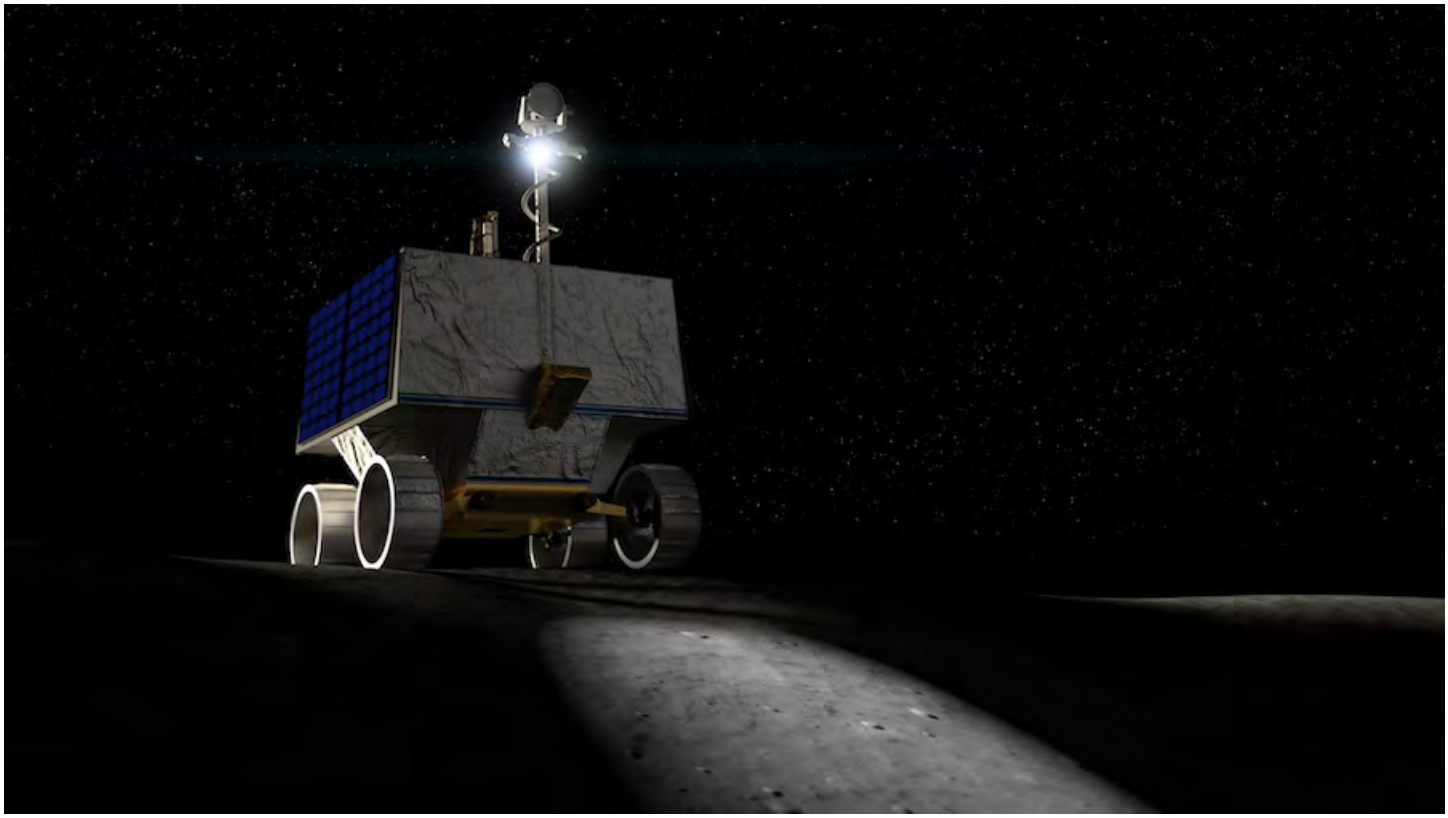
Space News Update

— November 1, 2019 —

Contents

1. **NASA's VIPER rover in development for scouting mission to moon's south**



Building on a mission canceled last year, NASA is developing a mobile robot named VIPER for launch in 2022 to scout for water ice at the moon's south pole, the same region where the agency aims to land astronauts by 2024.

The $250 million rover mission, developed by engineers and scientists at three NASA centers in California, Florida and Texas, will be delivered to the moon's south pole by a commercial lander.

About the size of a golf cart, the Volatiles Investigating Polar Exploration Rover will traverse several miles on the lunar surface, using its four instruments to survey the polar landscape and analyze the lunar soil's water content.

"The key to living on the moon is water – the same as here on Earth," said Daniel Andrews, the project manager of the VIPER mission and director of engineering at NASA's Ames Research Center in Silicon Valley. "Since the confirmation of lunar water ice ten years ago, the question now is if the moon could really contain the amount of resources we need to live off-world. This rover will help us answer the many questions we have about where the water is, and how much there is for us to use."

