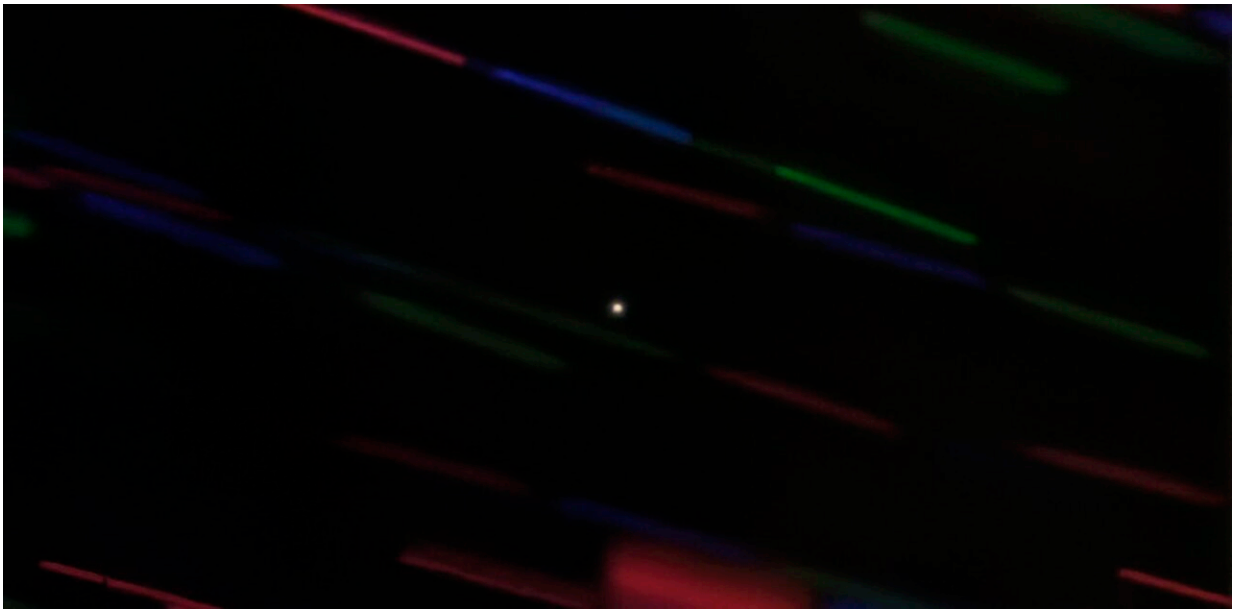
Earth is getting a tiny new mini-moon. It won't be the first (or the last)

September 23 2024, by Laura Nicole Driessen



The minimoon 2020 CD3 orbited Earth between 2018 and 2020. Credit: International Gemini Observatory/NOIRLab/NSF/AURA/G. Fedorets, CC BY

Earth is going to have its very own mini-moon from September 29 until November 25. The regular moon's new, temporary friend is 2024 PT_5, an asteroid captured from the Arjuna asteroid group (called the "Arjunas").

Our new mini-moon is approximately 10 meters in diameter and will be

captured by Earth's gravity for 57 days. It's small and faint, so it won't be visible by the eye or with small telescopes, but will be visible to larger telescopes.

What is a mini-moon?

NASA defines "moons" as "naturally formed bodies that orbit planets." Intuitively, we think of moons as big rocks that stick around for a while, like our very own moon.

Astronomers have defined mini-moons as asteroids or comets that are gravitationally captured by a planet for a temporary amount of time. Small mini-moons are very common, but ones big enough to spot are more rare.

2024 PT_5 is only the fifth ever detected mini-moon captured by Earth.

Orbiting or just flying by?

A mini-moon is a "temporarily captured orbiter" if it completes at least one full orbit of the Earth before returning to its usual orbit around the sun.

If a mini-moon is captured by Earth's gravity but doesn't make it around for a full orbit, it's a "temporarily captured flyby" instead.

