Space News Update

— April 26, 2019 —

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In the News

1. **NASA's InSight Lander Captures Audio of First Likely 'Quake' on Mars**

NASA's Mars InSight lander has measured and recorded for the first time ever a likely "marsquake."

The faint seismic signal, detected by the lander's Seismic Experiment for Interior Structure (SEIS) instrument, was recorded on April 6, the lander's 128th Martian day, or sol. This is the first recorded trembling that appears to have come from inside the planet, as opposed to being caused by forces above the surface, such as wind. Scientists still are examining the data to determine the exact cause of the signal.

"InSight's first readings carry on the science that began with NASA's Apollo missions," said InSight Principal Investigator Bruce Banerdt of NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California. "We've been collecting background noise up until now, but this first event officially kicks off a new field: Martian seismology!"

The new seismic event was too small to provide solid data on the Martian interior, which is one of InSight's main objectives. The Martian surface is extremely quiet, allowing SEIS, InSight's specially designed seismometer, to pick up faint rumbles. In contrast, Earth's surface is quivering constantly from seismic noise created by oceans and weather. An event of this size in Southern California would be lost among dozens of tiny crackles that occur every day.

"The Martian Sol 128 event is exciting because its size and longer duration fit the profile of moonquakes detected on the lunar surface during the Apollo missions," said Lori Glaze, Planetary Science Division director at NASA Headquarters.

NASA's Apollo astronauts installed five seismometers that measured thousands of quakes while operating on the Moon between 1969 and 1977, revealing seismic activity on the Moon. Different materials can change the speed of seismic waves or reflect them, allowing scientists to use these waves to learn about the interior of the Moon and model its formation. NASA currently is planning to return astronauts to the Moon by 2024, laying the foundation that will eventually enable human exploration of Mars.

InSight's seismometer, which the lander placed on the planet's surface on Dec. 19, 2018, will enable scientists to gather similar data about Mars. By studying the deep interior of Mars, they hope to learn how other rocky worlds, including Earth and the Moon, formed.

Three other seismic signals occurred on March 14 (Sol 105), April 10 (Sol 132) and April 11 (Sol 133). Detected by SEIS' more sensitive Very Broad Band sensors, these signals were even smaller than the Sol 128 event and more ambiguous in origin. The team will continue to study these events to try to determine their cause.

Regardless of its cause, the Sol 128 signal is an exciting milestone for the team.

“We’ve been waiting months for a signal like this,” said Philippe Lognonné, SEIS team lead at the Institut de Physique du Globe de Paris (IPGP) in France. “It's so exciting to finally have proof that Mars is still seismically active. We're looking forward to sharing detailed results once we've had a chance to analyze them.”

Most people are familiar with quakes on Earth, which occur on faults created by the motion of tectonic plates. Mars and the Moon do not have tectonic plates, but they still experience quakes – in their cases, caused by a continual process of cooling and contraction that creates stress. This stress builds over time, until it is strong enough to break the crust, causing a quake.

Detecting these tiny quakes required a huge feat of engineering. On Earth, high-quality seismometers often are sealed in underground vaults to isolate them from changes in temperature and weather. InSight’s instrument has several ingenious insulating barriers, including a cover built by JPL called the Wind and Thermal Shield, to protect it from the planet's extreme temperature changes and high winds.

SEIS has surpassed the team’s expectations in terms of its sensitivity. The instrument was provided for InSight by the French space agency, Centre National d’Études Spatiales (CNES), while these first seismic events were identified by InSight's Marsquake Service team, led by the Swiss Federal Institute of Technology.

“We are delighted about this first achievement and are eager to make many similar measurements with SEIS in the years to come,” said Charles Yana, SEIS mission operations manager at CNES.

JPL manages InSight for NASA’s Science Mission Directorate. InSight is part of NASA’s Discovery Program, managed by the agency’s Marshall Space Flight Center in Huntsville, Alabama. Lockheed Martin Space in Denver built the InSight spacecraft, including its cruise stage and lander, and supports spacecraft operations for the mission.