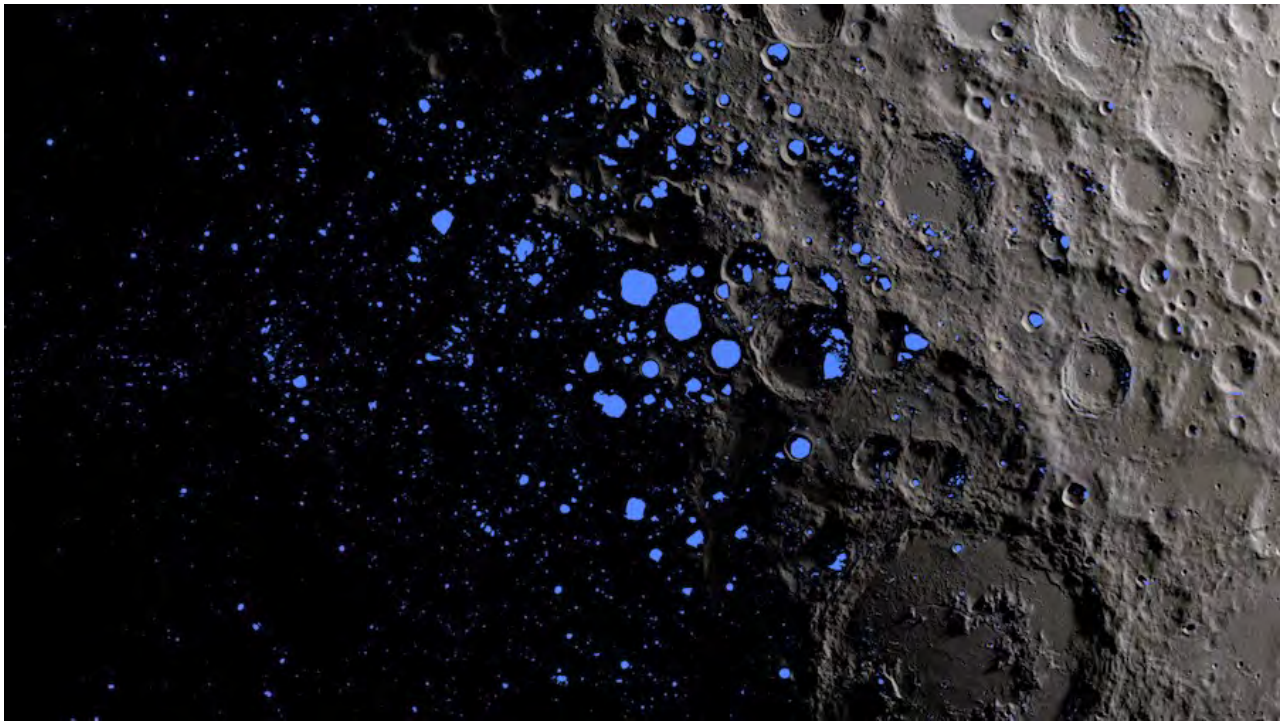
NASA formally unveiled plans for the lunar south pole rover Oct. 25, soon after VIPER passed a mission-level requirements review by an independent NASA review panel, agency officials said. With the mission requirements now established, the VIPER team is gearing up for a preliminary design review next year, in preparation for launch and delivery to the lunar surface in December 2022.

"This ambitious timeline was made possible because of the previous extensive technical work done for Resource Prospector," team members said in response to questions from Spaceflight Now.

Resource Prospector, which consisted of a NASA-developed lander and rover, was canceled last year as the agency emphasized a new commercial approach to lunar exploration. NASA selected nine companies last November to compete for contracts to deliver scientific payloads to the moon using new commercially-developed robotic landers.

The VIPER rover will ride to the moon on a privately-owned lander procured through the Commercial Lunar Payload Services, or CLPS, program, NASA said.

The rover will be about the size of a golf cart and weigh around 770 pounds (350 kilograms), officials said.



This is a map showing the permanently shadowed regions (blue) that cover about three percent of the moon's south pole. This map was generated using data from NASA's Lunar Reconnaissance Orbiter. Credit: NASA

During a 100-day mission, VIPER will scout the same region targeted for a human landing in 2024 by NASA's Artemis program.

"NASA's priority for VIPER will be a region that contains a range of terrains that offer differing temperatures and light conditions in order to fully understand the nature of the water and volatiles therein," the VIPER team wrote in a response to emailed questions. "The landing locations for the human landers have different specifications, driven by the specific needs of the human mission."

In March, Vice President Mike Pence challenged NASA to land the first woman and the next man at the moon's south pole by the end of 2024. Since then, the agency has fast-tracked development of new human-rated landers to accomplish a human return to the moon's surface within five years.

NASA plans to select up to four companies late this year or in early 2020 to begin development of a human-rated lander. Late next year, NASA intends to choose two of the companies to proceed into full-scale development for landing missions in 2024 and 2025.

But that schedule assumes Congress allocates funding to cover the multibillion-dollar cost of accelerating the lunar program from its previous targeted landing date in 2018.

Under NASA's current planning, the agency's Space Launch System and Orion crew capsule will launch on an unpiloted test flight in 2021, followed by a mission around the moon on the next SLS/Orion mission. Astronauts on the third SLS/Orion mission, designated Artemis 3, would attempt to land on the moon after rendezvousing with a lander already launched into lunar orbit by a commercial rocket.

Scientists discovered evidence of water ice bound in soil at the moon's poles using a NASA-funded instrument on India's Chandrayaan spacecraft, which operated in lunar orbit from November 2008 through August 2009.

The image shows the distribution of surface ice at the moon's south pole (left) and north pole (right), detected by NASA's Moon Mineralogy Mapper instrument. Blue represents the ice locations, plotted over an image of the lunar surface, where the gray scale corresponds to surface temperature (darker representing colder areas and lighter shades indicating warmer zones). The ice is concentrated at the darkest and coldest locations, in the shadows of craters. This is the first time scientists have directly observed definitive evidence of water ice on the moon's surface.
Credit: NASA

NASA crashed a satellite and a spent Centaur rocket stage into a crater near the south pole in 2009. Data gathered by that mission found the lunar materials excavated by the impacts contained water, providing scientists with another data point to confirm the presence of ice at the moon's polar regions.

