Space News Update

— August 7, 2018 —

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In the News

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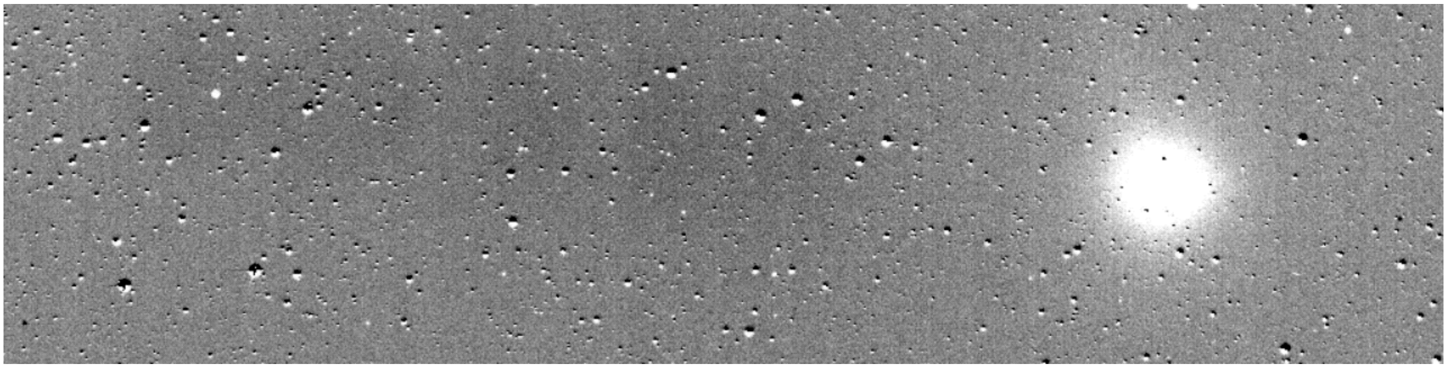
1. TESS Catches a Comet Before Starting Science



Before NASA's Transiting Exoplanet Survey Satellite (TESS) started science operations on July 25, 2018, the planet hunter sent back a stunning sequence of serendipitous images showing the motion of a comet.

Taken over the course of 17 hours on July 25, these TESS images helped demonstrate the satellite's ability to collect a prolonged set of stable periodic images covering a broad region of the sky -- all critical factors in finding transiting planets orbiting nearby stars.

Over the course of these tests, TESS took images of C/2018 N1, a comet discovered by NASA's Near-Earth Object Wide-field Infrared Survey Explorer (NEOWISE) satellite on June 29. The comet, located about 29 million miles (48 million kilometers) from Earth in the southern constellation Piscis Austrinus, is seen to move across the frame from right to left as it orbits the Sun. The comet's tail, which consists of gases carried away from the comet by an outflow from the Sun called the solar wind, extends to the top of the frame and gradually pivots as the comet glides across the field of view.

In addition to the comet, the images reveal a treasure trove of other astronomical activity. The stars appear to shift between white and black as a result of image processing. The shift also highlights variable stars -- which change brightness either as a result of pulsation, rapid rotation, or by eclipsing binary neighbors. Asteroids in our solar system appear as small white dots moving across the field of view. Towards the end of the video, one can see a faint broad arc of light moving across the middle section of the frame from left to right. This is stray light from Mars, which is located outside the frame. The images were taken when Mars was at its brightest near opposition, or its closest distance, to Earth.

These images were taken during a short period near the end of the mission's commissioning phase, prior to the start of science operations. The movie presents just a small fraction of TESS's active field of view. The team continues to fine-tune the spacecraft's performance as it searches for distant worlds.

Check out the video here.

Source: SpaceRef.com Return to Contents

2. SpaceX Launches Indonesian Comsat with ‘Used’ Booster

SpaceX launched the first previously-flown "block 5" version of its Falcon 9 rocket early Tuesday, sending an Indonesian communications satellite into space and successfully recovering the first stage booster with a pinpoint landing on an offshore droneship.