A number of European partners, including CNES and the German Aerospace Center (DLR), support the InSight mission. CNES provided the SEIS instrument to NASA, with the principal investigator at IPGP. Significant contributions for SEIS came from IPGP; the Max Planck Institute for Solar System Research in Germany; the Swiss Federal Institute of Technology (ETH Zurich) in Switzerland; Imperial College London and Oxford University in the United Kingdom; and JPL. DLR provided the Heat Flow and Physical Properties Package (HP^3) instrument, with significant contributions from the Space Research Center of the Polish Academy of Sciences and Astronika in Poland. Spain’s Centro de Astrobiología supplied the temperature and wind sensors.

Listen to audio of this likely marsquake at https://youtu.be/DLBP-5KoSCc.

For more information about InSight, visit https://www.nasa.gov/insight.

For more information about the agency’s Moon to Mars activities, visit https://www.nasa.gov/topics/moon-to-mars

Source: NASA

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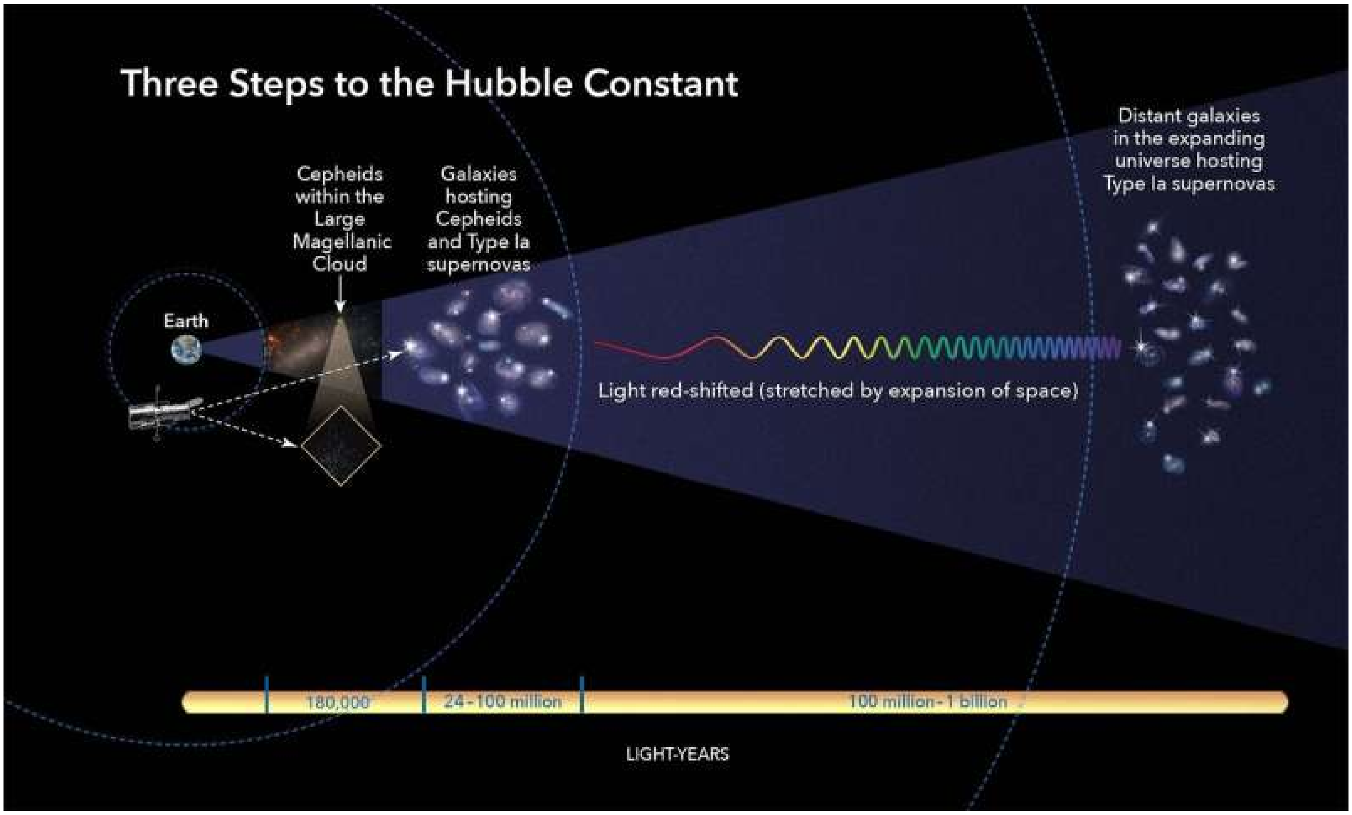
2. Mystery of the Universe's Expansion Rate Widens with New Hubble Data



Astronomers using NASA's Hubble Space Telescope say they have crossed an important threshold in revealing a discrepancy between the two key techniques for measuring the universe's expansion rate. The recent study strengthens the case that new theories may be needed to explain the forces that have shaped the cosmos.