Two of Earth's mini-moons were "temporarily captured orbiters," while the other three (including 2024 PT_5) fall into the "temporarily captured flybys" category.

Where do mini-moons come from?

Mini-moons are asteroids from the large population of near-Earth objects (or NEOs) that are temporarily grabbed from their orbit around the sun.

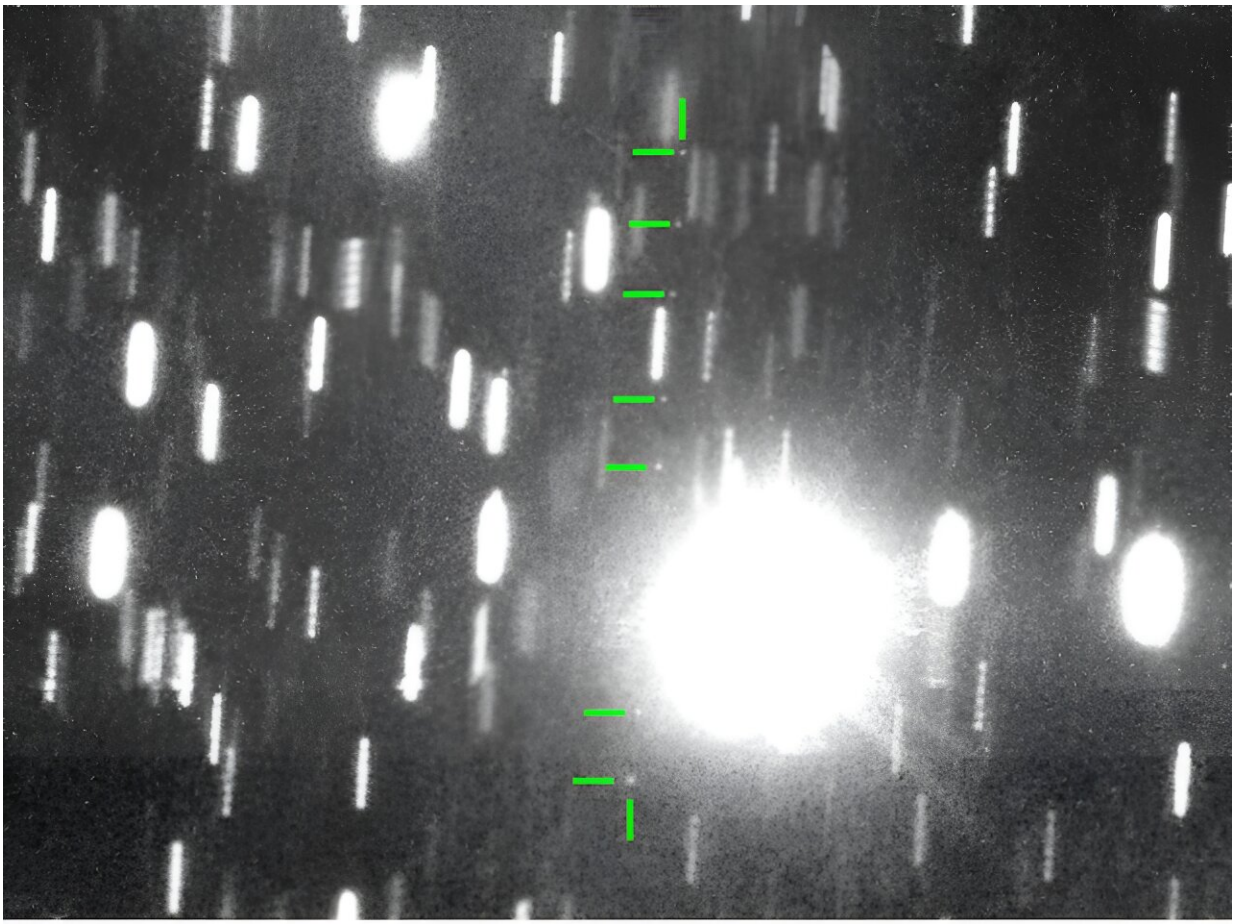
Near-Earth objects are defined as natural physical objects floating in space, such as asteroids (space rocks) or comets (dirty space snowballs made of rock and ice), that are orbiting the sun and approach to within 1.3 times Earth's distance from the sun at some point in their orbit.

