SPECIAL REPORT

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STAR SEEN SWALLOWING ITS PLANET WHOLE

The first-of-its-kind observation is a stark preview of Earth's fate.

ENGULFED. For the first time, astronomers have spotted an aging star in the act of enveloping one of its planets. INTERNATIONAL GEMINI OBSERVATORY/NOIRLAB/NSF/AURA/M. GARLICK/M. ZAMANI

In a few billion years, our aging Sun will run out of hydrogen fuel in its core and begin to swell, eventually engulfing Mercury, Venus, and probably Earth. Known as the red giant phase, this is a normal step in a mid-sized star's life cycle, when it expands a hundredfold in size. There are plenty of red giants in the night sky, but astronomers have never caught one in the act of swallowing its planets — until now.

Kishalay De of MIT first noticed the star while hunting for novae. A nova is when a star suddenly brightens, usually because it's siphoning material from another star orbiting nearby; this material can build up and eventually cause a runaway nuclear reaction on the surface of the star. At first glance, that's exactly what was happening with an event called ZTF SLRN-2020, a star that brightened and then dimmed over about a week of observations.

But when De and his colleagues looked closer with Keck Observatory on Maunakea in Hawaii, they realized it didn't look like a regular nova. Novae are hot, but this event was relatively cool. Another red flag was that Keck's spectral data told them the material being consumed was composed of molecules. Anything stolen directly from another star should be so hot that it will be stripped of any molecular bonds, leaving only isolated atoms of hydrogen or helium.

De gathered more data from telescopes and surveys, stretching further back in time. He found that the star had brightened in the infrared for a year before the visible light flared. This was not typical of a nova, and gave his team clues to unravel the mystery: Instead of material from a nearby star, this star had swallowed a Jupiter-sized planet. They published their discovery May 3 in *Nature*.

The find was made possible by the Zwicky Transient Facility (ZTF), a program at Caltech's Palomar Observatory in California, which repeatedly scans the sky to watch for changes from one image to the next. Surveys like ZTF flag objects that appear, disappear, or fluctuate in brightness, and serve as a record of how the sky looked in the past, even if scientists weren't actively monitoring a particular star.

Astronomers have previously spotted so-called "polluted" white dwarfs — stars that contain materials that shouldn't exist in a white dwarf. This is evidence that they already consumed planets rich in metals (the term astronomers use for any element heavier than helium). But seeing the light and heat from the feeding process is a new privilege.

IT'S MUTUAL

As the planet fell into its sun, the star began to rip away the planet's outer layers. At the same time, the world — a Jupiter-sized gas giant — began to tug on the star's puffy outer layers. This material drifted away from the star and cooled, causing the year-long infrared glow that

De had spotted in survey data as the planet spiraled closer to its star.

The visible flash — the first sign that astronomers noticed — was actually one of the last steps in this process, as the star swallowed the bulk of its planet and flared hot and bright. As its meal settled, the star returned to its former brightness. It took about 100 days from the time it began brightening to return to normal — the blink of an eye in astronomical terms.

The star is very similar to our own Sun, and when our Sun eventually expands to become a red giant, a similar fate awaits the rocky planets. Perhaps, in 5 billion years, alien astronomers will see a smaller, Earth-sized blip as our planet plunges into the Sun's dying embrace. – KOREY HAYNES

NASA picks Blue Moon for second Artemis lander

KITTED OUT. The 52-foot-high (16 m) Blue Moon will be capable of being loaded with more than 50 tons (45 metric tons) of fuel, and features an upper deck communications array, hydrogen tank, oxygen tank, solar array, docking adaptor, and room for four astronauts. BLUE ORIGIN

NASA ANNOUNCED May 19 that Blue Origin's Blue Moon will be the second lunar lander design for the Artemis program.

Intended for the crewed mission Artemis V launching in 2029, Blue Moon will provide an alternative to Space X's Starship lander. The latter is set for Artemis III, the mission slated for 2025 that will return humans to the lunar surface, and its follow-on, Artemis IV in 2028. Artemis V is seen as the mission that will move NASA into a yearly cadence of lunar landings. (Delays to this timeline are almost inevitable, some say.)

NASA originally selected SpaceX's landing design in 2021, after receiving only enough Congressional appropriations to award a single landing design contract at the time. Blue Origin protested and sued NASA, who later opened a call for a second design. The Blue Moon design won out over a bid from the firm Dynetics. Blue Moon is intended to launch on the not-yet-flown New Glenn rocket, also built by Blue Origin. The fixed-price contract is for $3.4 billion, with Blue Origin contributing more than that amount out of its own funding.

NASA Administrator Bill Nelson emphasized NASA's desire for more than one landing system: "We want more competition. We want two landers. And that's better. And that means you have reliability, you have backups." It should also reduce costs as SpaceX and Blue Origin vie for future NASA landing slots and other customers.

The announcement comes at a time of some budget queasiness. Between next year and 2028, NASA is slated to spend over $40 billion on Artemis. And skeptics wonder whether the expensive Space Launch System will ultimately survive if Space X's reusable Starship safely comes on board and reduces cost.

Yet Starship faces its own challenges: On its first launch it severely damaged its launch pad and blew up, scattering debris and starting a wildfire on public land. In response, the nonprofit Center for Biological Diversity is now suing the Federal Aviation Administration, contending inadequate oversight of SpaceX. – CHRISTOPHER COKINOS

QUICK TAKES

EUROPE'S WISH LIST

The ASTRONET Roadmap for 2022–2035 — Europe's equivalent of the U.S. decadal report — was released in May. Priorities include a next-gen gravitational-wave observatory dubbed the Einstein Telescope, a proposed 4.2-meter European Solar Telescope, and the completion of the European Extremely Large Telescope.

YOUNG RINGS

Saturn's rings formed surprisingly recently — just a few hundred million years ago at most, perhaps when dinosaurs still roamed Earth — according to new simulations reported May 12 in *Icarus*. The rings are likely to dissipate in about the same amount of time.

COSMIC TENSIONS

Observations of a gravitationally lensed supernova add to the Hubble tension — the disagreement between different measurement methods over how fast the universe is expanding. The new work, based on Hubble data from 2014–2015, agrees with the slower rate of expansion suggested by the cosmic microwave background, not the quicker rate indicated by supernovae measurements in the modern universe.

EXO-BELTS

Astronomers have identified radio emission from radiation belts around the ultracool dwarf star LSR J1835+3259. Similar to — but much stronger than — Earth's Van Allen belts, this is the first detection of such belts outside of our solar system.

FOURTH GEAR

The LIGO gravitational-wave observatory began its fourth observing run May 24 after a three-year hiatus. Upgrades in the intervening time should double its sensitivity to mergers of compact objects like black holes and neutron stars. – MARK ZASTROW