A brief recap: The universe is getting bigger every second. The space between galaxies is stretching, like dough rising in the oven. But how fast is the universe expanding? As Hubble and other telescopes seek to answer this question, they have run into an intriguing difference between what scientists predict and what they observe.

Hubble measurements suggest a faster expansion rate in the modern universe than expected, based on how the universe appeared more than 13 billion years ago. These measurements of the early universe come from the European Space Agency's Planck satellite. This discrepancy has been identified in scientific papers over the last several years, but it has been unclear whether differences in measurement techniques are to blame, or whether the difference could result from unlucky measurements.

The latest Hubble data lower the possibility that the discrepancy is only a fluke to 1 in 100,000. This is a significant gain from an earlier estimate, less than a year ago, of a chance of 1 in 3,000.

These most precise Hubble measurements to date bolster the idea that new physics may be needed to explain the mismatch.

"The Hubble tension between the early and late universe may be the most exciting development in cosmology in decades," said lead researcher and Nobel laureate Adam Riess of the Space Telescope Science Institute (STScI) and Johns Hopkins University, in Baltimore, Maryland. "This mismatch has been growing and has now reached a point that is really impossible to dismiss as a fluke. This disparity could not plausibly occur just by chance."

Tightening the bolts on the 'cosmic distance ladder'

Scientists use a "cosmic distance ladder" to determine how far away things are in the universe. This method depends on making accurate measurements of distances to nearby galaxies and then moving to galaxies farther and farther away, using their stars as milepost markers. Astronomers use these values, along with other measurements of the galaxies' light that reddens as it passes through a stretching universe, to calculate how fast the cosmos expands with time, a value known as the Hubble constant. Riess and his SH0ES (Supernovae H0 for the Equation of State) team have been on a quest since 2005 to refine those distance measurements with Hubble and fine-tune the Hubble constant.

In this new study, astronomers used Hubble to observe 70 pulsating stars called Cepheid variables in the Large Magellanic Cloud. The observations helped the astronomers "rebuild" the distance ladder by improving the comparison between those Cepheids and their more distant cousins in the galactic hosts of supernovas. Riess's team reduced the uncertainty in their Hubble constant value to 1.9% from an earlier estimate of 2.2%.

As the team's measurements have become more precise, their calculation of the Hubble constant has remained at odds with the expected value derived from observations of the early universe's expansion. Those measurements were made by Planck, which maps the cosmic microwave background, a relic afterglow from 380,000 years after the big bang.

The measurements have been thoroughly vetted, so astronomers cannot currently dismiss the gap between the two results as due to an error in any single measurement or method. Both values have been tested multiple ways.

"This is not just two experiments disagreeing," Riess explained. "We are measuring something fundamentally different. One is a measurement of how fast the universe is expanding today, as we see it. The other is a prediction based on the physics of the early universe and on measurements of how fast it ought to be expanding. If these values don't agree, there becomes a very strong likelihood that we're missing something in the cosmological model that connects the two eras."

How the new study was done

Astronomers have been using Cepheid variables as cosmic yardsticks to gauge nearby intergalactic distances for more than a century. But trying to harvest a bunch of these stars was so time-consuming as to be nearly unachievable. So, the team employed a clever new method, called DASH (Drift And Shift), using Hubble as a "point-and-shoot" camera to snap quick images of the extremely bright pulsating stars, which eliminates the time-consuming need for precise pointing.

"When Hubble uses precise pointing by locking onto guide stars, it can only observe one Cepheid per each 90-minute Hubble orbit around Earth. So, it would be very costly for the telescope to observe each Cepheid," explained team member Stefano Casertano, also of STScI and Johns Hopkins. "Instead, we searched for groups of Cepheids close enough to each other that we could move between them without recalibrating the telescope pointing. These Cepheids are so bright, we only need to observe them for two seconds. This technique is allowing us to observe a dozen Cepheids for the duration of one orbit. So, we stay on gyroscope control and keep 'DASHing' around very fast."

