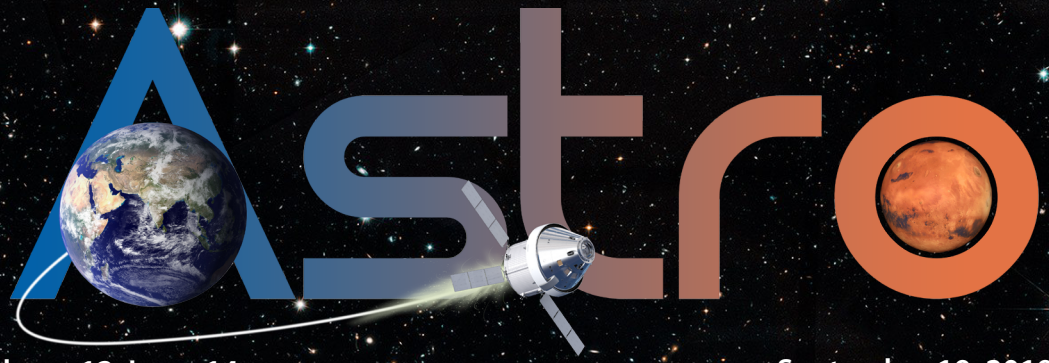


"Intelligence is the ability to adapt to change." Stephen Hawking



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Why Carbon Dioxide has Such Outsized Influence on Earth's Climate

It shouldn't be surprising that a small amount of carbon dioxide in the atmosphere can have a big effect. We take pills that are a tiny fraction of our body mass and expect them to affect us.

Today the level of carbon dioxide is higher than at any time in human history. Scientists widely agree that Earth's average surface temperature has already increased by about 2 F (1 C) since the 1880s, and that human-caused increases in carbon dioxide and other heat-trapping gases are extremely likely to be responsible.

Without action to control emissions, carbon dioxide might reach 0.1% of the atmosphere by 2100, more than triple the level before the Industrial Revolution.

EarthSky.org

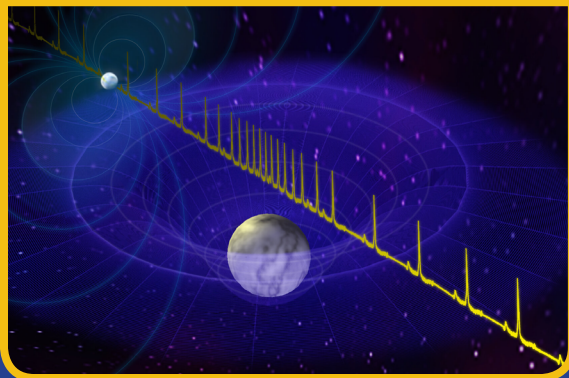
The Water Vapor Find on 'Habitable' Exoplanet

Astronomers are finding more and more alien worlds that may be capable of supporting Earth-like life, but none of these exoplanets so far are carbon copies of our home world.

The newest exciting find involves K2-18 b, a planet about 110 light-years from Earth that NASA's Kepler space telescope discovered in 2015.

K2-18 b lies in its parent star's "habitable zone," the range of distances that could support the existence of liquid water on a world's surface. Two teams of scientists announced this week that they've found water vapor in this world's air — a big milestone in the search for alien life.

Space.com



Astronomers Detect the Most Massive Neutron Star Ever Measured

West Virginia University researchers have helped discover the most massive neutron star to date, a breakthrough uncovered through the Green Bank Telescope in Pocahontas County.

The neutron star, called J0740+6620, is a rapidly spinning pulsar that packs 2.17 times the mass of the sun (which is 333,000 times the mass of the Earth) into a sphere only 20-30 kilometers, or about 15 miles, across. This measurement approaches the limits of how massive and compact a single object can become without crushing itself down into a black hole.

The star was detected approximately 4,600 light-years from Earth. One light-year is about six trillion miles. Pulsars get their name because of the twin beams of radio waves they emit from their magnetic poles. These beams sweep across space in a lighthouse-like fashion. Some rotate hundreds of times each second.

Since pulsars spin with such phenomenal speed and regularity, astronomers can use them as the cosmic equivalent of atomic clocks. Such precise timekeeping helps astronomers study the nature of spacetime, measure the masses of stellar objects and improve their understanding of general relativity.

[Phys.org](https://www.phys.org)



Astronomers Find a Supermassive Black Hole That is Feasting on a Regular Schedule

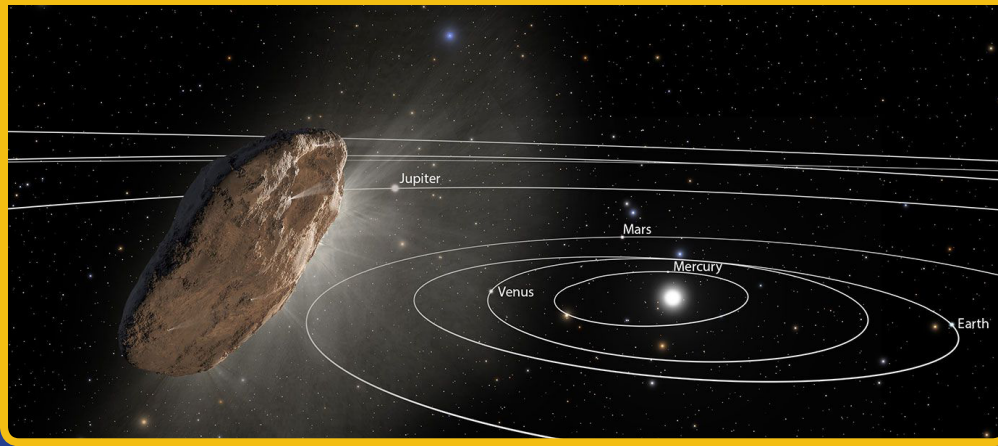
Astronomers have found a supermassive black hole (SMBH) with an unusually regular feeding schedule. The behemoth is an active galactic nucleus (AGN) at the heart of the Seyfert 2 galaxy GSN 069. The AGN is about 250 million light years from Earth, and contains about 400,000 times the mass of the Sun.

