Space News Update

— May 12, 2017 —

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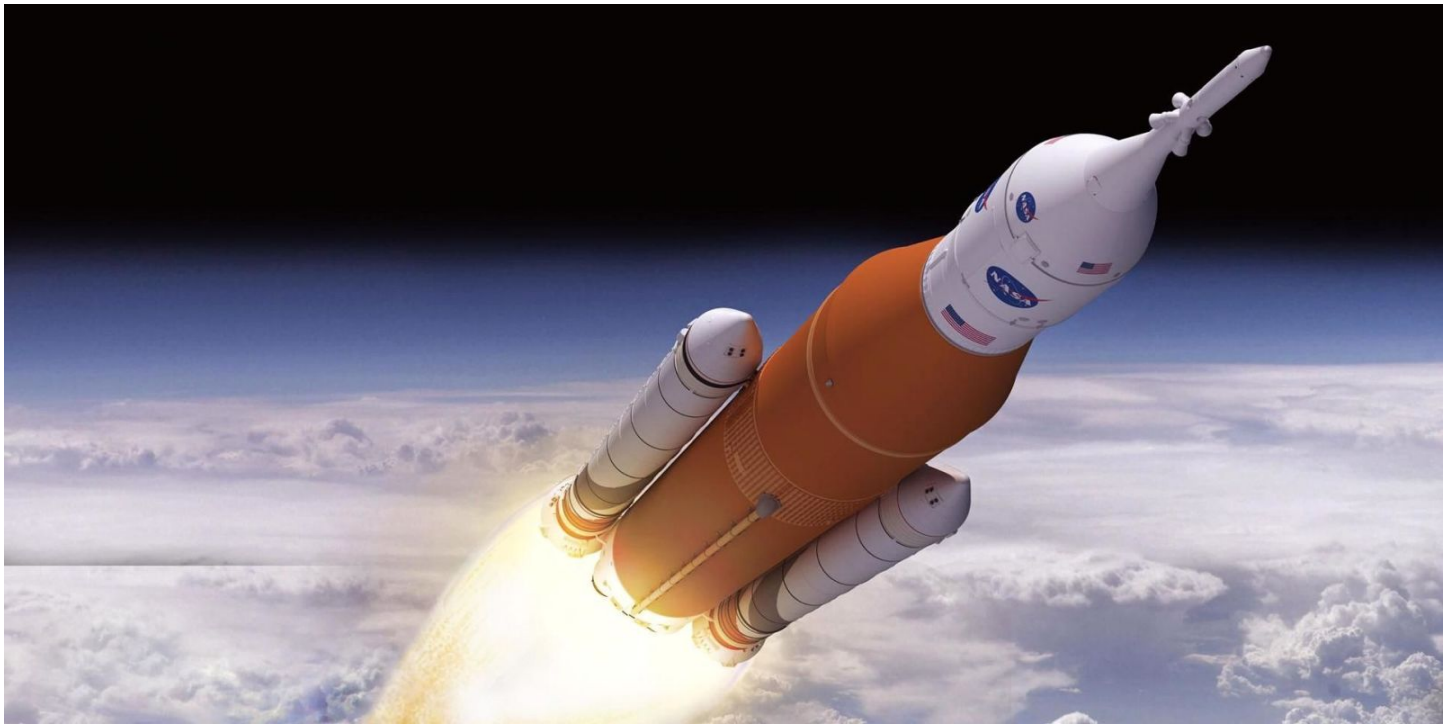
1. NASA Will Not Fly Astronauts on the First SLS Launch



Acting NASA Administrator Robert Lightfoot released a statement Friday, May 12, stating that NASA will not fly a crew on the first launch of the Space Launch System (SLS) rocket and Orion spacecraft. From the statement:

NASA appreciates the energy, creativity, and depth of engineering and program analysis that was brought to the decision, but ultimately, the decision was made not to fly crew on the first flight after weighing the data and assessing all implications. However, the work we did on this evaluation will flow into our planning for the next two years. We look forward to using this information to strengthen our EM-2 posture.

NASA was encouraged to explore the possibility of putting astronauts on the first flight of SLS and Orion by President Trump's NASA transition team. As a result, NASA and Lockheed Martin, the primary manufacturer of the Orion spacecraft, conducted a feasibility study to determine if it would be safe and practical to fly astronauts on the maiden flight of the SLS, known as Exploration Mission-1 or EM-1.