It was only the fourth flight of an upgraded block 5 booster since the rocket's debut in May and the first launch and recovery of a previously flown block 5 -- the same stage that helped launch a Bangladeshi satellite during its maiden flight three months ago.

The block 5 is the rocket SpaceX founder Elon Musk is counting on to launch astronauts to the International Space Station starting next year, the centerpiece of the company's drive to lower launch costs while improving reliability. With Tuesday's flight, SpaceX's record stands at at 60 successful Falcon 9 launches, with 28 successful booster recoveries, 12 on land and 16 on droneships.

The primary goal of Tuesday's flight was to boost the Merah Putih -- "Red and White" -- communications satellite into orbit for PT Telkom, the largest provider of telecommunications services in Indonesia. The name refers to the red and while colors of Indonesia's flag.

The 12,800-pound satellite, built by SSL, features 60 C-band transponders to provide mobile services across Indonesia and Southeast Asia.

The mission got underway at 1:18 a.m. EDT (GMT-4) when the Falcon 9's nine Merlin 1D engines ignited and throttled up to full thrust, producing a brilliant plume of fiery exhaust that instantly turned cooling water into billowing clouds of steam.

After a final lightning-fast series of computer checks, the 229-foot-tall rocket was released from pad 40 at the Cape Canaveral Air Force Station, quickly accelerating skyward atop 1.7 million pounds of thrust.

With its fiery exhaust plume visible for dozens of miles around, the Falcon 9 smoothly arced away to the east over the Atlantic Ocean, putting on a spectacular overnight display for area residents and tourists who stayed up late to catch a glimpse of the show.

The first stage powered the vehicle out of the dense lower atmosphere, shutting down as planned about two-and-a-half-minutes after liftoff. The stage then fell away to begin its trip back to Earth while the primary mission continued on the power of a single Merlin engine in the rocket's second stage.

A few minutes after separation, three of the first stage's nine engines re-ignited to slow the booster for entry back into the discernible atmosphere, using four titanium "grid fins" at the top of the rocket to maintain its orientation and trajectory. A final single-engine burn put the brakes on for landing on the droneship "Of Course I Still Love You" stationed several hundred miles east of Cape Canaveral.

Seconds before touchdown, four legs deployed and the rocket settled to an on-target landing. After it is hauled back to Cape Canaveral, it will be inspected and, if no major problems are found, it will go into the stockpile of available block 5 stages ready for use in downstream missions.

The first stage landed right about the same time the second stage engine shut down after reaching the planned preliminary "parking" orbit. A second engine firing was carried out 26 minutes after launch to finish the job.

The Merah Putih satellite then was released into an elliptical transfer orbit, the normal first step in getting a communications satellite into its intended orbit 22,300 miles above the equator. Satellites at such geosynchronous altitudes take 24 hours to complete one orbit and thus appear stationary in the sky.

Merah Putih's on-board propulsion system will be used to circularize the orbit at the intended 22,300-mile altitude and to maneuver it to its designated operational location at 108 degrees east longitude. After extensive testing and checkout, the satellite will be put into service.

Next up for SpaceX is launch of Telesat's Telstar 18 VANTAGE communications station from Cape Canaveral around Aug. 17, following by launch of an Earth-observation satellite for Argentina. That flight is scheduled for launch next month from Vandenberg Air Force Base in California.

Source: CBS News Return to Contents

3. Top Five Technologies Needed for a Spacecraft to Survive Deep Space

When a spacecraft built for humans ventures into deep space, it requires an array of features to keep it and a crew inside safe. Both distance and duration demand that spacecraft must have systems that can reliably operate far from home, be capable of keeping astronauts alive in case of emergencies and still be light enough that a rocket can launch it.

Missions near the Moon will start when NASA's Orion spacecraft leaves Earth atop the world's most powerful rocket, NASA's Space Launch System. After launch from the agency's Kennedy Space Center in Florida, Orion will travel beyond the Moon to a distance more than 1,000 times farther than where the International Space Station flies in low-Earth orbit, and farther than any spacecraft built for humans has ever ventured. To accomplish this feat, Orion has built-in technologies that enable the crew and spacecraft to explore far into the solar system.