The Hubble astronomers then combined their result with another set of observations, made by the Araucaria Project, a collaboration between astronomers from institutions in Chile, the U.S., and Europe. This group made distance measurements to the Large Magellanic Cloud by observing the dimming of light as one star passes in front of its partner in eclipsing binary-star systems.

The combined measurements helped the SH0ES Team refine the Cepheids' true brightness. With this more accurate result, the team could then "tighten the bolts" of the rest of the distance ladder that extends deeper into space.

The new estimate of the Hubble constant is 74 kilometers (46 miles) per second per megaparsec. This means that for every 3.3 million light-years farther away a galaxy is from us, it appears to be moving 74 kilometers (46 miles) per second faster, as a result of the expansion of the universe. The number indicates that the universe is expanding at a 9% faster rate than the prediction of 67 kilometers (41.6 miles) per second per megaparsec, which comes from Planck's observations of the early universe, coupled with our present understanding of the universe.

So, what could explain this discrepancy?

One explanation for the mismatch involves an unexpected appearance of dark energy in the young universe, which is thought to now comprise 70% of the universe's contents. Proposed by astronomers at Johns Hopkins, the theory is dubbed "early dark energy," and suggests that the universe evolved like a three-act play.

Astronomers have already hypothesized that dark energy existed during the first seconds after the big bang and pushed matter throughout space, starting the initial expansion. Dark energy may also be the reason for the universe's accelerated expansion today. The new theory suggests that there was a third dark-energy episode not long after the big bang, which expanded the universe faster than astronomers had predicted. The existence of this "early dark energy" could account for the tension between the two Hubble constant values, Riess said.

Another idea is that the universe contains a new subatomic particle that travels close to the speed of light. Such speedy particles are collectively called "dark radiation" and include previously known particles like neutrinos, which are created in nuclear reactions and radioactive decays.

Yet another attractive possibility is that dark matter (an invisible form of matter not made up of protons, neutrons, and electrons) interacts more strongly with normal matter or radiation than previously assumed.

But the true explanation is still a mystery.

Riess doesn't have an answer to this vexing problem, but his team will continue to use Hubble to reduce the uncertainties in the Hubble constant. Their goal is to decrease the uncertainty to 1%, which should help astronomers identify the cause of the discrepancy.

The team's results have been accepted for publication in The *Astrophysical Journal*.

Source: Phys.org Return to Contents

3. As Expected, the Newly Upgraded LIGO is Finding a Black Hole Merger Every Week

In February of 2016, scientists at the Laser Interferometer Gravitational-wave Observatory (LIGO) announced the first-ever detection of gravitational waves (GWs). Since then, multiple events have been detected, providing insight into a cosmic phenomena that was predicted over a century ago by Einstein's Theory of General Relativity.

A little over a year ago, LIGO was taken offline so that upgrades could be made to its instruments, which would allow for detections to take place "weekly or even more often." After completing the upgrades on April 1st, the observatory went back online and performed as expected, detecting two probable gravitational wave events in the space of two weeks.

LIGO announced the first of the two new GW events on April 8th, which was followed by a second announcement on April 12th. The signals were detected thanks to the three-facility collaboration between LIGO and the Virgo Observatory in Italy, and both are believed to have been the result of a pair of black holes merging.

Thanks to upgrades made to both LIGO and Virgo, this scientific collaboration has been able to increase the sensitivity of its instruments by about 40%. For their third observation run (dubbed O3), the astronomical community also benefited from a new public alert system, where the LIGO team sends out alerts the moment detections are made so that observatories around the world can point their telescopes at the source.

By observing the source in different wavelengths (optical, X-ray, ultraviolet, radio, etc.), scientists hope to learn more about what causes GW events and about the dynamics behind them. For these latest detections, a team of scientists from Penn State University – led by Chad Hanna, an associate professor of physics, astronomy and astrophysics – played a vital role.