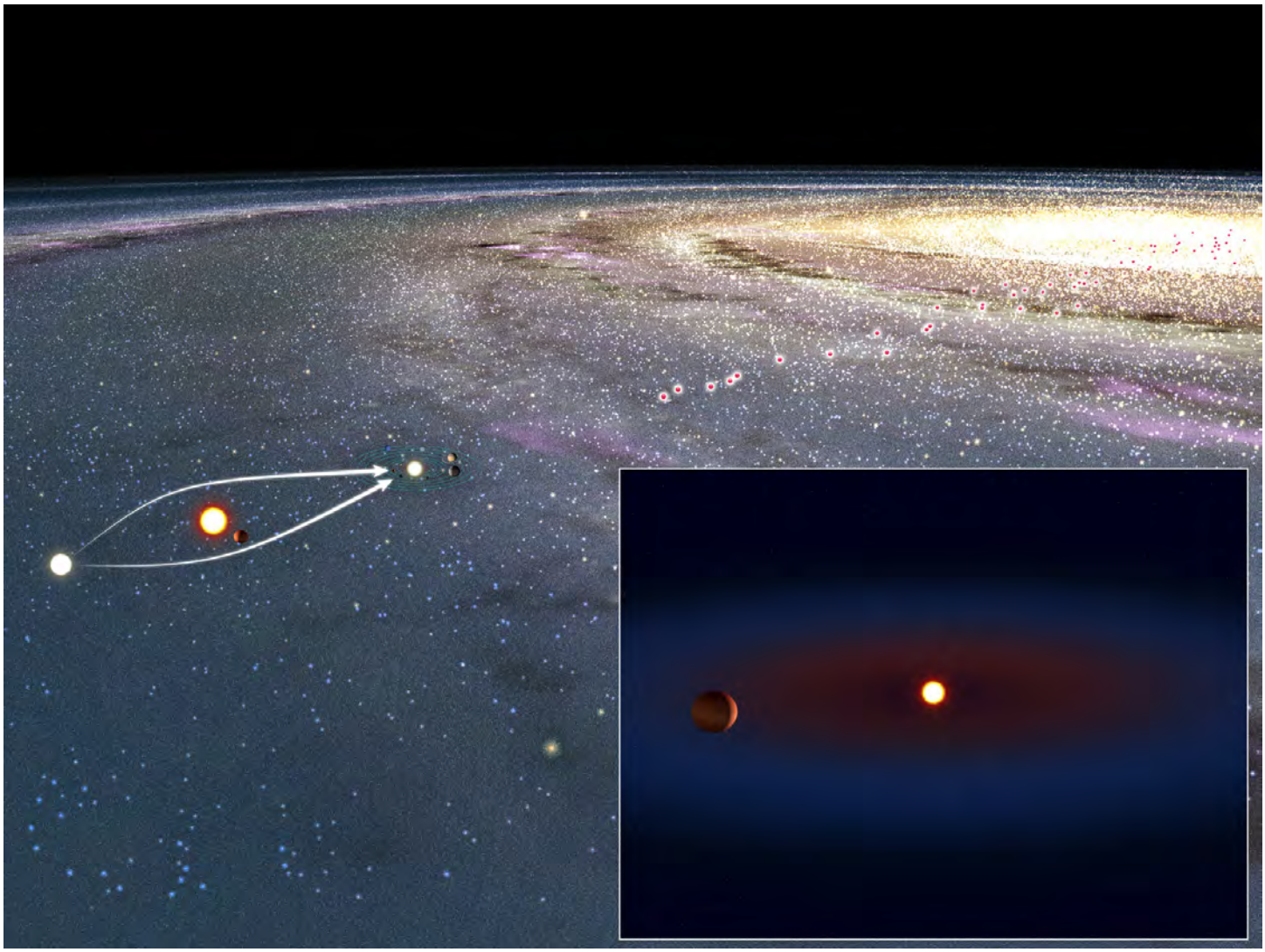
Water ice on the moon could be tapped by future missions to generate rocket propellant, breathing air and other resources.

"It's incredibly exciting to have a rover going to the new and unique environment of the south pole to discover where exactly we can harvest that water," said Anthony Colaprete, VIPER's project scientist at NASA's Ames Research Center, which is leading the VIPER mission. "VIPER will tell us which locations have the highest concentrations and how deep below the surface to go to get access to water."

VIPER will carry a neutron spectrometer to sense the presence of water below the lunar surface, and a drill provided by Honeybee Robotics will collect samples from a depth of up to a meter, or more than 3 feet, for analysis by on-board instruments.

Source: Spaceflight Now Return to Contents

2. Worldwide observations confirm nearby 'lensing' exoplanet



Researchers using telescopes around the world confirmed and characterized an exoplanet orbiting a nearby star through a rare phenomenon known as gravitational microlensing. The exoplanet has a mass similar to Neptune, but it orbits a star lighter (cooler) than the Sun at an orbital radius similar to Earth's orbital radius. Around cool stars, this orbital region is thought to be the birth place of gas-giant planets. The results of this research suggest that Neptune-sized planets could be common around this orbital region. Because the exoplanet discovered this time is closer than other exoplanets discovered by the same method, it is a good target for follow-up observations by world-class telescopes like the Subaru Telescope.