Systems to Live and Breathe

As humans travel farther from Earth for longer missions, the systems that keep them alive must be highly reliable while taking up minimal mass and volume. Orion will be equipped with advanced environmental control and life support systems designed for the demands of a deep space mission. A high-tech system already being tested aboard the space station will remove carbon dioxide (CO_2) and humidity from inside Orion. Removal of CO_2 and humidity is important to ensure air remains safe for the crew breathing. And water condensation on the vehicle hardware is controlled to prevent water intrusion into sensitive equipment or corrosion on the primary pressure structure.

The system also saves volume inside the spacecraft. Without such technology, Orion would have to carry many chemical canisters that would otherwise take up the space of 127 basketballs (or 32 cubic feet) inside the spacecraft—about 10 percent of crew livable area. Orion will also have a new compact toilet, smaller than the one on the space station. Long duration missions far from Earth drive engineers to design compact systems not only to maximize available space for crew comfort, but also to accommodate the volume needed to carry consumables like enough food and water for the entirety of a mission lasting days or weeks.

Highly reliable systems are critically important when distant crew will not have the benefit of frequent resupply shipments to bring spare parts from Earth, like those to the space station. Even small systems have to function reliably to support life in space, from a working toilet to an automated fire suppression system or exercise equipment that helps astronauts stay in shape to counteract the zero-gravity environment in space that can cause muscle and bone atrophy. Distance from home also demands that Orion have spacesuits capable of keeping astronaut alive for six days in the event of cabin depressurization to support a long trip home.

Proper Propulsion

The farther into space a vehicle ventures, the more capable its propulsion systems need to be to maintain its course on the journey with precision and ensure its crew can get home.

Orion has a highly capable service module that serves as the powerhouse for the spacecraft, providing propulsion capabilities that enable Orion to go around the Moon and back on its exploration missions. The service module has 33 engines of various sizes. The main engine will provide major in-space maneuvering capabilities throughout the mission, including inserting Orion into lunar orbit and also firing powerfully enough to get out of the Moon's orbit to return to Earth. The other 32 engines are used to steer and control Orion on orbit.

In part due to its propulsion capabilities, including tanks that can hold nearly 2,000 gallons of propellant and a back up for the main engine in the event of a failure, Orion's service module is equipped to handle the rigors of travel for missions that are both far and long, and has the ability to bring the crew home in a variety of emergency situations.

The Ability to Hold Off the Heat

Going to the Moon is no easy task, and it's only half the journey. The farther a spacecraft travels in space, the more heat it will generate as it returns to Earth. Getting back safely requires technologies that can help a spacecraft endure speeds 30 times the speed of sound and heat twice as hot as molten lava or half as hot as the sun.

When Orion returns from the Moon, it will be traveling nearly 25,000 mph, a speed that could cover the distance from Los Angeles to New York City in six minutes. Its advanced heat shield, made with a material called AVCOAT, is designed to wear away as it heats up. Orion's heat shield is the largest of its kind ever built and will help the spacecraft withstand temperatures around 5,000 degrees Fahrenheit during reentry though Earth's atmosphere.

Before reentry, Orion also will endure a 700-degree temperature range from about minus 150 to 550 degrees Fahrenheit. Orion's highly capable thermal protection system, paired with thermal controls, will protect Orion during periods of direct sunlight and pitch black darkness while its crews will comfortably enjoy a safe and stable interior temperature of about 77 degrees Fahrenheit.

Radiation Protection

As a spacecraft travels on missions beyond the protection of Earth's magnetic field, it will be exposed to a harsher radiation environment than in low-Earth orbit with greater amounts of radiation from charged particles and solar storms that can cause disruptions to critical computers, avionics and other equipment. Humans exposed to large amounts of radiation can experience both acute and chronic health problems ranging from near-term radiation sickness to the potential of developing cancer in the long-term.