As Cody Messick, a graduate student in physics at Penn State and member of the LIGO team, explained:

"Penn State is part of a small team of LIGO scientists that analyze the data in almost real-time. We are constantly comparing the data to hundreds of thousands of different possible gravitational waves and upload any significant candidates to a database as soon as possible. Although there are several different teams all performing similar analyses, the analysis ran by the Penn State team uploaded the candidates that were made public for both of these detections."

Over the past nine months, Messick has been responsible for ensuring that newly-uploaded GW candidates contain information from all detectors running at the time of detection. This helps astronomers localize signals by narrowing down the predicted area of the sky that the signal is predicted to have come from.

LIGO public alerts also include a sky-map that shows the possible location of the source in the sky, the time of the event, and what kind of event it is believed to be. LIGO has also said that in the future, announcements of candidate events will be followed by more detailed information once they have had a chance to properly vet and study them.

As Ryan Magee, a graduate student in physics at Penn State and member of the LIGO team, put it:

"These are near real-time detections of gravitational waves produced from two probable black holes colliding. We detected the first signal within about 20 seconds of its arrival to earth. We can set up automatic alerts to get phone calls and texts when a significant candidate is identified. I thought I was getting a spam phone call at first!"

So far, astronomers have deduced that GW events can be the result of binary black hole mergers, a merger between a black hole and a neutron star, or a binary neutron star merger. Each of these events produce gravitational waves with very different signals, which allows astronomers to determine the cause.

In this case, the events are believed to be the result of binary black hole mergers, which will be tested with follow-up observations in the coming weeks and months. Surabhi Sachdev, a Eberly Postdoctoral Research Fellow in physics at Penn State and member of the LIGO team, explained the importance of these latest events:

"This is the first LIGO observation that was made public right away in an automated fashion. This is the new LIGO policy starting with this observing run. Events are instantly made public automatically. After human vetting, a confirmation or retraction is issued within hours."

With the increased sensitivity of their detectors, the LIGO team hopes to not only make more detections, but detect a greater variety of signals. So far, events have been detected that were the result of mergers between two black holes or neutron stars. It is hoped that in the near future, the team might detect a signal produced by the merger of a black hole and a neutron star.

Whatever form the next events take, you can expect that we will be hearing about it! The public can keep track of public alerts at https://gracedb.ligo.org/latest/, or you can download the alert app at Gravitational Wave Events iPhone App.

Further Reading: PSU, LIGO Caltech

Source: Universe Today

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The Night Sky

Friday, April 26

• Last-quarter Moon (exact at 6:18 p.m. EDT). The Moon rises very late tonight, around 3 a.m. daylight-saving time, in the center of the dim, boat-shape pattern of Capricornus. High above the Moon is Altair. The brightest "stars" far to the Moon's right or upper right are Saturn, then brighter Jupiter.

Saturday, April 27

• As night descends, look high in the west for Pollux and Castor lined up almost horizontally (depending on your latitude). These two stars, the heads of the Gemini twins, form the top of the enormous Arch of Spring. To their lower left is Procyon, the left end of the Arch. Farther to their lower right is the other end, formed by Menkalinan (Beta Aurigae) and then brilliant Capella. The whole thing sinks lower through the evening.

Modern skywatchers are not alone in seeing the Arch of Spring as one big asterism. Extend it down past Procyon to add Sirius, and you've got the Hawaiian Canoe-Bailer of Makali‘i.

Sunday, April 28

• As the last of twilight fades out, the dim Little Dipper extends to the right from Polaris. High above the Little Dipper's bowl (marked by Kochab, Polaris's equal in brightness), you'll find the bowl of the Big Dipper.

Monday, April 29

• Just after dark, the Sickle of Leo stands vertical high in the south. Its bottom star is Regulus, the brightest of Leo. In second place is yellow Algieba above it.

Leo himself is walking horizontally westward. The Sickle forms his front leg, chest, mane, and part of his head. Denebola, about two and a half fists at arm's length left of Regulus, is his tail-tip.