On November 1, 2017 amateur astronomer Tadashi Kojima in Gunma Prefecture, Japan reported an enigmatic new object in the constellation Taurus. Astronomers around the world began follow-up observations and determined that this was an example of a rare event known as gravitational microlensing. Einstein's Theory of General Relativity tells us that gravity warps space. If a foreground object with strong gravity passes directly in front of a background object in outer space this warped space can act as a lens and focus the light from the background object, making it appear to brighten temporarily. In the case of the object spotted by Kojima, a star 1600 light-years away passed in front of a star 2600 light-years away. Furthermore, by studying the change in the lensed brightness, astronomers determined that the foreground star has a planet orbiting it.

This is not the first time an exoplanet has been discovered by the microlensing technique. But microlensing events are rare and short lived, so the ones discovered so far lie towards the Galactic Center, where stars are

the most abundant. In contrast, this exoplanet system was found in almost exactly the opposite direction as observed from the Earth.

One team led by Akihiko Fukui at the University of Tokyo using a collection of 13 telescopes located around the world, including the 188-cm telescope and 91-cm telescope at NAOJ's Okayama Astrophysical Observatory, observed this phenomenon for 76 days and collected enough data to determine the characteristics of the exoplanet system. The host star has a mass about half the mass of the Sun. The exoplanet around it has an orbit similar in size to Earth's orbit, and a mass about 20% heavier than Neptune.

This orbital radius around this type of star coincides with the region where water condenses into ice during the planet formation phase, making this place theoretically favorable for forming gas-giant planets. Theoretical calculations show that this kind of planet has an a priori detection probability of only 35%. The fact that this exoplanet was discovered by pure chance suggests Neptune-sized planets could be common around this orbital region.

This exoplanet system is closer and brighter as seen from Earth than other exoplanet systems discovered by microlensing. This makes it a prime target for follow-up observations with world-leading telescopes like the Subaru Telescope or next generation extremely large telescopes like the Thirty Meter Telescope TMT.

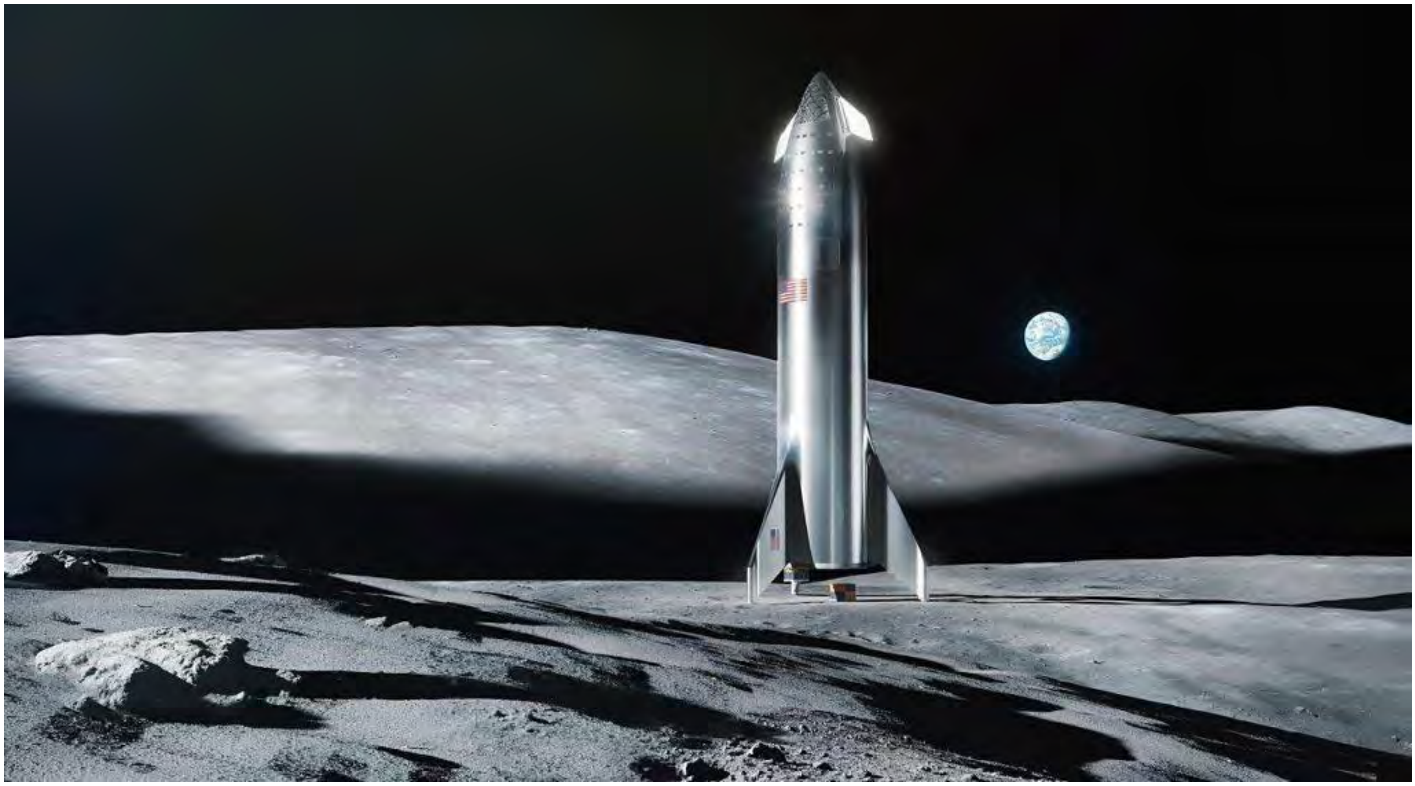
These findings were published as Fukui et al. "Kojima-1Lb is a Mildly Cold Neptune around the Brightest Microlensing Host Star" in the *Astronomical Journal* on November 1, 2019.