Orion was designed from the start with built in system-level features to ensure reliability of essential elements of the spacecraft during potential radiation events. For example, Orion is equipped with four identical computers that each are self-checking, plus an entirely different backup computer, to ensure Orion can still send commands in the event of a disruption. Engineers have tested parts and systems to a high standard to ensure that all critical systems remain operable even under extreme circumstances.

Orion also has a makeshift storm shelter below the main deck of the crew module. In the event of a solar radiation event, NASA has developed plans for crew on board to create a temporary shelter inside using materials on board. A variety of radiation sensors will also be on the spacecraft to help scientists better understand the radiation environment far away from Earth. One investigation called AstroRad, will fly on Exploration Mission-1 and test an experimental vest that has the potential to help shield vital organs and decrease exposure from solar particle events.

Constant Communication and Navigation

Spacecraft venturing far from home go beyond the Global Positioning System (GPS) in space and above communication satellites in Earth orbit. To talk with mission control in Houston, Orion's communication and navigation systems will switch from NASA's Tracking and Data Relay Satellites (TDRS) system used by the International Space Station, and communicate through the Deep Space Network.

Orion is also equipped with backup communication and navigation systems to help the spacecraft stay in contact with the ground and orient itself if it's primary systems fail. The backup navigation system, a relatively new technology called optical navigation, uses a camera to take pictures of the Earth, Moon and stars and autonomously triangulate Orion's position from the photos. Its backup emergency communications system doesn't use the primary system or antennae for high-rate data transfer.

Source: NASA

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The Night Sky

Tuesday, August 7

• Venus, Jupiter, and Mars currently outshine them, but the two brightest *stars* of summer are Vega, overhead shortly after nightfall, and Arcturus, shining in the west.

Draw a line down from Vega to Arcturus. A third of the way down, the line crosses the dim Keystone of Hercules. Two thirds of the way down it crosses the dim semicircle of Corona Borealis with its one modestly bright star, Alphecca or Gemma.

Vega and the Keystone's star closest to it form an equilateral triangle with Eltanin, the nose of Draco the Dragon, to their north. Eltanin is the brightest star of Draco's quadrilateral head. He's eternally eyeing Vega.

Wednesday, August 8

• With the advance of summer the Sagittarius Teapot, now moving into the south after dark, is starting to tilt and pour from its spout to the right. Saturn stands above the spout. The Teapot will tilt farther and farther for the rest of the summer — or for much of the night if you stay out late.

Thursday, August 9

• Bright Vega passes closest to overhead soon after dark now. How closely it misses your zenith depends on how far north or south you are. It passes right *through* your zenith if you're at latitude 39° north (Washington DC, Cincinnati, Kansas City, Lake Tahoe). How closely can you judge this by looking?

Then Deneb crosses closest to the zenith almost exactly two hours after Vega.

Friday, August 10

• **It's Perseid weekend!** The annual Perseid meteor shower should come to its peak late Sunday night August 12th. Already the meteors are increasing in number. You may have noticed a few early Perseids as early as a week or two ago.

Conditions are ideal this year. There's no moonlight, and the shower's predicted maximum comes during nighttime for Europe and North America on the night of August 12–13.

Whatever the night you'll see the most meteors when the shower's radiant is high: from about midnight to dawn. On peak night you may see one or two meteors a minute on average during this time if your sky is very dark. There will be fewer in the evening, but the ones you do see when the radiant is low will be "Earthgrazers" skimming the upper atmosphere in long, graceful flight paths.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Tue Aug 7, 8:50 PM	4 min	59°	34° above NNW	12° above ESE
Tue Aug 7, 10:25 PM	1 min	13°	10° above W	13° above WSW
Wed Aug 8, 9:33 PM	3 min	26°	15° above W	21° above SSW
Thu Aug 9, 8:43 PM	4 min	52°	39° above W	10° above SE
Fri Aug 10, 9:27 PM	1 min	10°	10° above WSW	10° above SW
Sat Aug 11, 8:35 PM	3 min	20°	17° above WSW	10° above S