Sickle of Leo

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver: No Sighting Opportunities

Date	Visible	Max Height	Appears	Disappears
Sun Apr 28, 5:07 AM	4 min	32°	10° above SSW	26° above E
Mon Apr 29, 4:19 AM	3 min	17°	15° above SSE	10° above E
Tue Apr 30, 5:03 AM	3 min	87°	19° above SW	38° above NE

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

NASA-TV Highlights
(all times Eastern Daylight Time)

No Special Programming

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

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Space Calendar

- Apr 26 - Asteroid 263251 Pandabear Closest Approach To Earth (1.486 AU)
- Apr 26 - Amor Asteroid 4947 Ninkasi Closest Approach To Earth (2.144 AU)
- Apr 26 - Asteroid 1008 La Paz Closest Approach To Earth (2.327 AU)
- Apr 26 - Asteroid 99905 Jeffgrossman Closest Approach To Earth (2.684 AU)
- Apr 26 - Owen Richardson's 140th Birthday (1879)
- Apr 27 - Comet P/2019 G1 (PANSTARRS) Closest Approach To Earth (2.068 AU)
- Apr 27 - Aten Asteroid 2019 GF1 Near-Earth Flyby (0.012 AU)
- Apr 27 - Apollo Asteroid 3103 Eger Closest Approach To Earth (1.013 AU)
- Apr 27 - Asteroid 2614 Torrence Closest Approach To Earth (1.513 AU)
- Apr 27 - Asteroid 12426 Racquetball Closest Approach To Earth (1.526 AU)
- Apr 27 - Asteroid 5050 Doctorwatson Closest Approach To Earth (1.678 AU)
- Apr 27 - Asteroid 2636 Lassell Closest Approach To Earth (1.832 AU)
- Apr 27 - Patrick Wiggins' 70th Birthday (1949)
- Apr 27-30 - 156th National Academy of Sciences Annual Meeting, Washington DC
- Apr 28 - Comet P/2014 U4 (PANSTARRS) At Opposition (3.353 AU)
- Apr 28 - Apollo Asteroid 2019 GX5 Near-Earth Flyby (0.018 AU)
- Apr 28 - Asteroid 10958 Mont Blanc Closest Approach To Earth (1.125 AU)
- Apr 28 - Asteroid 8627 Kunalnayyar Closest Approach To Earth (1.607 AU)
- Apr 28 - Asteroid 3989 Odin Closest Approach To Earth (1.656 AU)
- Apr 28 - Asteroid 9619 Terrygilliam Closest Approach To Earth (1.694 AU)
- Apr 28 - Asteroid 19019 Sunflower Closest Approach To Earth (1.975 AU)
- Apr 28 - Asteroid 4999 MPC Closest Approach To Earth (1.997 AU)
- Apr 28 - Asteroid 6216 San Jose Closest Approach To Earth (2.006 AU)
- Apr 28 - Asteroid 11739 Baton Rouge Closest Approach To Earth (3.912 AU)
- Apr 28 - Francis Baily's 245th Birthday (1774)
- Apr 29 - Comet P/2017 S8 (PANSTARRS) At Opposition (2.314 AU)
- Apr 29 - Comet C/2016 X1 (Lemmon) Perihelion (7.564 AU)
- Apr 29 - Aten Asteroid 2008 GL20 Near-Earth Flyby (0.084 AU)
- Apr 29 - Asteroid 8952 ODAS Closest Approach To Earth (1.452 AU)
- Apr 29 - Asteroid 1940 Whipple Closest Approach To Earth (2.188 AU)
- Apr 29 - Asteroid 60186 Las Cruces Closest Approach To Earth (2.369 AU)
- Apr 29 - Jupiter Trojan 4709 Ennomos At Opposition (4.342 AU)
- Apr 29 - Kuiper Belt Object 42355 Typhon At Opposition (21.207 AU)

Source: JPL Space Calendar

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Food for Thought

A Look at the Science Ahead for Christina Koch and Andrew Morgan

NASA is fine-tuning plans for two extended duration expeditions for astronauts who launch to space this year. One month after her arrival on the International Space Station, NASA astronaut Christina Koch got word she will stay in space just short of a year, and her colleague Andrew Morgan, who launches on his first flight on the 50th anniversary of the first human Moon landing, also will stay in space longer than the typical six-month mission.

"One month down, ten to go," Koch tweeted Wednesday morning after receiving the news. "Today the possibility has become a reality."

Koch arrived on board the space station March 14, beginning scientific research activities as part of the Expedition 59 crew. She's now scheduled to remain in orbit until February 2020, spanning Expedition 59, 60 and 61.

"I still have the grin on my face that won't seem to go away just that I'm here," Koch said. "To walk into the actual reality of the space station, the fact that it actually exists, was like walking into a movie set."