During a press conference held on May 12, however, Robert Lightfoot announced that EM-1 would remain uncrewed as originally planned. "At the end of the day we found it technically feasible to fly a crew on EM-1," Lightfoot said. However, "we decided that while it was technically feasible, we decided that the baseline plan we had in place was the best plan," he continued.

"EM-1 will go to a distant retrograde orbit around the moon," said William Gerstenmaier, Associate Administrator of NASA's Human Explorations and Operations. He continued to say that by not having a crew on EM-1, NASA will be able to push the Orion spacecraft and propulsion systems harder and longer, targeting a mission of between 21 and 25 days.

Last month, NASA announced that the first flight of SLS, crewed or not, would not happen until 2019. The agency was previously shooting for a 2018 launch date. However, structural challenges with the core stage of the rocket and other technical challenges forced NASA to push that first flight back until 2019 at the earliest. "NASA will execute its normal process to determine an official revised launch date for EM-1," Lightfoot wrote in his statement.

NASA still plans to launch astronauts on the second flight of SLS. Lightfoot mentioned in the press conference that keeping EM-1 uncrewed will allow NASA to accelerate the development of crewed systems, such as life support and a robust heat shield, that will be needed for EM-2. "An uncrewed mission will actually help EM-2 be a safer mission," he said.

In his statement, Lightfoot outlined the progress of SLS and Orion, which he described as "challenging but going well."

Currently, the SLS engine section structural test hardware is being shipped via barge to the Marshall Space Flight Center for testing. The Orion abort attitude control system was tested in Maryland, and Orion's heat shield is being fabricated and will be installed in a few months. All European systems for the Orion service module have been integrated into the Orion testing laboratory near Denver. Meanwhile, ground systems and software continue development at the Kennedy Space Center.

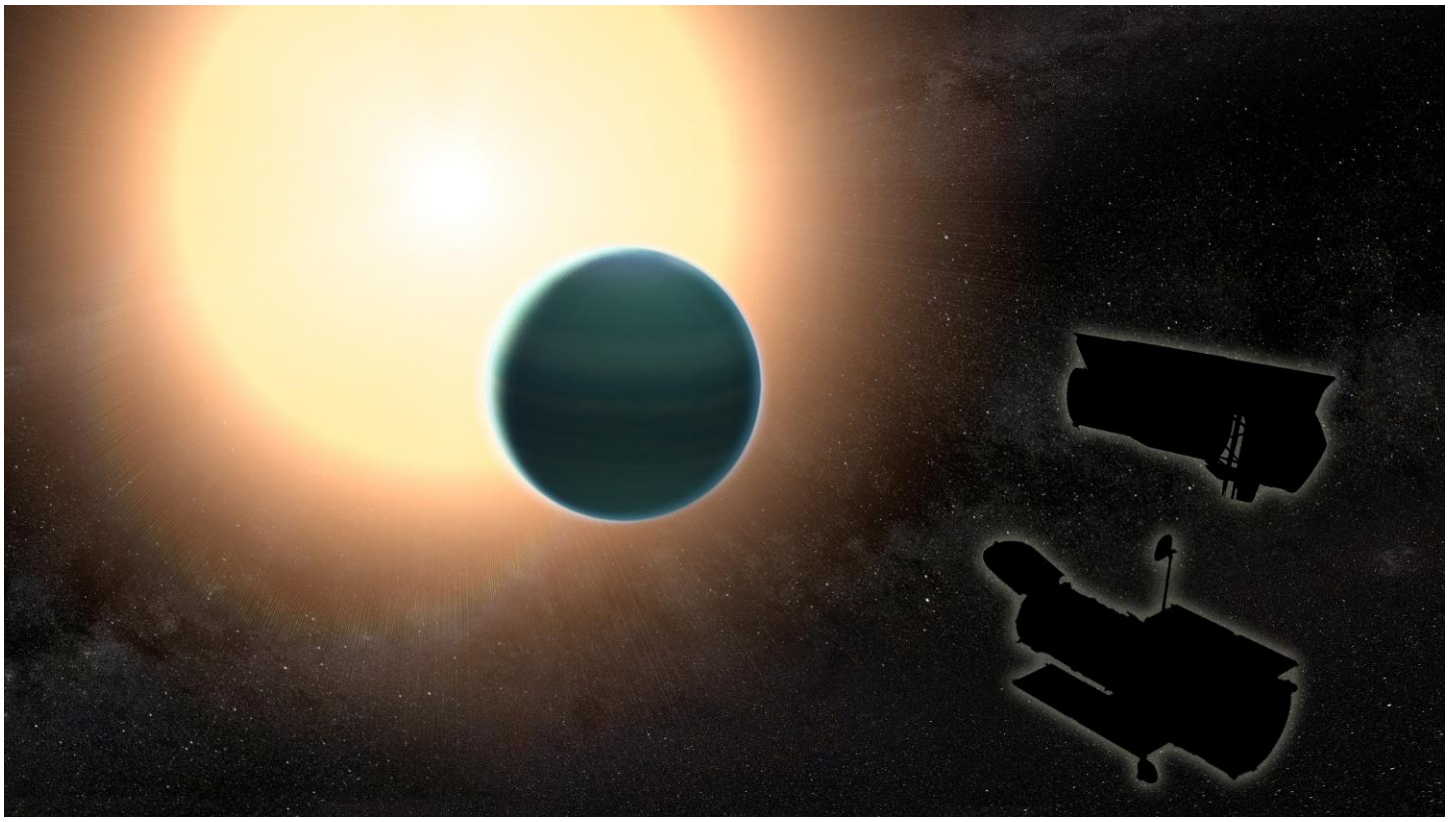
NASA plans for the SLS rocket and Orion spacecraft to be the flagship of the agency for decades to come, flying astronauts deeper into space than ever before. The massive rocket could take the first astronauts to Mars, and it could be used to launch robotic spacecraft to distant planets, such as Jupiter and Saturn, in just a few years rather than the roughly 8 to 10 years it takes with a smaller rocket.