Sighting information for other cities can be found at NASA's Satellite Sighting Information

NASA-TV Highlights

(all times Eastern Daylight Time)

August 7, Tuesday
12:15 p.m. – Space Station Educational In-Flight Event with the Challenger Center in Washington, D.C., and NASA astronaut Ricky Arnold (All Channels)

August 9, Thursday
1 p.m. - Parker Solar Probe Pre-Launch Mission Briefing (All Channels)
2:35 p.m. – Space Station Educational In-Flight Event with the McAuliffe-Shepard Discovery Center in Concord, New Hampshire, and International Space Station Commander Drew Feustel and astronauts Ricky Arnold and Serena Aunon-Chancellor of NASA (All Channels)

August 10, Friday
6 a.m. – Live interviews from Kennedy Space Center on upcoming launch of Parker Solar Probe (All Channels)
6:30 p.m. – NASA Edge: Live Tower Rollback for Parker Solar Probe (All Channels)
7:30 p.m. – Sunset Show: How Parker Solar Probe helps NASA – Live from Kennedy Space Center (All Channels)

Watch NASA TV on the Net by going to the NASA website.

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Space Calendar

- Aug 07 - Comet C/2017 S3 (PANSTARRS) Closest Approach To Earth (0.758 AU)
- Aug 07 - Comet P/2011 A2 (Scotti) At Opposition (3.486 AU)
- Aug 07 - Aten Asteroid 2018 MD7 Near-Earth Flyby (0.059 AU)
- Aug 07 - Asteroid 9957 Rafaellosanti Closest Approach To Earth (0.998 AU)
- Aug 07 - Asteroid 16809 Galapagos Closest Approach To Earth (1.563 AU)
- Aug 07 - Asteroid 2620 Santana Closest Approach To Earth (1.789 AU)
- Aug 07 - Asteroid 241418 Darmstadt Closest Approach To Earth (1.839 AU)
- Aug 07 - Apollo Asteroid 6063 Jason Closest Approach To Earth (2.795 AU)
- Aug 07 - Kuiper Belt Object 2008 OG19 At Opposition (37.703 AU)
- Aug 08 - Comet 66P/du Toit Closest Approach To Earth (0.917 AU)
- Aug 08 - Comet P/2009 SK280 (Spacewatch-Hill) Closest Approach To Earth (3.430 AU)
- Aug 08 - Apollo Asteroid 2018 OG Near-Earth Flyby (0.059 AU)
- Aug 08 - 40th Anniversary (1978), Pioneer Venus 2 Launch
- Aug 08 - Svetlana Savitskaya's 70th Birthday (1948)
- Aug 08 - 155th Anniversary (1863), Pillistfer Meteorite Fall (Hit Building in Estonia)
- Aug 09 - Comet 172P/Yeung Closest Approach To Earth (2.922 AU)
- Aug 09 - Comet C/2017 M5 (TOTAS) At Opposition (5.039 AU)
- Aug 09 - Apollo Asteroid 2008 HU4 Closest Approach To Earth (1.236 AU)
- Aug 09 - Asteroid 27596 Maldives Closest Approach To Earth (1.314 AU)
- Aug 09 - Asteroid 6349 Acapulco Closest Approach To Earth (1.772 AU)
- Aug 09 - Asteroid 78756 Sloan Closest Approach To Earth (2.056 AU)
- Aug 10 - Comet 105P/Singer Brewster Perihelion (2.045 AU)
- Aug 10 - Comet C/2016 M1 (PANSTARRS) Perihelion (2.211 AU)
- Aug 10 - Comet 129P/Shoemaker-Levy At Opposition (3.625 AU)
- Aug 10 - Apollo Asteroid 11500 Tomaiyowit Closest Approach To Earth (0.462 AU)
- Aug 10 - Apollo Asteroid 1566 Icarus Closest Approach To Earth (0.551 AU)
- Aug 10 - Asteroid 1951 Lick Closest Approach To Earth (0.668 AU)
- Aug 10 - Amor Asteroid 3352 McAuliffe Closest Approach To Earth (1.531 AU)
- Aug 10 - Asteroid 58221 Boston Closest Approach To Earth (2.039 AU)
- Aug 10 - Asteroid 1941 Wild Closest Approach To Earth (2.070 AU)
- Aug 10 - Asteroid 1069 Planckia Closest Approach To Earth (2.382 AU)
- Aug 10 - 15th Anniversary (2003), 1st Person to Marry in Space (Yuri Malenchenko)
- Aug 10 - 50th Anniversary (1968), Piancaldoli Meteorite Fall (Hit House in Italy)
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Source: JPL Space Calendar