X-ray emissions from this SMBH have been known and observed since July 2010, but they were steady. The new paper is based on 54 days of observations beginning in December 2018, beginning with the ESA's XMM-Newton Observatory. That observatory spotted two bursts on December 24th. In January, XMM-Newton found three more of these regular bursts.

Then astronomers requested more observing time with NASA's Chandra Observatory to investigate. Chandra observed five more of these events. During the current regular eruptions, the X-ray flaring activity increases by two

orders of magnitude over the background X-ray emissions. Each flare lasts just over one hour and occurs every nine hours.

For larger SMBHs, much larger than this one, their brightness fluctuations are a lot slower. Rather than erupting every nine hours, it should take them months or even years to flare like this. That would explain why quasi-periodic eruptions (QPEs) like these haven't been observed. X-Ray observatories are busy, and there's no way to train one on a single target for that long. There've been several cases where large increases or decreases in X-rays produced by black holes have been observed. Those observations relied on repeated observations over months, or even years. Some of those changes are too fast to be explained by the standard theory of in-falling matter from a black hole's accretion disk. But this discovery could explain those observations. They may be experiencing similar behavior as GSN 069.



Astronomers May Have Just Discovered an Interstellar Comet Visiting Our Solar System

Astronomers are increasingly confident that a newly discovered comet is a visitor from another solar system, making it the second known interstellar object.

A newly discovered comet has astronomers excited. Formally named C/2019 Q4 (Borisov), the object appears to have come from outside our solar system. If confirmed, that would make it the second known interstellar visitor to our solar system, after the space rock Oumuamua.

The potential interstellar comet, which so far is only a fuzzy blip, was first seen on August 30 by observer Gennady Borisov. Ever since then, astronomers around the world have been tracking it and mapping its trajectory to determine its origin. The preliminary data suggests that the object could have originated outside our solar system.

While 'Oumuamua wasn't seen until it was on its way out of the solar system, C/2019 Q4 is still on its way in — and should remain visible for a year.

With current orbit calculations, C/2019 Q4 is expected to reach its closest approach to the Sun in December 2019, providing astronomers with time to observe it more closely.

The comet will likely come within 2 AU of the Sun, which is outside the orbit of Mars. Though currently around a brightness magnitude around 18 — too dim to be seen with a small telescope — the comet is expected to brighten to around 15th magnitude.

The first interstellar visitor, now called 'Oumuamua, was discovered in 2017 when it streaked past Earth as it started to fly out of our solar system. Astronomers had long anticipated finding interstellar comets.

Mars 2020 Spacecraft Comes Full Circle

Engineers took NASA's Mars 2020 for a spin on Aug. 29, 2019. The 2,300-pound (1,040-kilogram) Martian vehicle was rotated clockwise and counterclockwise at about 1 revolution per minute on what is called a spin table in the clean room of the Spacecraft Assembly Facility at NASA's Jet Propulsion Laboratory in Pasadena, California. The engineers were looking for the rover's center of gravity, or the point at which weight is evenly dispersed on all sides.

Establishing the rover's center of gravity is a key part of the assembly process and helps ensure that the spacecraft travels smoothly from launch to entry, descent and landing on Mars as calculated.

Engineers can add weights in order to help balance out the vehicle. In the end, they affixed nine tungsten weights totaling 44 pounds (20 kilograms) to the rover chassis at predetermined attachment points to get the center of gravity just right.

JPL is building and will manage operations of the Mars 2020 rover for NASA. The rover will launch on a United Launch Alliance Atlas V rocket in July 2020 from Space Launch Complex 41 at Cape Canaveral. NASA's Launch Services Program, based at the agency's Kennedy Space Center in Florida, is responsible for launch management.

MarsDaily.com



Astronomy Picture of the Day

Pluto in True Color

Image Credit & Copyright: NASA, JHU APL, SwRI, Alex Parker

What color is Pluto, really? It took some effort to figure out. Even given all of the images sent back to Earth when the robotic New Horizons spacecraft sped past Pluto in 2015, processing these multi-spectral frames to approximate what the human eye would see was challenging. The result featured here, released three years after the raw data was acquired by New Horizons, is the highest resolution true color image of Pluto ever taken. Visible in the image is the light-colored, heart-shaped, Tombaugh Regio, with the unexpectedly smooth Sputnik Planitia, made of frozen nitrogen, filling its western lobe. New Horizons found the dwarf-planet to have a surprisingly complex surface composed of many regions having perceptibly different hues. In total, though, Pluto is mostly brown, with much of its muted color originating from small amounts of surface methane energized by ultraviolet light from the Sun.

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