Source: Phys.org Return to Contents

3. **SpaceX is Sure They'll be Able to Land Starship on the Moon in 2022**

Things are looking pretty good for Elon Musk and SpaceX, the company he founded back in 2002 with the intent of reinvigorating space exploration. In the last six months alone, SpaceX has deployed the first batch of its Starlink broadband internet satellites to space, conducted two successful untethered tests with the *Starship Hopper*, and finished work on the first orbital-class *Starship* test vehicle (the Mk.1).

And at the 70th International Astronautical Congress, which took place last week in Washington, DC, SpaceX president and Cheif Operations Officer Gwynne Shotwell provided additional details about the *Starship*'s mission timeline. As she indicated during a series of interviews, the company hopes to be sending the *Starship* to orbit next year, landing on the Moon by 2022, and sending crews to the lunar surface by 2024.



Stainless Steel Starship on the Moon. Credit: SpaceX

As Shotwell was quoted as saying by TechCrunch:

"Aspirationally, we want to get Starship to orbit within a year. We definitely want to land it on the Moon before 2022. We want to [...] stage cargo there to make sure that there are resources for the folks that ultimately land on the Moon by 2024, if things go well, so that's the aspirational time frame."

The two *Starship* prototypes (Mk.1 and Mk.2), are being developed at their South Texas Launch Site in Boca Chica, Texas, and Cape Canaveral Space Launch Complex 40 (SLC-40) in Florida, respectively. The Mk.1 was unveiled at a press conference back in September (during the company's 11th anniversary) where Musk presented the latest updates on the *Starship*'s design and the company's proposed timeline.

If this is starting to sound familiar, that's probably because it's entirely like Elon Musk himself to be optimistic with timelines. And while SpaceX has not always met the deadlines Musk has set in the past, they have managed to deliver on all of their promises – from the development of reusable first stage rockets and the creation of the *Falcon Heavy* to the recovery of payload fairings and the deployment of broadband satellites.

And as Shotwell touched on during her onstage interview at the 2019 IAC, Musk's ambitious nature is an essential part of their success:

"Elon puts out these incredibly audacious goals and people say 'You're not going to do it, you'll never get to orbit, you'll never get a real rocket to orbit, […] you'll never get Heavy to orbit, you'll never get Dragon to the station, you'll never get Dragon back, and you'll never land a rocket,'. So, frankly, I love when people say we can't do it, because it motivates my fantastic 6,500 employees to go do that thing."

Speaking of ambitious, Musk has already stated that he hopes to conduct high-altitude test flights using the Mk.1 and Mk.2 sometime next year. Once this is complete, the company will be constructing additional prototypes for launch to Low Earth Orbit and, eventually, crewed test flights. In recent years, he's also revealed details about the first lunar tourism mission that is tentatively scheduled by 2023 (in a campaign called #dearmoon).

Already, SpaceX has contracted with Intuitive Machines and ispace, two commercial aerospace companies that have signed with NASA to deliver payloads to the Moon. These contracts are part of the agency's Lunar Cargo Transportation and Landing by Soft Touchdown(CATALYST) program, which is seeking partners to provide logistical support in advance of the Artemis missions, which are scheduled to send astronauts there by 2024.

Artist's impression of the stainless steel Starship and Super Heavy launch system in orbit. Credit: SpaceX

These agreements specify that SpaceX will be providing launch services using its fleet of *Falcon 9* rockets. However, SpaceX made it known some time ago that the *Starship* and *Super Heavy* launch system will be replacing their *Falcon 9* and *Falcon Heavy* rockets as the company's workhouse.

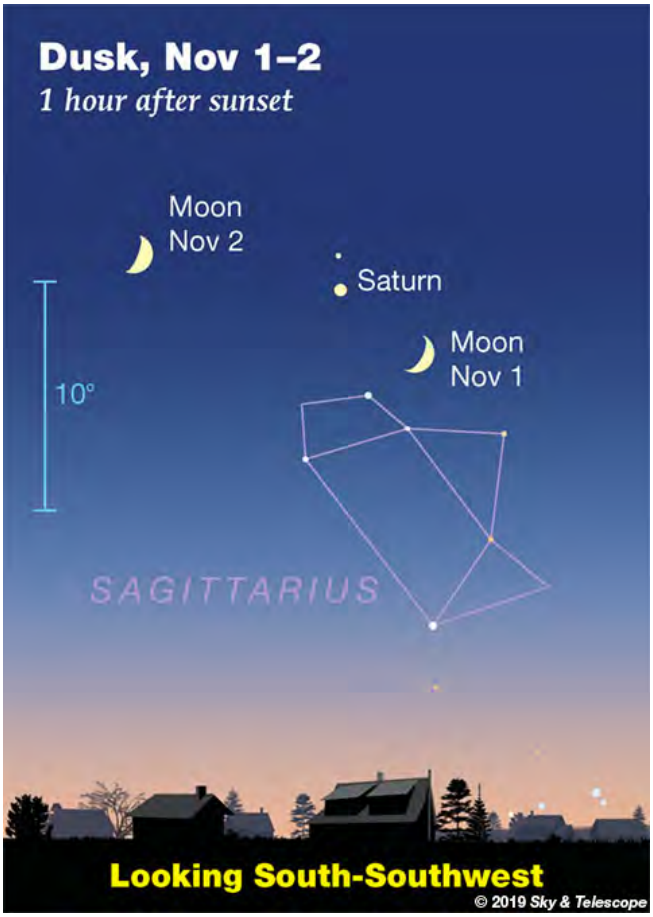
Sending cargo and passengers to the Moon will also be a major step towards fulfilling Musk's ultimate vision, which is establishing a human settlement on Mars. If all goes according to plan and in a timely manner, Musk hopes to have this settlement up and running by 2028 – yet another optimistic and ambitious goal!

