Space News Update

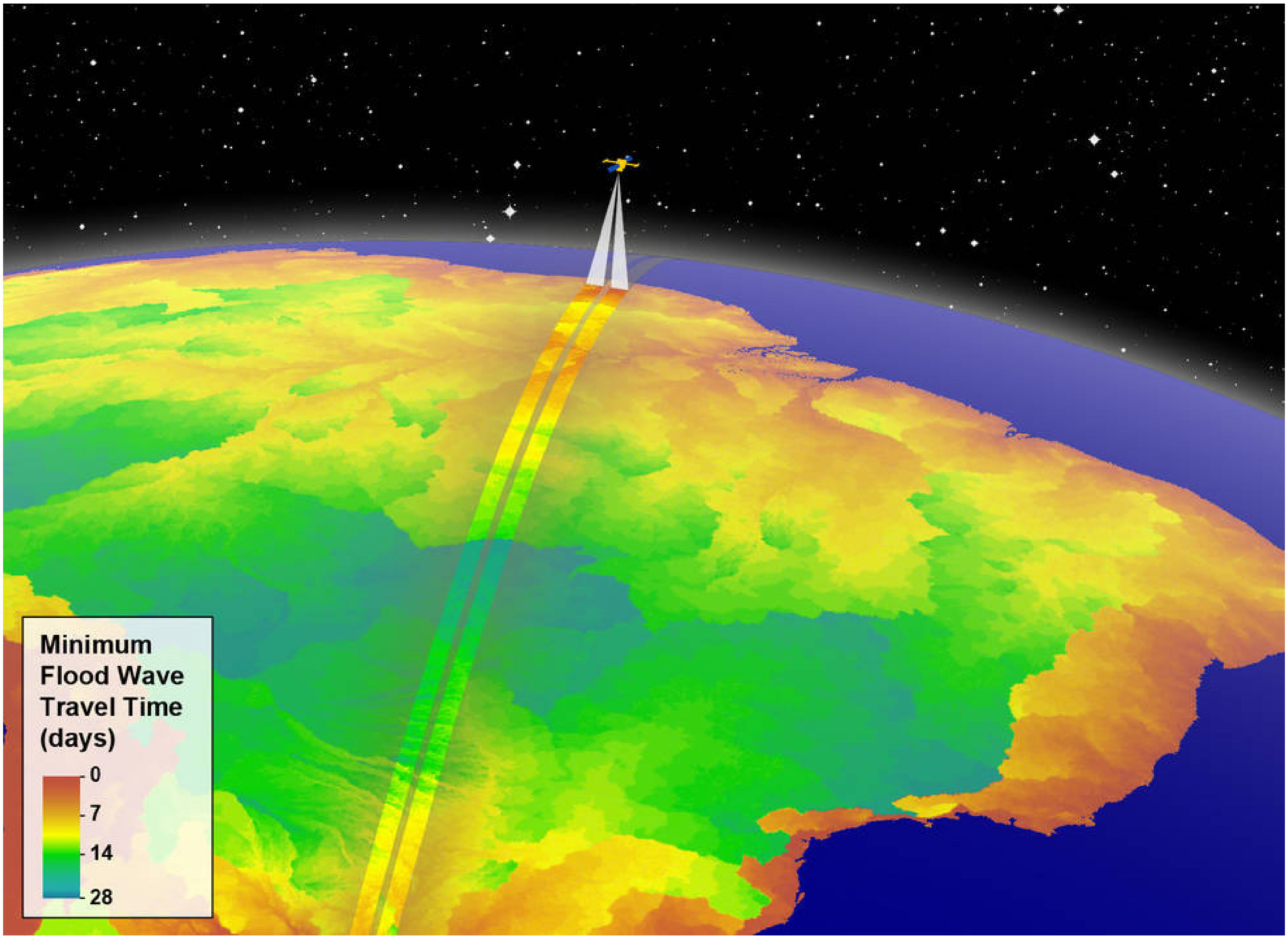
— April 27, 2018 —

Contents

In the News

Departments

1. Before the Flood Arrives



New NASA Study May Improve Future River-Observing Satellites

River floods are one of the most common and devastating of Earth's natural disasters. In the past decade, deluges from rivers have killed thousands of people every year around the world and caused losses on the order of tens of billions of U.S. dollars annually. Climate change, which is projected to increase precipitation in certain areas of the planet, might make river floods in these places more frequent and severe in the coming decades.

