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YOUNG ASTRONOMERS NEWSLETTER

TWO DETECTORS FIND METHANE IN MARS ATMOSPHERE

The presence of methane [CH_4] in the Earth's atmosphere is primarily due to the action of microorganisms on decaying matter. It occurs over farm animal lots and swamps, for example. It is also produced geologically. The air in coal mines may contain explosive amounts of the gas.

So, the detection of methane in the atmosphere of Mars has gotten planetary scientists speculating about where it is coming from.

NASA's Curiosity rover has determined that background levels of methane seem to be rising and falling in a cyclic manner. Curiosity has detected two surges to date in Gale Crater – one in June, 2013 and another in early 2014. The 2013 detection has been corroborated by Europe's Mars Express orbiter. It also noticed a spike in 2004, before Curiosity arrived on the red planet.

Mars Express detected the 2013 spike on June 16, 2013, just one day after Curiosity reported a peak at 6 ppb (parts per billion). Ordinary background levels of methane measured by Curiosity had been at the 0.24 to 0.65 ppb level.

So, where is the methane coming from?

It is not very likely that it is being produced by currently living organisms. More likely, it is trapped under layers of subsurface ice and periodically released through faults (cracks) in the permafrost as it undergoes geologic shifting. The methane could have been trapped there for eons.

Another spacecraft, the European-Russian ExoMars orbiter, which has been circling the planet since 2016 could also be put into service to look for methane.

The location of the source of the gas was determined independently by Curiosity and Mars Express. The two determinations coincide at a location about 500 km (310 miles) east of Gale Crater. [Space.com, April 1, 2019].

BINARY STAR SYSTEMS ARE INTERESTING AND USEFUL TO ASTRONOMERS

The study of stars since the time of Galileo, has determined that over half of all visible stars are part of multiple star systems. This could mean that two, three, or more stars are associated in orbits with each other. Many stars may appear to us to be binaries, but often they are just optical double stars. That is, they are in the same line of sight as viewed from Earth. True binaries are gravitationally paired and orbit around a common gravity center (barycenter).

It has been speculated that our Sun had a binary partner many billions of years ago, but the two bodies drifted apart over eons of time.

The study of binaries helps astronomers learn about the characteristics of individual stars. If one can measure the orbital period of one star around another, it is possible to use Kepler - Newton's equations to determine the masses of the individual binary members. With some knowledge of the spectral class of the stars, it is possible to estimate size and density as well.

Some common binary star systems described in the May issue of Sky & Telescope are Sirius, Castor, 70-Ophiuchi and Gamma Virginis. Some common stars such as Polaris and the Mizar – Alcor system (in the handle of the Big Dipper – Ursa Major) contain up to six stars which are gravitationally held together. The United States Naval Observatory has compiled

the Washington Double Star catalog which contains over 100,000 binaries and related multiple star systems.

JAPAN'S HAYABUSA 2 SPACECRAFT IS THOROUGHLY EXAMINING ASTEROID RYUGU

Hayabusa 2 (H-2) is the second mission sent by Japan to study and sample an asteroid. Hayabusa 2 arrived at Ryugu in June, 2018 and launched two hopping rovers to its surface in September. In February of this year H-2 fired a bullet into the surface which kicked up dust from which a small sample could be collected.

More recently, H-2 released a baseball-sized copper ball onto Ryugu and is in the process of studying the newly formed crater and preparing to scoop out another sample. All these complex maneuvers are taking place at a distance of 170 million miles from Earth, on a body that is only about 3000 feet in diameter. Further study and possibly sampling should be complete by the end of 2019, after which the spacecraft will head home with its scientifically valuable cargo. [Space.com; April 5, 2019].

HOW DID WATER ACCUMULATE ON EARTH?

Planetary scientists have been studying and speculating on how so much water ended up on Earth's surface and interior. Three sources are possibilities: water condensing from the original solar nebula that encompassed the entire newly forming planets (about 4.5 billion years ago), impact by comets or impact by asteroids.