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Food for Thought

That Newfound Mineral Isn't Harder Than Diamond — But It Is from Space

Gold hunters in southern Russia might have been disappointed to learn that the speckled, yellow rock they uncovered was not a sizeable pebble of valuable metal. Instead, it was a rare piece of space-borne rubble containing a new mineral that had never before been seen on Earth.

The mineral came from the Uakit meteorite, named for the Russian location where it was found. Scientists recently presented their discovery of the meteorite's new mineral, named uakitite, at the Annual Meeting of the Meteoritical Society in Moscow.

The researchers found that more than 98 percent of the meteorite consists of kamacite, an alloy of iron and 5 to 10 percent nickel, that's formed in space and is found only in meteorites, which are rocks that fall from space to Earth's surface. The remaining 1 to 2 percent of the meteorite consists of just over a dozen minerals that, for the most part, are exclusively formed in space. On top of that, the composition of the extraordinary space rock suggests that it must have formed under brutally hot temperatures, well over 1,800 degrees Fahrenheit (1,000 degrees Celsius), the researchers said.

The team examined the meteorite with powerful microscopes and identified uakitite as tiny grains no bigger than 5 micrometers — about 25 times smaller than a fine grain of sand. The new mineral is so tiny that the scientists couldn't piece together all its physical properties.

But they were able to determine that the mineral is structurally similar to two other space-borne minerals, carlsbergite and osbornite. These minerals are referred to as mononitrides because they contain a single nitrogen atom in their chemical formula.

Mononitrides are very hard and are sometimes used as abrasive material, said Victor Sharygin, a geologist at the Institute of Geology and Mineralogy in Novosibirsk, Russia, and lead researcher on the discovery of uakitite.