Now, a new study led by researchers at NASA's Jet Propulsion Laboratory in Pasadena, California, analyzes what it would take for river-observing satellites to become an even more useful tool to mitigate flood damage and improve reservoir management globally in near real-time.

"Early flood warning systems traditionally depend on gauge networks that detect floods farther up the river, but gauge data are becoming more and more scarce," said George Allen, lead author of the new research and a hydrologist at JPL. "Our study shows that there's room for satellites to help fill in the gap. But for satellites to inform real-time flood mitigation, they have to provide data to water managers within a sufficiently short lag time."

River floods occur when a channel fills with water beyond the capacity of its banks, normally due to heavy rainfall. The flood travels along the course of the river as a wave, moving downstream faster than the water itself. Several satellite missions have been able to detect floods as sudden changes in the height or width of river waters. Once a flood is observed, it is relatively easy to predict accurately how it will move down the river. This information is extremely useful in early flood warning systems and other real-time river management applications.

To study the speed at which floods propagate through the planet's rivers, Allen and his colleagues ran a simple numerical model of flow waves that used information such as the width, slope, depth and roughness -- the amount of friction water experiences when traveling along a river -- of rivers worldwide. After analyzing wave speeds through 11 million miles (17.7 million kilometers) of rivers around the planet, the researchers found that flood waves traveling at their maximum speed take a median time of three days to reach the next downstream dam, four days to arrive to the next downstream city and six days to exit the river system entirely.

The team compared their model's results with discharge records from more than 20,000 U.S. Geological Survey gauge stations along around 40,000 miles (64,400 kilometers) of varied river systems in the United States. They found that the model estimated faster wave speeds than the gauge data showed.

"That was expected, based on the fact that we're modeling waves moving at maximum speeds, whereas the gauge data are looking at all types of wave speeds: low speeds, high speeds, everything in between," Allen said. "In this way, our study estimates a worst-case-scenario of how fast floods can move down rivers."

The scientists then used their wave speed findings to calculate data latency -- how quickly satellite data should be downloaded, processed and made available to the public to be useful for flood early warning systems and other real-time flood mitigation strategies, as well as reservoir management. In particular, they focused on future data from NASA's upcoming Surface Water and Ocean Topography (SWOT) mission. SWOT, scheduled to launch in 2021, is specifically designed to observe rivers. That's because it has a repeat orbit of 21 days and will be able to detect flood waves, particularly in higher-latitude large rivers. The researchers found that making SWOT data available within days after being acquired by the spacecraft could be useful for real-time flood mitigation. Compared to past or current satellites providing river and flood information, SWOT will provide never-before-seen maps of river height, allowing for more reliable prediction of flood timing and magnitude.

If the data were to be processed in two days or less, Allen's team calculated, it would be ready for emergency managers before at least two-thirds of observed waves reached the next downstream city. For dams, the quick turnaround of satellite measurements would give advance notice to downstream reservoirs in at least half of the cases when SWOT detects a flood wave.

"There is a trade-off between data latency and data quality," said Cédric David of JPL, who directed the new study and is a member of SWOT's science team. "So, do we want to wait to get the best data possible, or do we want to get a rough version of what's going on now, so we can provide actionable information? As we prepare for new satellite missions like SWOT, that's when we start asking these types of questions."

Satellite data that could inform flood early warning systems would be particularly useful for developing nations, where either there are insufficient river gauges or countries do not share gauge data with their downstream neighbors, Allen said.