Source: Universe Today Return to Contents

The Night Sky

Friday, Nov. 1

• The waxing crescent Moon shines in the south-southwest at dusk, with Saturn glowing 4° or 5° to its upper left (for North America) as shown here. Look much farther lower right, by nearly 20°, for Jupiter.



Saturday, Nov. 2

• Saturn shines right of the Moon in early evening, as shown here. Look much higher above them for Altair, a little brighter than Saturn.

• Capella sparkles low in the northeast these evenings. Look for the Pleiades cluster, fingertip-size, about three fists at arm's length to Capella's right. These harbingers of the cold months rise higher as evening grows late.

Upper right of Capella, and upper left of the Pleiades, the stars of Perseus lie astride the Milky Way.

• Standard time resumes at 2 a.m. Sunday morning for most of North America. Clocks fall back an hour. And for astronomers, darkness henceforth arrives an hour earlier!

Sunday, Nov. 3

• First-quarter Moon (exactly so at 5:23 a.m. Monday morning EST). On Sunday evening the Moon shines inside the huge triangle of Saturn to its lower right, Altair much higher to its upper right, and Fomalhaut way off to the Moon's left.

• Sometime around 10 p.m., depending on where you live, zero-magnitude Capella will have risen exactly as high in the northeast as zero-magnitude Vega has sunk in the west-northwest. How accurately can you time this event? Astrolabe not required. . . but it would help.

Monday, Nov. 4

• The Moon this evening is almost as close to first quarter as it was yesterday evening. You'll find that the Moon is nearly in line with Fomalhaut, about two fists to its lower left, and Altair, three or four fists to its upper right.

Tuesday, Nov. 5

• Fomalhaut is lower left of the Moon this evening, by almost two fists. Look for Diphda (Beta Ceti) two or three fists left of Fomalhaut.
Very high in the southeast now is the Great Square of Pegasus. Its western side points down nearly to 1st-magnitude Fomalhaut. It's eastern side points down, a little more askew, toward 2nd-magnitude Diphda.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Fri Nov 1, 6:33 AM	2 min	11°	10° above NNW	10° above NNE
Sat Nov 2, 5:45 AM	< 1 min	12°	12° above N	10° above NNE
Sun Nov 3, 5:33 AM	2 min	11°	10° above N	10° above NNE
Mon Nov 4, 4:45 AM	< 1 min	10°	10° above N	10° above NNE
Tue Nov 5, 5:32 AM	4 min	14°	10° above NNW	10° above NE

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

NASA-TV Highlights

(all times Eastern Daylight Time)

November 1, Friday
11:30 a.m. – Northrop Grumman Cygnus CRS-12 "What's On Board" Briefing (Public Channel)
12 p.m. – International Space Station Expedition 61 in-flight event with WABI-TV, Bangor, Maine, and WBUR-FM Radio, Boston and NASA astronuat Jessica Meir (Media Channel)
1 p.m. – Coverage of the release of the JAXA HTV-8 "Kounotori" cargo craft from the International Space Station; release scheduled at 1:20 p.m. EDT (All Channels)
2:30 p.m. - Northrop Grumman NG-12 Cygnus Cargo Craft Pre-Launch News Conference (All Channels)
5 p.m., 8 p.m. – Replay of the Northrop Grumman Cygnus CRS-12 "What's On Board" Briefing (All Channels)
6:30 p.m., 9:30 p.m. - Replay of the Northrop Grumman NG-12 Cygnus Cargo Craft Pre-Launch News Conference (All Channels)

November 2, Saturday
7 a.m. – Replay of the Northrop Grumman Cygnus CRS-12 "What's On Board" Briefing (All Channels)
8:30 a.m. - Replay of the Northrop Grumman NG-12 Cygnus Cargo Craft Pre-Launch News Conference (All Channels)
9:30 a.m. – Coverage of the Launch of the Northrop Grumman NG-12 Cygnus Cargo Craft Mission to the International Space Station; launch scheduled at 9:59 a.m. EDT – Johnson Space Center via Wallops Flight Facility, Virginia (All Channels)

November 4, Monday
2:45 a.m. - Coverage of the Rendezvous and Capture of the Northrop Grumman NG-12 Cygnus Cargo Craft at the International Space Station; capture scheduled at 4:10 a.m. EST (All Channels)
6:30 a.m. - Coverage of the Installation of the Northrop Grumman NG-12 Cygnus Cargo Craft to the Unity Module of the International Space Station (All Channels