Because these objects are around the same distance from the sun as the Earth, they can sometimes be captured by Earth's gravity.

2024 PT_5 and and a previous mini-moon called 2022 NX_1 were both captured from a group of asteroids orbiting the sun at a similar distance from Earth, called the Arjunas. Arjuna is one of the main characters of the Hindu epic, Mahābhārata.

The first mini-moon—and a fake one

The first known mini-moon was called 1991 VG. It arrived in late 1991 and left in early 1992, and like 2024 PT_5 it was around 10 meters in diameter.



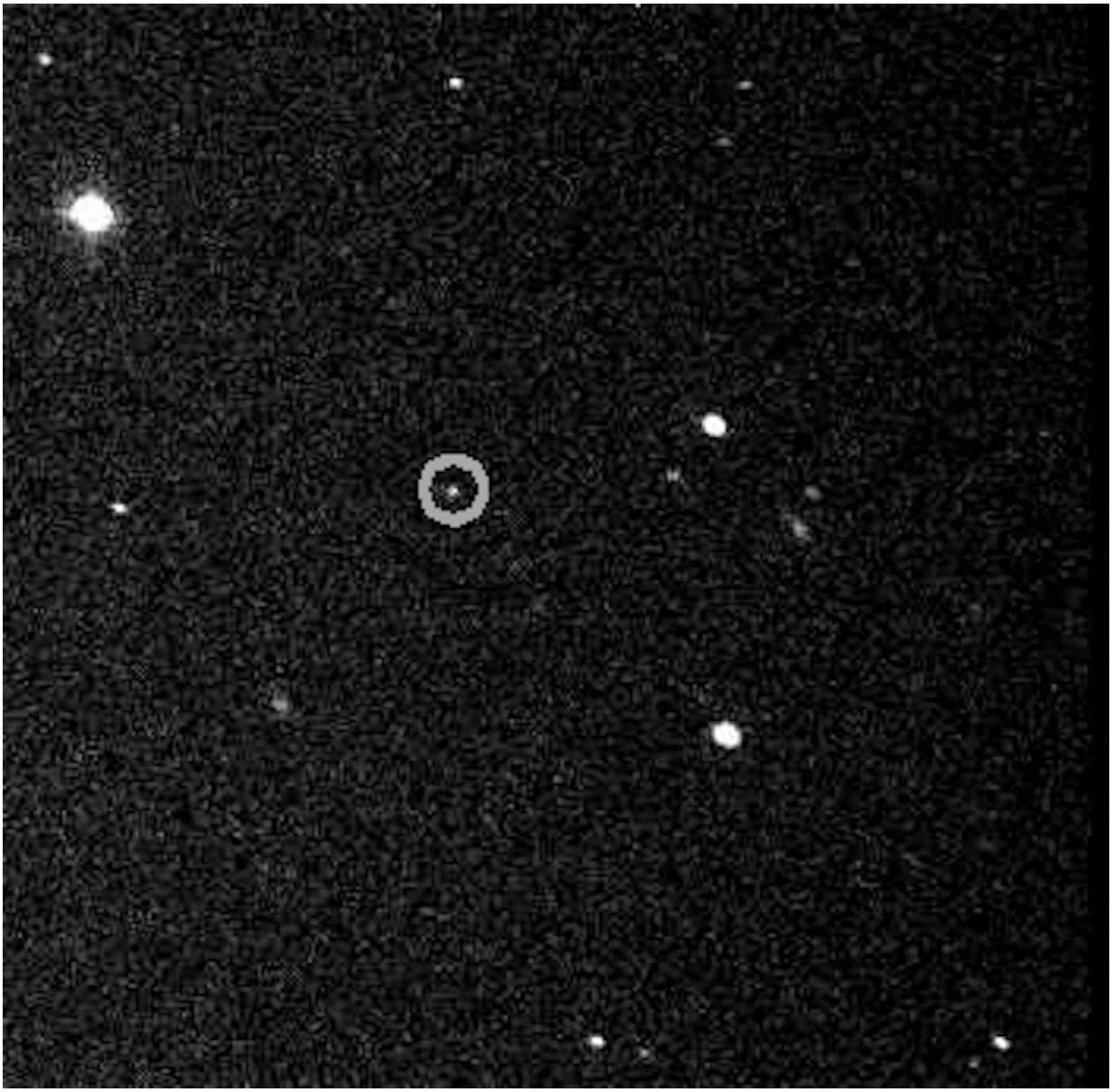
The mini-moon 1991 VG (marked with green lines). This image was made by combining seven images from the European Southern Observatory (ESO) Very Large Telescope (VLT). All images were taken on May 30 2017. The images were taken by tracking the asteroid position, so background stars appear as streaks. Credit: Hainaut/Micheli/Koschny via Wikipedia, CC BY