Her mission will set a record for the longest single spaceflight by a woman, eclipsing the previous mark set by Peggy Whitson of 288 days on Expeditions 50 through 52 in 2016-2017.

"It's an honor to follow in Peggy's footsteps," Koch said. "Peggy has been a mentor and a heroine of mine for many, many years. I hope that me being up here and giving my best every day is a way for me to say thank you to people like her, who not only paved the way through their examples, but actively reached out to make sure we could be successful."

Koch's planned mission duration will be just shy of the longest single spaceflight by a NASA astronaut, 340 days set by former NASA astronaut Scott Kellyduring his one-year mission in 2015-2016. Koch's mission will provide researchers the opportunity to observe effects of long-duration spaceflight on a woman to complement the data from Kelly's mission. Both represent exciting opportunities for NASA's Human Research Program and the work to prepare for human missions to the Moon and Mars.

"Astronauts demonstrate amazing resilience and adaptability in response to long duration spaceflight exposure," said Jennifer Fogarty, chief scientist of the Human Research Program at NASA's Johnson Space

Center. “These opportunities have also demonstrated that there is a significant degree of variability in the responses of humans to spaceflight, and it is important to determine the acceptable degree of change for both men and women.”

The majority of data available is on male astronauts; however, male and female bodies respond differently, and health conditions occur at different rates in male and female populations. Some studies, including one led by NASA researcher Steven Platts, have found that women are more likely than men to experience faintness as a result of ”orthostatic hypotension,” a cardiovascular issue. Men, on the other hand, appear more prone to vision changes caused by spaceflight associated neuro-ocular syndrome (SANS).

Koch’s mission is an exciting opportunity to gather extended duration biomedical data to enable missions to the Moon and Mars. Although with a different research portfolio than Kelly’s one-year mission and the Twins Study or Whitson’s previous record setting missions, Koch will participate in some studies in which Whitson also participated, including the Functional Immune and Food Acceptability studies. Scott Kelly also participated in a study on functional immunity. Integrating her extended-duration studies with those of Kelly and Whitson will enable researchers to better understand astronaut adaptability over long periods of space exposure and better support the development of effective countermeasures to maintain crew health.

Several studies planned during Koch’s stay on the station will come from NASA’s international partners. Collaborative research enables NASA and its international partners to develop innovative measures to protect astronauts and mitigate the effects of spaceflight hazards.

Morgan also will have an extended-duration expedition on the station in his career-first spaceflight. He is set to launch July 20 aboard the Soyuz MS-13 with crewmates ESA (European Space Agency) astronaut Luca Parmitano, and Roscosmos cosmonaut Alexander Skvortsov. NASA selected Koch and Morgan in the same astronaut class in 2013.

“I’ve been preparing for this mission for almost six years, and I’m ready to do what the station program has asked of me,” Morgan said. “I’ve been mentally prepared for the idea of my mission being extended for a little while now, so my family and I are ready to take on this very exciting challenge.”

Morgan is scheduled to return to Earth aboard Soyuz MS-15 in March 2020 with NASA astronaut Jessica Meir and Russian cosmonaut Oleg Skripochka.

“This is exactly what we’ve trained for,” Morgan said. “Might as well jump into the deep end and do all nine months right up front.”

“Any time you increase the diversity of a pool of folks participating in any of those human research studies, you make the results of those studies more robust,” Koch said. “We’re happy to be participating in those and to get the numbers up.”

Meanwhile, NASA’s Human Research Program continues to lay the groundwork for future one-year missions on the space station and has selected 25 proposals to investigate biological, physiological, and behavioral adaptations to spaceflight. With information gained from the selected studies during future one-year missions, NASA aims to address five hazards of human space travel: space radiation, isolation and confinement, distance from Earth, gravity fields (or lack thereof), and hostile/closed environments that pose great risks to the human mind and body in space.

