer at the University of Texas at Austin. "That's a telltale sign of a planet." The data also contain hints that a second planet might exist, orbiting Proxima somewhere between every 100 and 400 days.

The researchers now hope to learn whether the Proxima planet's pass across the face of its star can be seen from Earth. Such a 'transit' could reveal whether the planet has an atmosphere. A team led by Kipping has been independently looking for transits around Proxima, and is frantically crunching its data in search of a signal.

The discovery of the Proxima planet comes at a time of growing scientific interest in small planets around dwarf stars, says Steinn Sigurdsson, an astrophysicist at Pennsylvania State University in University Park. NASA's Kepler space telescope has shown that rocky planets are common around such stars, which themselves are the most common type of star in the Galaxy. "This is a total vindication of that strategy," he says.

One day, the Proxima planet might be seen as the start of a new stage in planetary research. "It gives us the target and focus to build the next generation of telescopes and one day maybe even get to visit," says Kipping. "It's exactly what we need to take exoplanetary science to the next level." ■ SEE NEWS & VIEWS P.408

1. Anglada-Escudé, G. *et al. Nature* http://dx.doi.org/10.1038/nature19106 (2016).
2. Dumusque, X. *et al. Nature* **491,** 207–211 (2012).
3. Hatzes, A. P. *Astrophys. J.* **770,** 133 (2013).
4. Rajpaul, V., Aigrain, S. & Roberts, S. *Mon. Not. R. Astron. Soc.* **456,** L6–L10 (2016).

INTELLECTUAL PROPERTY

Personalized medicine takes hit

US Supreme Court decisions seem to drive patent rejections.

BY HEIDI LEDFORD

Rejections of US patents in categories related to personalized medicine have spiked after Supreme Court decisions tightened the rules for such claims, an analysis of more than 39,000 patent applications reveals.

The data, presented on 11 August at the Intellectual Property Scholars Conference in Stanford, California, address patent applications in eight categories that commonly include personalized-medicine patents. They show that following a key Supreme Court decision in 2012, the US Patent and Trademark Office (USPTO) was nearly four times more likely to deem subjects of such applications unpatentable — and applicants were less than half as likely to overcome those rejections.

> ***"Personalized medicine is probably the poster child of what we think should be incentivized by patents."***

"The change in office actions was absolutely striking," says Nicholson Price, who studies intellectual property at the University of Michigan Law School in Ann Arbor. "The data are very clear that the patent office has changed its behaviour."

Over the past decade, the Supreme Court has used a series of patent cases to clarify what the USPTO should consider patentable. Natural phenomena and abstract ideas, for example, are not patentable, according to section 101 of the US patent code. The court has attempted to distinguish between these categories and true inventions.

Two of those Supreme Court cases touched directly on the biomedical industry. In 2012, the *Mayo Collaborative Services* v. *Prometheus Laboratories, Inc.* decision struck down two patents on medical diagnostics, and in the 2013 *Association for Molecular Pathology* v. *Myriad Genetics* ruling, the court threw out patents on gene sequences used to assess cancer risk. In the wake of those decisions, many lawyers predicted that patents on inventions that are important to personalized medicine — particularly, diagnostic tests that could match individuals to a particular therapy — would be hard to come by, potentially driving away investors.

Legal scholar Bernard Chao of the University of Denver in Colorado decided to find out just how big the impact has been. Chao sifted through around 85,000 records of USPTO actions taken on more than 39,000 patent applications, and sorted out those that had been rejected for not meeting the requirements of section 101.

He found that, last year, 22.5% of those patent-office actions were rejections because of section 101, compared with only 5.5% in 2011, the year before the *Mayo* decision. Applicants were also less likely to overcome those rejections in the wake of the *Mayo* decision: before *Mayo*, 70.7% of the section 101 rejections were successfully overcome. After *Mayo*, that proportion dropped to 29.7%.

But Chao notes that there are caveats to his analysis: the categories he examined omit some personalized-medicine patents and contain other kinds of patents as well. In the future, he hopes to take a closer look at individual patent applications, and to learn more about whether certain applications are more likely to get through than others.

Those analyses will be key to finding out how patent applicants are adapting to the new requirements, says Price. "Patent attorneys are clever," he says, and may have learnt how to construct their patents to avoid conflict with the recent decisions.

Others have documented a clear effect of the Supreme Court's patent decisions on software patent applications. But some have cheered that change, Chao adds. Software patents are controversial, and some scholars have argued that such patents cause more harm to the industry than help it. Personalized-medicine patents, however, tend to get more support: "Personalized medicine is probably the poster child of what we think should be incentivized by patents."

Ultimately, it will be difficult to unravel what impact the patent decline is having on the personalized-medicine industry, cautions Arti Rai, a legal scholar at Duke University in Durham, North Carolina. The sector is facing challenges from several sides: the US Food and Drug Administration has proposed tougher regulations, and insurance companies have been reluctant to pay for new diagnostic tests.

"Diagnostics start-ups are not in a good space right now, that's clear," Rai says. "But how much of that is due to *Mayo* is less clear." ■