In 2002, amateur astronomer Bill Yeung found what he thought was a second mini-moon: J002E3.

However, on closer inspection, the object displayed a spectrum of light suggesting it was coated in white paint containing titanium oxide. Then, a study of how the object's brightness changed over time found its shape

resembled something like the upper stage of a rocket.

Astronomers now believe J002E3 is the third stage of the Apollo Saturn V rocket (S-IVB) instead of a natural mini-moon.



Images of the false mini-moon J002E3 taken by amateur Bill Yeung on September 3 2002. Credit: Bill Yeung / Bob Denny via Wikipedia, CC BY

More discoveries—with a note of caution

The plot twist of J002E3 made astronomers a bit more cautious. When another mini-moon (2006 RH_{120}) was spotted on September 14, 2006, it was first classified as artificial. However, after more observations it turned out to be a natural mini-moon about 2–7 meters in diameter. 2006 RH_{120} stuck around from July 2006 until July 2007.

The next mini-moon, 2020 CD_3, was gravitationally captured by Earth for more than two years, making it the longest-captured mini-moon observed to date. It escaped Earth's orbit in May of 2020. This mini-moon was around 1–2 meters in diameter.

Amateur astronomers Grzegorz Duszanowicz and Jordi Camarasa discovered 2022 NX_1 using the moonbase South Observatory in Namibia . Similar to 2006 RH_{120}, it was initially thought to be an artificial object from a past space mission.

It was later determined to originate from the Arjunas, just like 2024 PT_5. While it was discovered in 2022, it was temporarily captured by Earth's gravity in January 1981 and June 2022. It'll be captured again in December 2051.

2022 NX_1 was later found to be a natural mini-moon 5–15 meters in diameter.

Will we find more mini-moons?

Modeling suggests that, at any given time, Earth has at least one captured mini-moon less than 1 meter in diameter.

Even though astronomers think we always have a mini-moon, these bodies are challenging to detect. This is because they're small and faint. They are usually found by projects specifically looking for asteroids near Earth.

2024 PT_5 was discovered using the Asteroid Terrestrial-impact Last Alert System (ATLAS), which is an ongoing project specifically designed to search for asteroids. 2006 RH_{120} and 2020 CD_3 were discovered using the ongoing Catalina Sky Survey (CSS) for Near Earth Asteroids. 1991 VG was discovered by the SPACEWATCH group using the Spacewatch Telescope.

These projects will continue to search for asteroids, including mini-moons. We can also look forward to new discoveries and investigations when the Vera C. Rubin Observatory's Legacy Survey of Space and Time (LSST) starts observing in the next couple of years.

This enormous project will take images of the entire sky every few days for a period of ten years. First light of the Vera C. Rubin observatory is expected in mid-2025.

Provided by The Conversation