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

Space Calendar

- Nov 01 - NEW [Oct 31] Apollo Asteroid 2019 UG11 Near-Earth Flyby (0.001 AU)
- Nov 01 - NEW [Oct 31] Apollo Asteroid 2019 UG12 Near-Earth Flyby (0.010 AU)
- Nov 01 - NEW [Oct 25] Apollo Asteroid 2019 UM4 Near-Earth Flyby (0.029 AU)
- Nov 01 - NEW [Nov 01] Amor Asteroid 2019 UD13 Near-Earth Flyby (0.039 AU)
- Nov 01 - NEW [Oct 27] Apollo Asteroid 2019 UP7 Near-Earth Flyby (0.040 AU)
- Nov 01 - Apollo Asteroid 2014 UC192 Near-Earth Flyby (0.084 AU)
- Nov 01 - Asteroid 8299 Tealeoni Closest Approach To Earth (1.408 AU)
- Nov 01 - Asteroid 8837 London Closest Approach To Earth (1.510 AU)
- Nov 01 - Asteroid 3784 Chopin Closest Approach To Earth (2.309 AU)
- Nov 01 - Neptune Trojan 2005 TN53 At Opposition (27.986 AU)
- Nov 01 - Neptune Trojan 385695 (2005 TO74) At Opposition (28.679 AU)
- Nov 01 - Neptune Trojan 2001 QR322 At Opposition (29.169 AU)
- Nov 01 - Kuiper Belt Object 15760 Albion (1992 QB1) At Opposition (40.396 AU)
- Nov 01 - Kuiper Belt Object 42301 (2001 UR163) At Opposition (52.250 AU)
- Nov 01 - 25th Anniversary (1994), Wind Launch
- Nov 01 - 130th Anniversary (1889), Edward Barnard Observes Dark Shadows ("Spokes") on Saturn's Rings
- Nov 02 - HOT [Oct 30] Cygnus CRS-12 (NG-12)/ SORTIE (Helio 5)/ CaNOP/ CryoCube 1 (CC 1)/ CySat 1/ HuskySat 1 (HS 1)/ NEUTRON 1/ Phoenix/ RadSat-u/ SOCRATES/ SPOC/ Argus (SLU 02)/ AztechSat 1/ SwampSat 2 Antares 230 Launch (International Space Station)
- Nov 02 - Moon Occults Saturn
- Nov 02 - Moon Occults Dwarf Planet Pluto
- Nov 02 - Comet 65P/Gunn At Opposition (3.218 AU)
- Nov 02 - NEW [Nov 01] Apollo Asteroid 2019 UR12 Near-Earth Flyby (0.025 AU)
- Nov 02 - Apollo Asteroid 2019 UU3 Near-Earth Flyby (0.034 AU)
- Nov 02 - Apollo Asteroid 7092 Cadmus Closest Approach To Earth (1.669 AU)
- Nov 02 - Asteroid 2309 Mr. Spock Closest Approach To Earth (1.795 AU)
- Nov 02 - Neptune Trojan 385571 Otrera At Opposition (28.337 AU)
- Nov 02 - Richard Taylor's 90th Birthday (1929)
- Nov 03 - HOT [Oct 27] Daylight Saving - Set Clock Back 1 Hour (United States)
- Nov 03 - Taurids Meteor Shower Peak
- Nov 03 - Comet 261P/Larson Closest Approach To Earth (1.316 AU)
- Nov 03 - NEW [Oct 28] Apollo Asteroid 2019 UL8 Near-Earth Flyby (0.007 AU)
- Nov 03 - Apollo Asteroid 2019 UH3 Near-Earth Flyby (0.027 AU)
- Nov 03 - Apollo Asteroid 2015 JD1 Near-Earth Flyby (0.033 AU)
- Nov 03 - Asteroid 78756 Sloan Closest Approach To Earth (2.103 AU)
- Nov 03 - 25th Anniversary (1994), STS-66 Launch (Space Shuttle Atlantis, ATLAS-3)
- Nov 03 - Kevin Chilton's 65th Birthday (1954)
- Nov 04 - Comet 372P/McNaught Closest Approach To Earth (3.048 AU)
- Nov 04 - Comet P/2005 XA54 (LONEOS-Hill) At Opposition (3.473 AU)
- Nov 04 - Asteroid 4 Vesta Occults TYC 0650-00327-1 (11.7 Magnitude Star)
- Nov 04 - Apollo Asteroid 11885 Summanus Closest Approach To Earth (0.347 AU)
- Nov 04 - Asteroid 3768 Monroe Closest Approach To Earth (1.569 AU)
- Nov 04 - Asteroid 81203 Polynesia Closest Approach To Earth (2.115 AU)
- Nov 04 - Neptune Trojan 2014 QO441 At Opposition (32.322 AU)
- Nov 05 - NEW [Oct 25] Comet P/2019 T6 (PANSTARRS) Closest Approach To Earth (1.091 AU)
- Nov 05 - Comet C/2018 DO4 (Lemmon) Closest Approach To Earth (1.578 AU)
- Nov 05 - Comet 245P/WISE At Opposition (1.673 AU)

- Nov 05 - Comet P/2010 B2 (WISE) Closest Approach To Earth (2.369 AU)
- Nov 05 - Comet C/2018 Y1 (Iwamoto) At Opposition (2.800 AU)
- Nov 05 - NEW [Oct 25] Apollo Asteroid 2019 UH5 Near-Earth Flyby (0.034 AU)
- Nov 05 - Apollo Asteroid 2012 PW Near-Earth Flyby (0.078 AU)
- Nov 05 - Asteroid 6349 Acapulco Closest Approach To Earth (2.047 AU)
- Nov 05 - Kuiper Belt Object 472271 (2014 UM33) At Opposition (42.565 AU)

Source: JPL Space Calendar Return to Contents

Food for Thought

Scientists may have discovered whole new class of black holes

Black holes are an important part of how astrophysicists make sense of the universe—so important that scientists have been trying to build a census of all the black holes in the Milky Way galaxy.