It is theorized that during its hot, formation period, the Earth lost any water that it might have had due to evaporation. But about 100 million years after it cooled, it went through a period which is called "late heavy bombardment" during which asteroids and comets were plentiful and were being tossed around by the big guys, like Jupiter and Saturn. The small bodies carried some water and deposited it on the Earth's surface. From there, the water pooled into oceans or it was swallowed up by tectonic activity and then converted into water-bearing minerals that are part of Earth's mantle.

One method that scientists use to identify sources of water is to measure its deuterium to hydrogen ratio. We label water as H_2O , however, all the hydrogen in the universe is a mixture of hydrogen isotopes. The three isotopes are ordinary hydrogen (one proton and one electron in each atom), deuterium (one neutron in the atomic nucleus, with the proton) and tritium, which has two neutrons with the proton (and is radioactive). Tritium quantities are almost vanishingly small, so we look at the amount of deuterium present, which is about 0.02% of all water. Measurements of DHO to H_2O ratios from various sources indicate that the Moon and asteroids have a ratio very similar to Earth's. But comets have a higher ratio. This has caused scientists to believe that comets were not a major source of Earth's early water.

But the picture is exceedingly complex. The solar nebula, with its own water, having a low D/H ratio, could have been incorporated into the young, developing Earth. This could have undergone "isotopic fractionation" that caused ordinary hydrogen to be attracted toward the Earth's irony core. This has been born out by analysis of Baffin Island rock samples, which are believed to originate in the Earth's mantle. The samples have a lower D/H ratio, which is more similar to the solar nebula. So, the lower D/H ratio could be due to the isotopic fractionation or the early incorporation of solar nebula. So, the question of where Earth got its water still needs lots of study. [Astronomy, May, 2019].

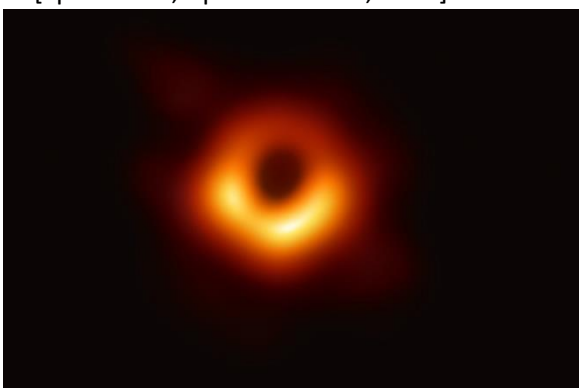
ASTRONOMERS HAVE TAKEN A SNAPSHOT OF A BLACK HOLE

Astronomers announced on April 10 that they have captured an image of a black hole. This was accomplished by cooperation of a large

International group of 200 astronomers using nine radio telescopes positioned around the world.

The radio signals were carefully synchronized to produce the final composite image. The radio image was colorized to produce the photo that made the headlines in all the media.

The black hole is classified as a supermassive black hole. It is located in the M87 galaxy in the constellation Virgo, some 55 million light-years away. Its size would encompass the whole solar system. The ring that we see corresponds to the "Event Horizon" which represents energy being released as matter falls into the black hole. The central black hole has such a huge gravitational pull that not even light can escape it. [Space.com, April 10 and 16, 2019]



This image by the Event Horizon Telescope project shows the event horizon of a supermassive black hole at the heart of M87 galaxy.
Credit: EHT Collaboration

ISRAEL'S BERESHEET SPACECRAFT CRASHES DURING MOON LANDING ATTEMPT

The robotic Beresheet spacecraft built by Space IL and Israel Aerospace Industries came to an unfortunate demise on the lunar surface. As it was attempting a soft landing on April 11, ground control operators lost control of the robot and it crashed.