Source: NASA

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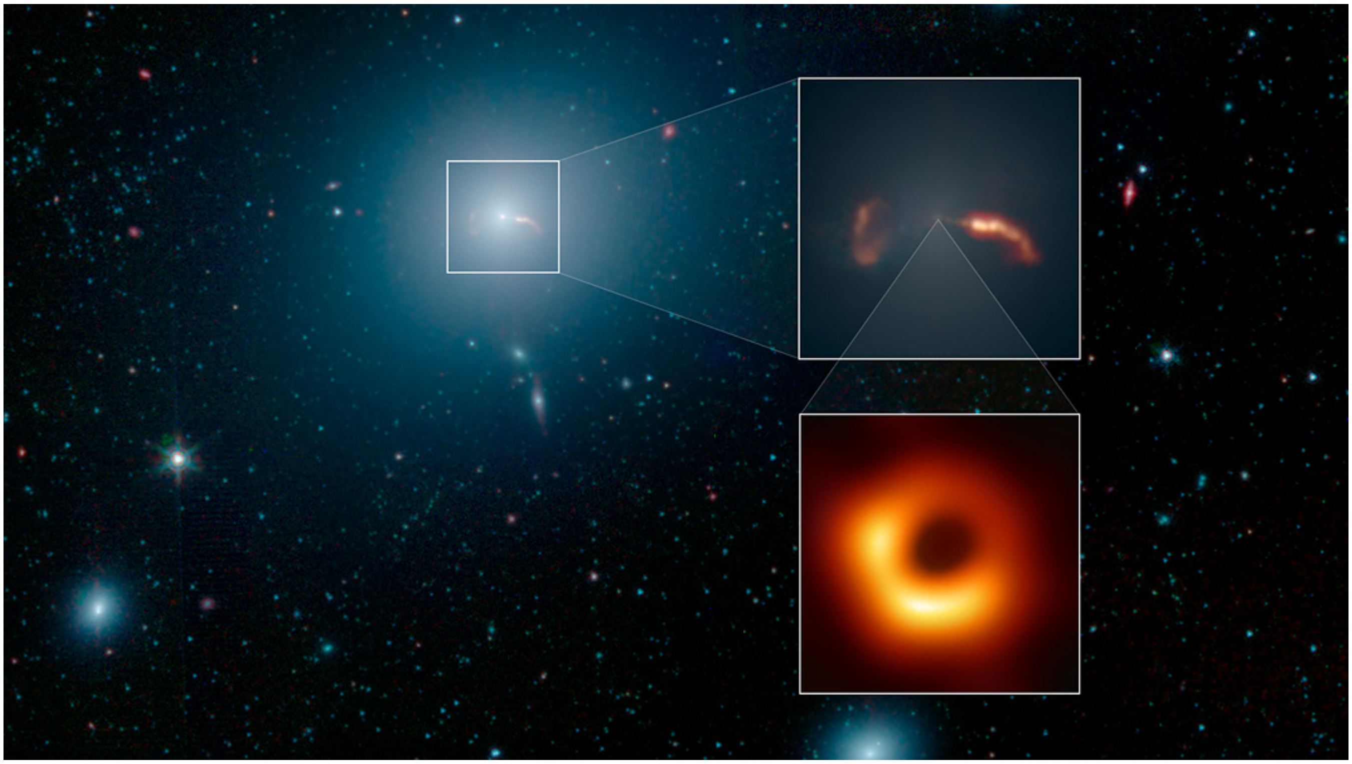
Space Image of the Week



The Galaxy, the Jet, and the Black Hole

Explanation Bright elliptical galaxy Messier 87 (M87) is home to the supermassive black hole captured by planet Earth's Event Horizon Telescope in the first ever image of a black hole. Giant of the Virgo galaxy cluster about 55 million light-years away, M87 is the large galaxy rendered in blue hues in this infrared image from the Spitzer Space telescope. Though M87 appears mostly featureless and cloud-like, the Spitzer image does record details of relativistic jets blasting from the galaxy's central region. Shown in the inset at top right, the jets themselves span thousands of light-years. The brighter jet seen on the right is approaching and close to our line of sight. Opposite, the shock created by the otherwise unseen receding jet lights up a fainter arc of material. Inset at bottom right, the historic black hole image is shown in context, at the center of giant galaxy and relativistic jets. Completely unresolved in the Spitzer image, the supermassive black hole surrounded by infalling material is the source of the enormous energy driving the relativistic jets from thecenter of active galaxy M87.

Image Credit: NASA, JPL-Caltech, Event Horizon Telescope Collaboration

Source: APOD

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