"We need to keep in mind that EM-1 is the first in a broad series of exploration missions that will eventually take humans to deep space," Lightfoot wrote in his statement.

The enormous launch vehicle has been continually delayed since it was announced in 2010, however, and costs for the program continue to rise. A single launch of the SLS is expected to cost around $500 million, and the total program costs are estimated at more than $20 billion. The only way to start making those development costs back is to start launching the beast.

Source: Popular Mechanics Return to Contents

2. Primitive atmosphere discovered around 'Warm Neptune'



A pioneering new study uncovering the 'primitive atmosphere' surrounding a distant world could provide a pivotal breakthrough in the search to how planets form and develop in far-flung galaxies.

A team of international researchers, co-lead by Hannah Wakeford from NASA and Professor David Sing from the University of Exeter, has carried out one of the most detailed studies to date of a 'Warm Neptune' - a planet that is similar in size to our own Neptune, but which orbits its sun more closely.

The study revealed that the exoplanet - found around 430 light years from Earth - has an atmosphere that composed almost entirely of hydrogen and helium, with a relatively cloudless sky.

This primitive atmosphere suggests the planet most likely formed closer to its host star or later in its solar system development, or both, compared to the Ice Giants Neptune or Uranus.

Crucially, the discovery could also have wide implications for how scientists think about the birth and development of planetary systems in distant galaxies.

The research is published in leading journal, *Science*, on May 11 2017.

Professor Sing, from the University of Exeter's Astrophysics department said: "This exciting new discovery shows that there is a lot more diversity in the atmospheres of these exoplanets than we have previously thought.

"This 'Warm Neptune' is a much smaller planet than those we have been able to characterize in depth, so this new discovery about its atmosphere feels like a big breakthrough in our pursuit to learn more about how solar systems are formed, and how it compares to our own."

In order to study the atmosphere of the planet - named HAT-P-26b - the researchers used data collected when the planet passed in front of its host star, events known as transits.

During a transit, a fraction of the starlight gets filtered through the planet's atmosphere, which absorbs some wavelengths of light but not others. By looking at how the signatures of the starlight change as a result of this filtering, researchers can work backward to figure out the chemical composition of the atmosphere.

In this case, the team pooled data from four separate transits measured by NASA's Hubble Space Telescope, and two seen by NASA's Spitzer Space Telescope.

The analysis provided enough detail to determine the planet's atmosphere is relatively clear of clouds and has a strong water signature - also the best measurement of water to date on an exoplanet of this size.

The researchers used the water signature to estimate the metallicity, an indication of how rich the planet is in all elements heavier than hydrogen and helium. Astronomers calculate the metallicity because it gives them clues about how a planet formed.

To compare planets by their metallicities, scientists use the sun as a point of reference - similar to describing how much caffeine different drinks have by comparing them to a standard cup of coffee.

In our solar system, the metallicity in Jupiter (5 times greater than the sun) and Saturn (10 times) suggest these 'Gas Giants' are made almost entirely of hydrogen and helium. Neptune and Uranus, however, are richer in the heavier elements, with metallicities of about 100 times that of the sun.

