New Scientist

WEEKLY April 2 - 8, 2022

WHAT IS A PLANET?

WHEN TRAUMATIC DOESN'T EQUAL TRAUMA

TRACKING ANIMALS FROM SPACE

HOW TO GREEN YOUR HOME

GENE-THERAPY GEL

Is CONSCIOUSNESS FUNDAMENTAL *to the* COSMOS?

Rethinking the relationship between mind and matter

PLUS VAMPIRE APPLIANCES /
A COW'S-EYE VIEW OF THE WORLD /
WHEN SNAKES LOST THEIR LEGS /
BANANA-PEELING ROBOT

Science and technology news **www.newscientist.com**

No3380 US$6.99 CAN$9.99

13

0 72440 30690 5

Astronomy

The struggle to define a planet sees some alien worlds kicked off the list

Alex Wilkins

WHAT is a planet? Astronomers still haven't found a definition that everyone can agree on – and the problem only gets harder when considering worlds outside our solar system, as the latest controversial attempt to define an exoplanet shows.

The International Astronomical Union (IAU), arbiter of all things cosmic, set out a final definition for planets in our solar system in 2006, famously demoting Pluto to a dwarf planet in the process. Its first requirement is that a planet is in orbit around the sun, which rules out all exoplanets.

An IAU definition of exoplanets set out in 2003 included any object below 13 times the mass of Jupiter, a cut-off chosen because objects of this mass with the same chemical composition as the sun start undergoing star-like fusion of deuterium, a form of hydrogen. At the other end of the scale, it excluded anything below the minimum size of a planet in our solar system, although this, in turn, wasn't actually well-defined.

"Since that time, we have discovered many exoplanets and many different systems," says the IAU's Alain Lecavelier des Etangs – NASA puts the latest count at 5000. "The knowledge we have about these exoplanets is totally different from the knowledge we had in 2003."

To better conform to the new discoveries, the IAU's working group on exoplanets, a body of more than 400 astronomers, voted in 2018 for a definition that adds a new requirement: an exoplanet's mass must be less than 1/25th of the mass of the object it orbits.

This ratio is important because it implies something about how an object formed, says Beth Biller at the University of Edinburgh, UK. "If the mass ratio is fairly large, this is something that has formed in a disc around its star, like a planet, as opposed to something that forms more like a binary star," she says.

The new definition also decreed that an exoplanet must be "clearing the neighbourhood" in its orbit, meaning that it has gravitationally removed other objects of similar size. This brings exoplanets in line with the definition of a planet within our solar system. Although the exoplanet rules were voted on in 2018, details have only now come to light with a newly published explanation of the decision that has caught the attention of the wider astronomical community.

"Several objects that are listed by NASA are no longer technically exoplanets"

Mikko Tuomi at the University of Herefordshire, UK, called the new definition "horrible" in a tweet, saying it would be impossible for astronomers to detect whether an exoplanet has cleared its neighbourhood, while the mass-ratio requirement means free-floating "rogue planets" are technically not planets because they don't orbit another body.

The mass ratio also kicks some existing exoplanets out of the club. "Several objects that are listed in the NASA Exoplanet Archive are no longer technically exoplanets," says David Kipping at Columbia University in New York, such as MOA-2010-BLG-073L b, which is 11 times the mass of Jupiter. "This is because they orbit very low mass stars, and so dividing that by 25 ends up cutting out [such] super-Jupiters."

Astronomers understand that definitions change as more information comes in, but it is in the marginal cases, where things can be considered a planet or a star, that questions often arise. "If you have a 13 Jupiter-mass object orbiting a star, and then you have a 12.5 Jupiter-mass object orbiting a star, and one is just slightly massive enough that it has deuterium fusion, then is that enough to call one a planet and one not?" says Biller. ▮

Evolution

Ostrich necks act like a radiator to control head temperature

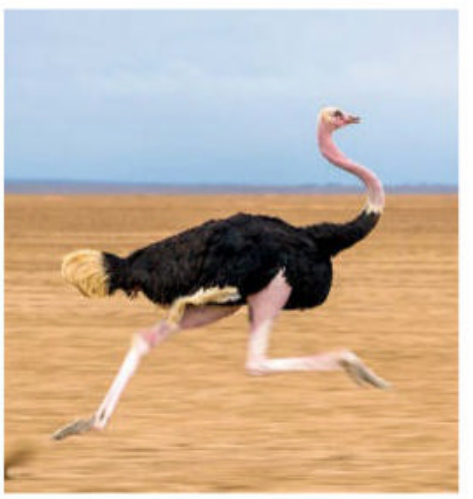
THE ostrich's long, flexible neck is an important way to stay cool in the heat and keep warm in cooler weather, and it may have evolved partly as an adaptation to wildly variable climatic conditions.

Large animals are vulnerable to rapid temperature changes because their big bodies tend to hold on to heat. To investigate how they evolve thermal tolerance, Erik Svensson at Lund University, Sweden, and his colleagues looked to the world's largest bird: the common ostrich (*Struthio camelus*).

From 2012 to 2017, they took nearly 5600 infrared photos of 794 ostriches at a research farm in Klein Karoo, South Africa. The team found that the neck was a "thermal window", emitting excess heat in hot conditions and retaining heat in the cold, stabilising the temperature of the head and brain.

The farm hosts three populations of the birds: South African "black" ostriches, Zimbabwean "blue" ostriches and the Kenyan "reds". Ostriches that evolved in what is now South Africa or Zimbabwe, regions with more climatic variability, were more efficient at shifting the temperature in their necks.

On hot days, female ostriches with a greater difference between their head and neck temperatures laid more eggs in the following days compared with those with a smaller heat gap (bioRxiv, doi.org/hm6t). This all suggests that the neck is a buffer for heat stress, the team says.



KLEIN & HUBERT/NATUREPL

A male Kenyan "red" ostrich (*Struthio camelus massaicus*)

The researchers also suggest that, as the planet warms, ostrich necks could evolve to become even longer. Using pedigree data from ostriches on the farm, they confirmed that the neck radiator's efficiency is heritable.

Ben Smit at Rhodes University in South Africa says ostriches use evaporation from their open mouth and throat to lose heat. He wonders if the excess heat in the neck is mostly warm blood being shunted to the head, where evaporative cooling happens. ▮

Jake Buehler