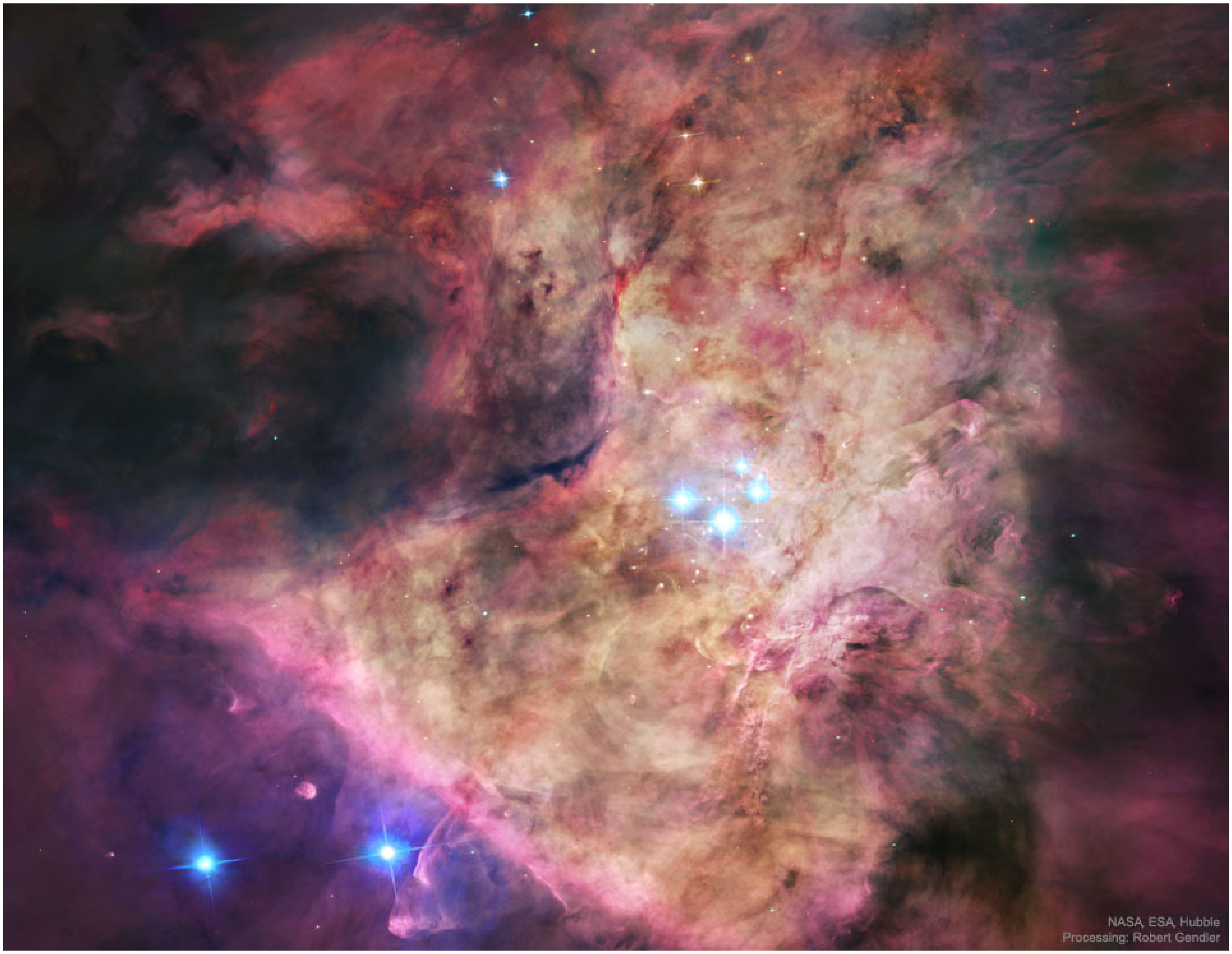
A few news publications have reported that uakitite is harder than a diamond, but Sharygin said that's not the case. In fact, he said, "the hardness of uakitite was not measured directly," because the grains were too small. Instead, the scientists estimated the hardness using synthetically produced vanadiumnitride, a mineral that closely resembles uakitite.

The researchers predicted that uakitite is between 9 and 10 on the Mohs hardness scale, meaning it's very hard — a diamond falls at 10. But Sharygin explained that the Mohs scale has a wide range between 9 and 10. All mononitrides fall at this end of the scale, he said, "but their hardness is lower than [that of] a diamond."

Sharygin said that synthetic boron nitride, another mineral produced at insanely hot temperatures, is likely the only mineral that comes close to being as hard as a diamond.

Source: Space.com Return to Contents

Space Image of the Week



Trapezium: At the Heart of Orion
Image Credit: *Data:* Hubble Legacy Archive, *Processing:* Robert Gendler

Explanation: Near the center of this sharp cosmic portrait, at the heart of the Orion Nebula, are four hot, massive stars known as the Trapezium. Gathered within a region about 1.5 light-years in radius, they dominate the core of the dense Orion Nebula Star Cluster. Ultraviolet ionizing radiation from the Trapezium stars, mostly from the brightest star Theta-1 Orionis C powers the complex star forming region's entire visible glow. About three million years old, the Orion Nebula Cluster was even more compact in its younger years and a recent dynamical study indicates that runaway stellar collisions at an earlier age may have formed a black hole with more than 100 times the mass of the Sun. The presence of a black hole within the cluster could explain the observed high velocities of the Trapezium stars. The Orion Nebula's distance of some 1,500 light-years would make it the closest known black hole to planet Earth.

Source: APOD

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