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Astronomy

Seeing Earth as another planet

From afar, most of the other planets in our solar system could be mistaken for Earth

Leah Crane

TAKING a picture of a far-off world may not be enough to identify what sort of planet it is. We know this because from outside our solar system, every other planet except for Jupiter could be mistaken for Earth.

When planets beyond our solar system, called exoplanets, are discovered via directly taking an image of them, we usually only get two pieces of information from that image: the planet's apparent brightness and its apparent distance from its star.

Dean Keithly and Dmitry Savransky at Cornell University in New York investigated whether, given only those two pieces of information, we are likely to confuse one planet for another. They used our solar system as an example, calculating how often different planets could have properties that would make us think they were Earth from afar.

"Intuitively, you would think planets that appear brighter are bigger, and stars that appear further from their star are further from their star – but that's not quite right," says Nicolas Cowan at McGill University in Montreal, Canada. In fact, a planet's apparent brightness is related to both its size and its reflectivity, and its apparent location is related to both its actual distance from its star and its position on its orbit.

The researchers found that from about 72 per cent of viewing angles, there are locations in Venus's orbit where it could be mistaken for Earth. Mars and Mercury are the next most likely to impersonate our planet – respectively, about 43 and 36 per cent of the angles from which you could view them present an opportunity for confusion. Saturn, Uranus and Neptune can only look like Earth from less than 4 per cent of locations, and Jupiter is so colossal that it never looks like Earth no matter how you view it (*The Astrophysical Journal Letters*, doi.org/gxzc).

Exoplanets that look Earth-like might actually be more like Venus

LIMBITECH/SHUTTERSTOCK

Making such a mix-up could be expensive. "The rough cost for a 1.5-day observation of an exoplanet is about $2.4 million," says Keithly. "So if we make a detection and then we want to follow up on it because it seems Earth-like, we could be wasting $2.4 million and time that we could be using to find other exoplanets."

Luckily, the probability of making such a mistake is relatively low. "Although it's true that Neptune or Saturn or whatever can masquerade as the Earth if you catch it at the right place in its orbit, it's actually really unlikely," says Cowan. "A broken clock is right twice a day, but you'd have to get really unlucky to look at a broken clock and have it tell you the right time."

This also isn't an intractable problem – multiple observations of an exoplanet's motion over time will reveal its true distance from its star. Other observations, like the colour of light bouncing off the planet, can help distinguish what kind of world it is too. Still, when we are looking for distant Earth-like worlds, we have to make sure the exoplanets we spot really are as they appear. ▮

Archaeology

Source of marble found for huge ancient Greek statue

ONE of the great statues of antiquity has been connected to its likely birthplace by analysis of its marble.

The Colossus of the Naxians on the Greek island of Delos once stood about 9 metres tall, but is now in pieces. One is at the British Museum in London, while the rest are in Greece. The statue's name refers to the island of Naxos, which has been a major source of marble since the Greek archaic era from 800 BC to 480 BC – but it isn't from either of two known quarries of that period.

Instead, the marble has the chemical signature of a deposit in another part of the island, found by Scott Pike at Willamette University in Oregon. He will present his results at a meeting of the Geological Society of America on 11 October.

His interest in the statue dates from the 1990s, when he tried to check the assertion carved on the base that it was made "of one marble". The British Museum let him take a sample from the right foot, but permission from Greek authorities was difficult to come by.

Pike compared the proportions of stable isotopes of carbon and oxygen in the marble to a database of known Greek quarries. "Marble is metamorphosed limestone," he says. "The isotopic signature is related to how that limestone formed." The data suggested the marble of the statue came from somewhere in the south of Naxos.

Recently, Pike got permission to do a geological survey there,

"The Colossus of the Naxians on the island of Delos once stood 9 metres tall, but is now in pieces"

and he found a line of hills capped by marble not noted on geological maps. The isotopes in the marble are a good match for the statue.

There was an abandoned quarry as well, but due to its size and the pattern of extractions, Pike doubts that it birthed the Colossus of the Naxians. Because he didn't have a permit for archaeological sampling, he couldn't date it. He plans to return with such a permit and a lidar-equipped drone to see if he can find other quarries or the roads and slipways used to transport finished statues. ▮

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