But new research shows that their search might have been missing an entire class of black holes that they didn't know existed.

In a study published today in the journal *Science*, astronomers offer a new way to search for black holes, and show that it is possible there is a class of black holes smaller than the smallest known black holes in the universe.

"We're showing this hint that there is another population out there that we have yet to really probe in the search for black holes," said Todd Thompson, a professor of astronomy at The Ohio State University and lead author of the study.

"People are trying to understand supernova explosions, how supermassive black stars explode, how the elements were formed in supermassive stars. So if we could reveal a new population of black holes, it would tell us more about which stars explode, which don't, which form black holes, which form neutron stars. It opens up a new area of study."

Imagine a census of a city that only counted people 5'9" and taller—and imagine that the census takers didn't even know that people shorter than 5'9" existed. Data from that census would be incomplete, providing an inaccurate picture of the population. That is essentially what has been happening in the search for black holes, Thompson said.

Astronomers have long been searching for black holes, which have gravitational pulls so fierce that nothing—not matter, not radiation—can escape. Black holes form when some stars die, shrink into themselves, and explode. Astronomers have also been looking for neutron stars—small, dense stars that form when some stars die and collapse.

Both could hold interesting information about the elements on Earth and about how stars live and die. But in order to uncover that information, astronomers first have to figure out where the black holes are. And to figure out where the black holes are, they need to know what they are looking for.

One clue: Black holes often exist in something called a binary system. This simply means that two stars are close enough to one another to be locked together by gravity in a mutual orbit around one another. When one of those stars dies, the other can remain, still orbiting the space where the dead star—now a black hole or neutron star—once lived, and where a black hole or neutron star has formed.

For years, the black holes scientists knew about were all between approximately five and 15 times the mass of the sun. The known neutron stars are generally no bigger than about 2.1 times the mass of the sun—if they were above 2.5 times the sun's mass, they would collapse to a black hole

But in the summer of 2017, a survey called LIGO—the Laser Interferometer Gravitational-Wave Observatory—saw two black holes merging together in a galaxy about 1.8 billion light years away. One of those black holes was about 31 times the mass of the sun; the other about 25 times the mass of the sun.

"Immediately, everyone was like 'wow,' because it was such a spectacular thing," Thompson said. "Not only because it proved that LIGO worked, but because the masses were huge. Black holes that size are a big deal—we hadn't seen them before."

Thompson and other astrophysicists had long suspected that black holes might come in sizes outside the known range, and LIGO's discovery proved that black holes could be larger. But there remained a window of size between the biggest neutron stars and the smallest black holes.

Thompson decided to see if he could solve that mystery.

He and other scientists began combing through data from APOGEE, the Apache Point Observatory Galactic Evolution Experiment, which collected light spectra from around 100,000 stars across the Milky Way. The spectra, Thompson realized, could show whether a star might be orbiting around another object: Changes in spectra—a shift toward bluer wavelengths, for example, followed by a shift to redder wavelengths—could show that a star was orbiting an unseen companion.

Thompson began combing through the data, looking for stars that showed that change, indicating that they might be orbiting a black hole.

Then, he narrowed the APOGEE data to 200 stars that might be most interesting. He gave the data to a graduate research associate at Ohio State, Tharindu Jayasinghe, who compiled thousands of images of each potential binary system from ASAS-SN, the All-Sky Automated Survey for Supernovae. (ASAS-SN has found some 1,000 supernovae, and is run out of Ohio State.)

Their data crunching found a giant red star that appeared to be orbiting something, but that something, based on their calculations, was likely much smaller than the known black holes in the Milky Way, but way bigger than most known neutron stars.

After more calculations and additional data from the Tillinghast Reflector Echelle Spectrograph and the Gaia satellite, they realized they had found a low-mass black hole, likely about 3.3 times the mass of the sun.

"What we've done here is come up with a new way to search for black holes, but we've also potentially identified one of the first of a new class of low-mass black holes that astronomers hadn't previously known about." Thompson said. "The masses of things tell us about their formation and evolution, and they tell us about their nature."

Source: Phys.org Return to Contents

Space Image of the Week

The Day After Mars
Image Credit & Copyright: Rolando Ligustri (CARA Project, CAST)

Explanation: October 31, 1938 was the day after Martians encountered planet Earth, and everything was calm. Reports of the invasion were revealed to be part of a Halloween radio drama, the now famous broadcast based on H.G. Wells' scifi novel War of the Worlds. On Mars October 20, 2014 was calm too, the day after its close encounter with Comet Siding Spring (C/2013 A1). Not a hoax, this comet really did come within 86,700 miles or so of Mars, about 1/3 the Earth-Moon distance. Earth's spacecraft and rovers in Mars orbit and on the surface reported no ill effects though, and had a ringside seat as a visitor from the outer solar system passed by. Spanning over 2 degrees against stars of the constellation Ophiuchus, this colorful telescopic snapshot captures our view of Mars on the day after. Bluish star 51 Ophiuchi is at the upper right and the comet is just emerging from the Red Planet's bright glare.

Source: APOD

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