Scientists think this happened because, as the solar system was taking shape, Neptune and Uranus formed in a region toward the outskirts of the enormous disk of dust, gas and debris that swirled around the immature sun.

As a result, they would have been bombarded with a lot of icy debris that was rich in heavier elements. Jupiter and Saturn, in contrast, formed in a warmer part of the disk and would therefore have encountered less of the icy debris.

This new study However, this new study discovered that HAT-P-26b bucks the trend. The research team believes its metallicity is only about 4.8 times that of the sun - much closer to the value for Jupiter than for Neptune.

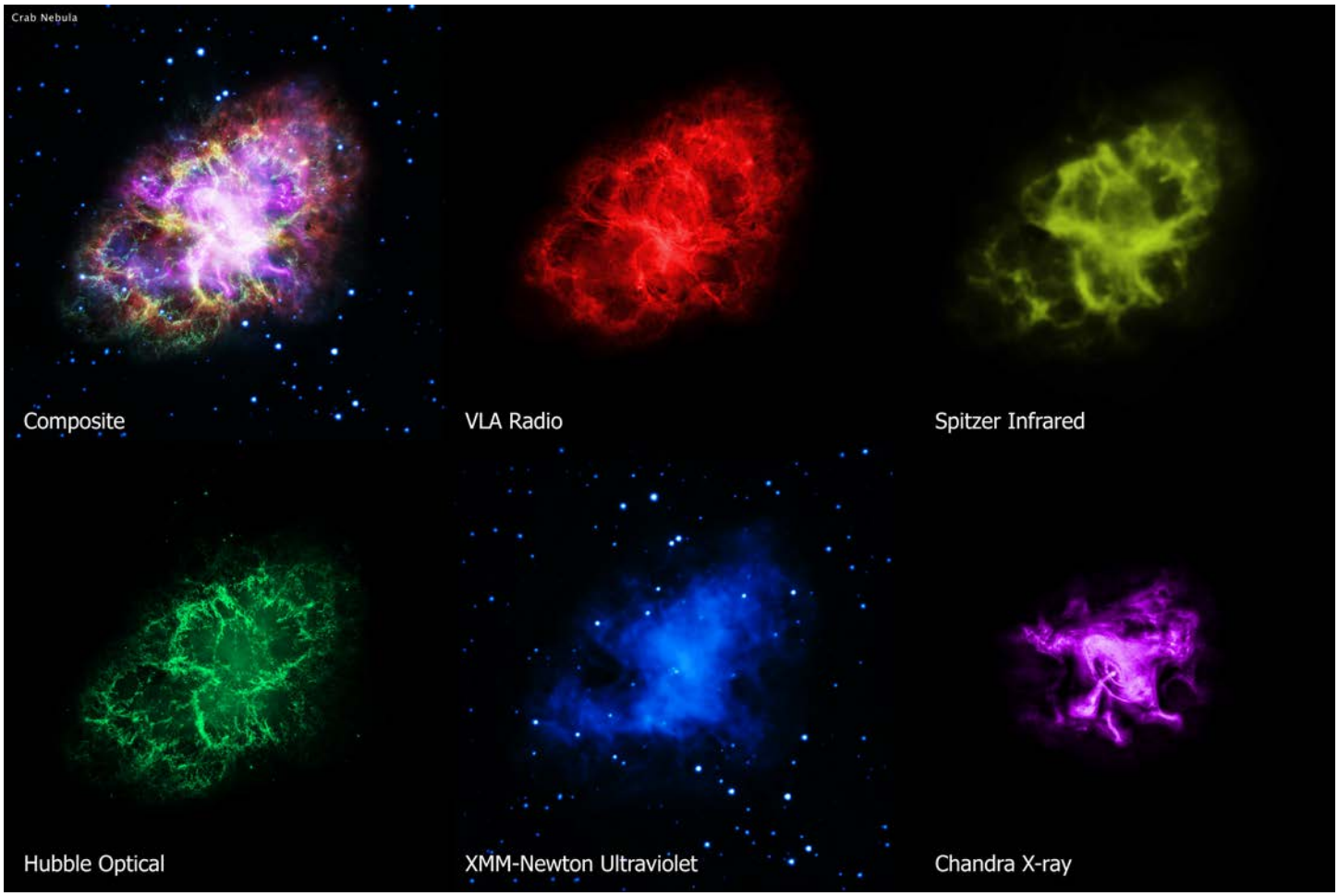
Hannah Wakeford, who previously studied at the University of Exeter and is now a postdoctoral researcher at NASA's Goddard Space Flight Center in Greenbelt, Maryland, led the study.