The mission was initiated as an attempt to collect the $20 million Google Lunar X Prize. Executives at Lunar X decided to award Space IL $1 million in spite of the failure in landing the craft. [Space.com, April 11, 2019].

WHEN WILL BETELGEUSE BLOW?

From stargazers to professional astronomers, many of us have been fascinated by the red super giant star Betelgeuse. We are fascinated by its size and the fact that it could blow up at any time as a supernova. Betelgeuse (pronunciations vary: bet-ell-juz or beet-ell-juz or other variations) is more formally labeled as Alpha (α) Orionis and is found in the right arm of the constellation Orion. It is a huge, old giant, about 1000 times the size of our Sun. Latest measurements put it at a distance of about 700 light years. Its distance and size are difficult to measure because the star has an ill-defined surrounding envelope of hot gas.

The spectrum displayed by Betelgeuse indicates that it has aged past the hydrogen fusion stage in its core and moved on to helium fusion. This produces higher elements like carbon. Eventually, heavier elements will build up and fusion energy will lessen. This will cause the star's core to collapse and lead to a rebound explosion that we call a supernova.

Astronomers have detected that Betelgeuse shows some variable output. That is, it alternates its light production in variable cycles on the order of 370 to 425 days. This is another indicator of instability.

If Betelgeuse should explode right now, it would take around 700 years for us to detect the flash. The blast would likely appear to us as a slightly larger red dot. Estimates for the event vary from 100,000 to a million years in the future. So, don't hold your breath. [Sky & Telescope, May, 2019]

BIRTHDAYS IN MAY:

Antony Hewish (Brit.). b. May 11, 1924. Radio astronomer. Nobel Prize 1974. Mentor of Jocelyn Bell Burnell, who first detected pulsars.

Theodore von Kármán (Hung. – Amer.) b. May 11, 1881; d. May 6, 1963. Mathematician, aerospace engineer. Specialty supersonic and hypersonic air flow. One of the founders of Jet Propulsion Laboratories.

Willem deSitter (Neth.). b. May 6, 1872, d. Nov. 6, 1934. Dutch mathematician, physicist and astronomer. Collaborated with Einstein in describing the shape of the universe. Used celestial mechanics to analyze the motions of the four Galilean moons.

Cecilla Payne Gaposchkin (Brit.-Amer.) b. May 10, 1900, d. Dec. 7, 1979. Astronomer –astrophysicist. Was the first to propose that hydrogen and helium were the predominant constituents of stars.

MOON PHASES IN MAY: New: Sat. the 4th; First qtr.: Sun. the 12th; Full: Sat. 18th; Last qtr.: Sun. the 26th.

THE PLANETS IN MAY: Mars can still be seen in the southwest. It's a conspicuous red "star" in Taurus and gives us a distortion of the bull's horns. **Mercury** gives us a chance to peek at it low in the west, a half hour after sunset. Binoculars will help. **Jupiter** rises around 11 p.m. and with a magnitude of -2.5 is easy to find. **Saturn** follows about two hours behind the gas giant. At a magnitude of 0.3 to 0.2, it is brighter than any of the stars in the constellation Sagittarius. Its rings are tilted nicely for those viewing with telescopes. **Venus** rises about an hour before sunrise. Over the past couple of months it has been dropping lower and lower, although it is still bright at magnitude -3.8 .

OTHER MAY EVENTS: The Eta Aquariids. This meteor shower should be decent this year since it peaks on May 6, near the time of New Moon. The meteors are caused by the Earth passing through the trail of Comet 1P/Halley.

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FORSYTH ASTRONOMICAL SOCIETY: Meetings are held the second Wednesday of the month at Kaleideum North (formerly SciWorks) at 7:30 p.m. Check with the FAS website: www.fas37.org to learn about various activities, such as public observations. Outdoor activities are always subject to cancellation due to unfavorable weather. Check the website or call the Kaleideum front desk at 336-767-6730, ext. 1000

For astronomy, things are looking up.

Bob Patsiga, editor