Hannah said: "Astronomers have just begun to investigate the atmospheres of these distant Neptune-mass planets, and almost right away, we found an example that goes against the trend in our solar system. This kind of unexpected result is why I really love exploring the atmospheres of alien planets."

Co-author Tiffany Kataria of the Jet Propulsion Laboratory in Pasadena, California added: "To have so much information about a warm Neptune is still rare, so analyzing these data sets simultaneously is an achievement in and of itself."

Source: Phys.org Return to Contents

3. Observatories Combine to Crack Open the Crab Nebula



Astronomers have produced a highly detailed image of the Crab Nebula, by combining data from telescopes spanning nearly the entire breadth of the electromagnetic spectrum, from radio waves seen by the Karl G. Jansky Very Large Array (VLA) to the powerful X-ray glow as seen by the orbiting Chandra X-ray Observatory. And, in between that range of wavelengths, the Hubble Space Telescope's crisp visible-light view, and the infrared perspective of the Spitzer Space Telescope.

The Crab Nebula, the result of a bright supernova explosion seen by Chinese and other astronomers in the year 1054, is 6,500 light-years from Earth. At its center is a super-dense neutron star, rotating once every 33 milliseconds, shooting out rotating lighthouse-like beams of radio waves and light -- a pulsar (the bright dot at image center). The nebula's intricate shape is caused by a complex interplay of the pulsar, a fast-moving wind of particles coming from the pulsar, and material originally ejected by the supernova explosion and by the star itself before the explosion.

This image combines data from five different telescopes: the VLA (radio) in red; Spitzer Space Telescope (infrared) in yellow; Hubble Space Telescope (visible) in green; XMM-Newton (ultraviolet) in blue; and Chandra X-ray Observatory (X-ray) in purple.

The new VLA, Hubble, and Chandra observations all were made at nearly the same time in November of 2012. A team of scientists led by Gloria Dubner of the Institute of Astronomy and Physics (IAFE), the National Council of Scientific Research (CONICET), and the University of Buenos Aires in Argentina then made a thorough analysis of the newly revealed details in a quest to gain new insights into the complex physics of the object. They are reporting their findings in the Astrophysical Journal.

"Comparing these new images, made at different wavelengths, is providing us with a wealth of new detail about the Crab Nebula. Though the Crab has been studied extensively for years, we still have much to learn about it," Dubner said.

Source: JPL Return to Contents

The Night Sky

Friday, May 12
• The Arch of Spring spans the western sky in late twilight. Pollux and Castor form its top: they're lined up roughly horizontally in the west-northwest, about three finger-widths at arm's length apart. Look far to their lower left for Procyon, and farther to their lower right for Menkalinan and then bright Capella. The Arch of Spring is the last departing section of the even bigger Winter Hexagon.

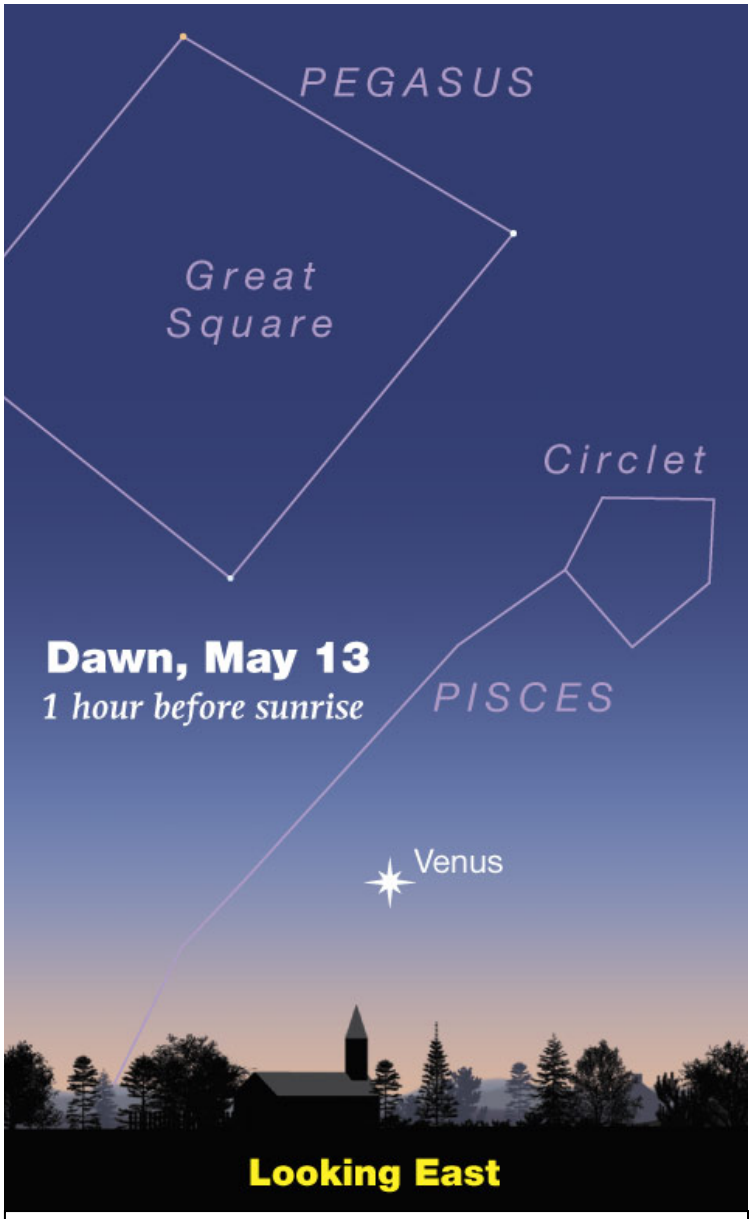
• By 1 or 2 a.m. tonight the waning gibbous Moon is up in the east, with Antares to its right and Saturn to its lower left. By dawn Saturday, the Moon has moved noticeably closer to Saturn.

Saturday, May 13
• Three zero-magnitude stars shine after dark in May: Arcturus high in the southeast, Vega much lower in the northeast, and Capella in the northwest. They appear so bright because each is at least 60 times as luminous as the Sun, and because they're all relatively nearby: 37, 25, and 42 light-years from us, respectively.

• In early dawn Sunday morning, look for Saturn lower right of the Moon. Much farther to the lower right of this pair is fiery Antares.

Sunday, May 14
• As twilight fades, look very low in the west-southwest. Can you can still pick up Sirius, twinkling hard? The farther north you are, the harder it will be. Binoculars help. When is the final date you'll see Sirius at all?

Monday, May 15
• As the stars come out, face north and look almost straight up for the Big Dipper, now in its floating-upside-down position. Its handle curves in the direction toward bright Arcturus.



All this month you'll find the "Morning Star" low in the east as dawn brightens. Follow it with a telescope even after sunrise.

Tuesday, May 16
• Vega is the brightest star in the east-northeast after dark. Look 14° (about a fist and a half at arm's length) to Vega's upper left for Eltanin, the nose of Draco the Dragon. Closer above and upper left of Eltanin are the three fainter stars of Draco's stick-figure head, also called the Lozenge. Draco always points his nose to Vega; he looks curious about it.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Fri May 12, 2:32 AM	< 1 min	14°	14° above ENE	11° above ENE
Fri May 12, 4:04 AM	3 min	21°	16° above WNW	16° above NNE
Sat May 13, 3:14 AM	1 min	29°	29° above N	20° above NNE
Sat May 13, 4:49 AM	2 min	11°	10° above NNW	10° above N
Sun May 14, 2:24 AM	< 1 min	15°	15° above NE	12° above NE
Sun May 14, 3:56 AM	3 min	14°	10° above NW	12° above N
Mon May 15, 3:06 AM	1 min	19°	19° above NNW	15° above N
Mon May 15, 4:43 AM	< 1 min	10°	10° above N	10° above N
Tue May 16, 2:15 AM	< 1 min	17°	17° above NNE	17° above NNE
Tue May 16, 3:50 AM	2 min	11°	10° above NNW	10° above N

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

NASA-TV Highlights

(all times Eastern Daylight Time)

No Live Event coverage through May 19th.

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

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Space Calendar

- May 12 - NEW [May 07] Apollo Asteroid 2017 JA2 Near-Earth Flyby (0.007 AU)
- May 12 - Apollo Asteroid 2016 LJ49 Near-Earth Flyby (0.062 AU)
- May 12 - Aten Asteroid 2017 HZ4 Near-Earth Flyby (0.072 AU)
- May 12 - Atira Asteroid 2012 VE46 Closest Approach To Earth (0.536 AU)
- May 12 - Apollo Asteroid 4769 Castalia Closest Approach To Earth (0.751 AU)
- May 12 - Neptune Trojan 2010 TS191 At Opposition (29.692 AU)
- May 12 - Meeting: The Large Synoptic Survey Telescope, London, United Kingdom
- May 13 - Comet 211P/Hill At Opposition (2.586 AU)
- May 13 - Comet 36P/Whipple At Opposition (3.989 AU)
- May 13 - NEW [May 07] Apollo Asteroid 2017 JR1 Near-Earth Flyby (0.040 AU)
- May 13 - Asteroid 10387 Bepicolombo Closest Approach To Earth (1.705 AU)
- May 13 - Asteroid 91007 Ianfleming Closest Approach To Earth (1.765 AU)
- May 13 - Asteroid 34901 Mauna Loa Closest Approach To Earth (2.796 AU)
- May 14 - Comet C/2016 T1 (Matheny) Closest Approach To Earth (1.562 AU)
- May 14 - Comet 255P/Levy Closest Approach To Earth (1.765 AU)
- May 14 - Asteroid 7958 Leakey Closest Approach To Earth (0.976 AU)
- May 14 - Asteroid 274020 Skywalker Closest Approach To Earth (2.089 AU)
- May 14 - Asteroid 27500 Mandelbrot Closest Approach To Earth (2.621 AU)
- May 14-20 - 2nd Nuclear Science Summer School (NS3), East Lansing, Michigan
- May 15 - UPDATED [May 11] Inmarsat 5 F4 Falcon 9 Launch
- May 15 - Cassini, Distant Flyby of Ephimetheus, Pan, Aegaeon & Atlas
- May 15 - Comet P/2015 D6 (Lemmon-PANSTARRS) Closest Approach To Earth (4.520 AU)
- May 15 - NEW [May 11] Apollo Asteroid 2017 JM2 Near-Earth Flyby (0.013 AU)
- May 15 - Apollo Asteroid 1996 VB3 Near-Earth Flyby (0.054 AU)
- May 15 - Asteroid 58221 Boston Closest Approach To Earth (1.932 AU)
- May 15 - Asteroid 3992 Wagner Closest Approach To Earth (2.027 AU)
- May 15 - Asteroid 78756 Sloan Closest Approach To Earth (2.054 AU)
- May 15 - Asteroid 100007 Peters Closest Approach To Earth (2.243 AU)
- May 15 - 20th Anniversary (1997), STS-84 Launch (Space Shuttle Atlantis, Mir Space Station)
- May 15 - Williamina Fleming's 160th Birthday (1857)
- May 15-19 - International Conference on Mars Aeronomy 2017, Boulder, Colorado
- May 16 - Comet 73P-AE/Schwassmann-Wachmann Perihelion (0.966 AU)
- May 16 - Comet 216P/LINEAR Closest Approach To Earth (2.294 AU)
- May 16 - Apollo Asteroid 2012 EC Near-Earth Flyby (0.050 AU)
- May 16 - Asteroid 93 Minerva Closest Approach To Earth (1.469 AU)
- May 16 - Asteroid 6143 Pythagoras Closest Approach To Earth (1.879 AU)
- May 16 - Asteroid 188534 Mauna Kea Closest Approach To Earth (1.941 AU)
- May 16 - Forrest Petersen's 95th Birthday (1922)

Source: JPL Space Calendar

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Food for Thought

Europa Lander Could Carry a Microphone and "Listen" to the Ice to Find Out What's Underneath

Between the Europa Clipper and the proposed Europa Lander, NASA has made it clear that it intends to send a mission to this icy moon of Jupiter in the coming decade. Ever since the *Voyager 1* and *2* probes conducted their historic flybys of the moon in 1973 and 1974 – which offered the first indications of a warm-water ocean – scientists have been eager to peak beneath the surface and see what lies within.

Towards this end, NASA has issues a grant to a team of researchers from Arizona State University to build and test a specially-designed seismometer that the lander would use to listen to Europa's interior. Known as the Seismometers for Exploring the Subsurface of Europa (SESE), this device will help scientists determine if the interior of Europa is conducive to life.

According to the profile for the Europa Lander, this microphone would be mounted to the robotic probe. Once it reached the surface of the moon, the seismometer would begin collecting information on Europa's subsurface environment. This would include data on its natural tides and movements within the shell which would determine it's thickness.

It would also determine if the surface has pockets of water – i.e. subsurface lakes – and see how often water rises to the surface. For some time, scientists have suspected that Europa's "chaos terrain" would be the ideal place to search for evidence of life. These features, which are basically a jumbled mess of ridges, cracks, and plains, are believed to be spots where the subsurface ocean is interacting with the icy crust.

As such, any evidence of organic molecules or biological organisms would be easiest to find there. In addition, astronomers have also detected water plumes coming from Europa's surface. These are also considered one of

the best bets for finding evidence of life in the interior. But before these features can be explored directly, determining where reservoirs of water reside beneath the ice and if they are connected to the interior ocean is paramount.

And this is where instruments like the SESE would come into play. Hongyu Yu is an exploration system engineer from ASU's School of Earth and Space Exploration and the leader of the SESE team. As he stated in a recent ASU Now article, "We want to hear what Europa has to tell us. And that means putting a sensitive 'ear' on Europa's surface."

While the idea of a Europa Lander is still in the concept-development stage, NASA is working to develop all the necessary components for such a mission. As such, they have provided the ASU team with a grant to develop and test their miniature seismometer, which measures no more than 10 cm (4 inches) on a side and could be easily fitted aboard a robotic lander.

More importantly, their seismometer differs from conventional designs in that it does not rely on a mass-and-spring sensor. Such a design would be ill-suited for a mission to another body in our Solar System since it needs to be positioned upright, which requires that it be carefully planted and not disturbed. What's more, the sensor needs to be placed within a complete vacuum to ensure accurate measurements.

By using a micro-electrical system with a liquid electrolyte for a sensor, Yu and his team have created a seismometer that can operate under a wider range of conditions. "Our design avoids all these problems," he said. "This design has a high sensitivity to a wide range of vibrations, and it can operate at any angle to the surface. And if necessary, they can hit the ground hard on landing."

As Lenore Dai – a chemical engineer and the director of the ASU's School for Engineering of Matter, Transport and Energy – explained, the design also makes the SESE well suited for exploring extreme environments – like Europa's icy surface. "We're excited at the opportunity to develop electrolytes and polymers beyond their traditional temperature limits," she said. "This project also exemplifies collaboration across disciplines."

As Yu indicated, SESE can take a beating without compromising its sensor readings, which was tested when the team struck the SESE with a sledgehammer and found that it still worked afterwards. According to seismologist Edward Garnero, who is also a member of the SESE team, this will come in handy. Landers typically have six to eight legs, he claims, which could be mated with seismometers to turn them into scientific instruments.

Having this many sensors on the lander would give scientists the ability to combine data, allowing them to overcome the issue of variable seismic vibrations recorded by each. As such, ensuring that they are rugged is a must.

"Seismometers need to connect with the solid ground to operate most effectively. If each leg carries a seismometer, these could be pushed into the surface on landing, making good contact with the ground. We can also sort out high frequency signals from longer wavelength ones. For example, small meteorites hitting the surface not too far away would produce high frequency waves, and tides of gravitational tugs from Jupiter and Europa's neighbor moons would make long, slow waves."

Such a device could also prove crucial to missions other "ocean worlds" within the Solar System, which include Ceres, Ganymede, Callisto, Enceladus, Titan and others. On these bodies as well, it is believed that life could very well exist in warm-water oceans that lie beneath the surface. As such, a compact, rugged seismometer that is capable of working in extreme-temperature environments would be ideal for studying their interiors.

What's more, missions of this kind would be able to reveal where the ice sheets on these bodies are thinnest, and hence where the interior oceans are most accessible. Once that's done, NASA and other space agencies will know exactly where to send in the probe (or possibly the robotic submarine). Though we might have to wait a few decades on that one!

Source: Universe Today Return to Contents

Space Image of the Week

Hubble Catches a Galaxy Duo by the "Hare"

This image from the NASA/ESA Hubble Space Telescope shows the unusual galaxy IRAS 06076-2139, found in the constellation Lepus (The Hare). Hubble's Wide Field Camera 3 (WFC3) and Advanced Camera for Surveys (ACS) instruments observed the galaxy from a distance of 500 million light-years.

This particular object stands out from the crowd by actually being composed of two separate galaxies rushing past each other at about 2 million kilometers (1,243,000 miles) per hour. This speed is most likely too fast for them to merge and form a single galaxy. However, because of their small separation of only about 20,000 light-years, the galaxies will distort one another through the force of gravity while passing each other, changing their structures on a grand scale.

Such galactic interactions are a common sight for Hubble, and have long been a field of study for astronomers. The intriguing behaviors of interacting galaxies take many forms; galactic cannibalism, galaxy harassment and even galaxy collisions. The Milky Way itself will eventually fall victim to the

latter, merging with the Andromeda Galaxy in about 4.5 billion years. The fate of our galaxy shouldn't be alarming though: while galaxies are populated by billions of stars, the distances between individual stars are so large that hardly any stellar collisions will occur.

Source: NASA Return to Contents