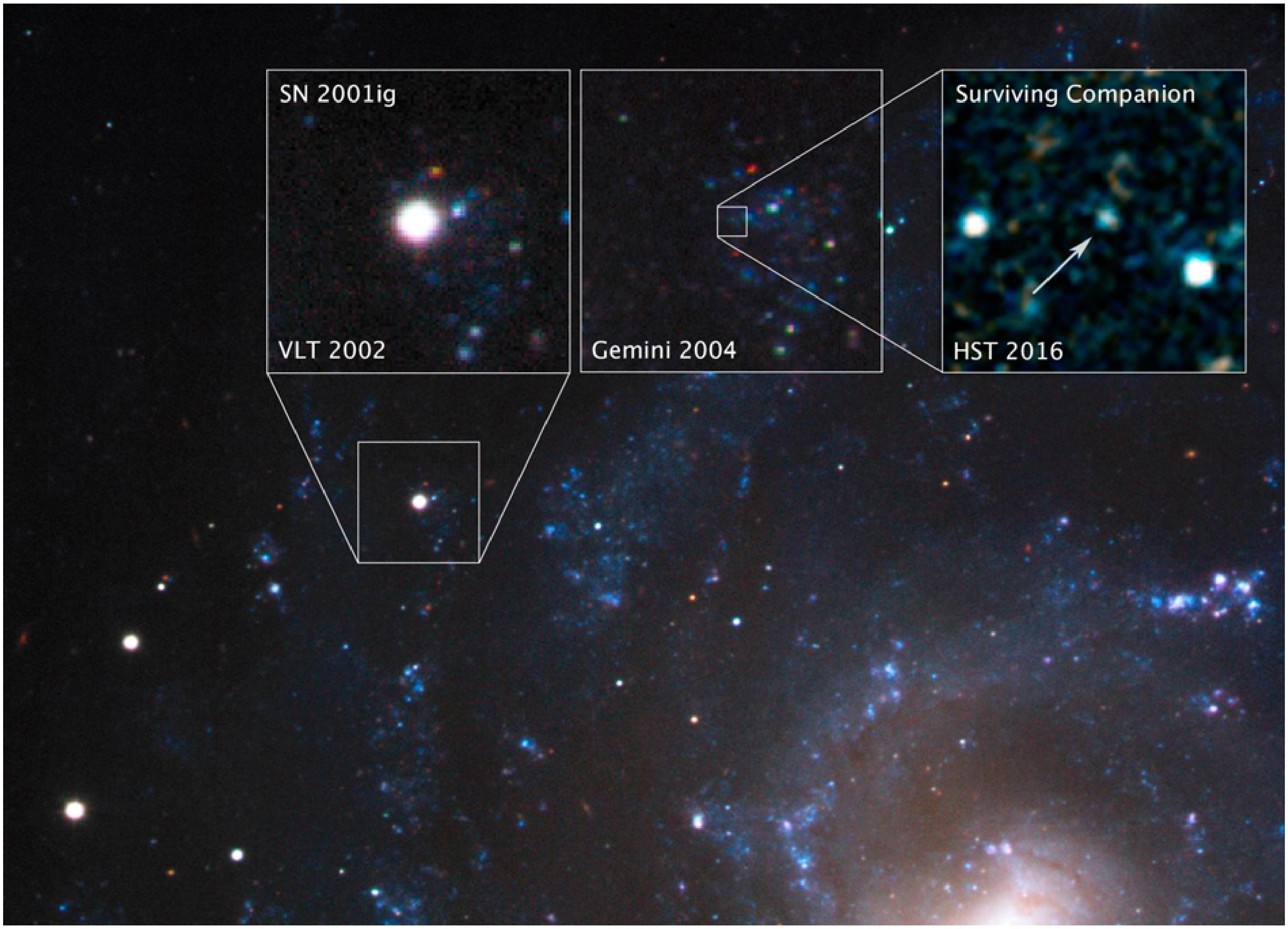
Results of the study are published in the journal Geophysical Research Letters.

For more information on SWOT, visit https://swot.jpl.nasa.gov/.

Source: NASA

Return to Contents

2. Stellar Thief is The Surviving Companion to a Supernova



How stripped-envelope supernovas lose that outer envelope is not entirely clear.

They were originally thought to come from single stars with very fast winds that pushed off the outer envelopes. The problem was that when astronomers started looking for the primary stars from which supernovas were spawned, they couldn't find them for many stripped-envelope supernovas.

"That was especially bizarre, because astronomers expected that they would be the most massive and the brightest progenitor stars," explained team member Ori Fox of the Space Telescope Science Institute in Baltimore. "Also, the sheer number of stripped-envelope supernovas is greater than predicted." That fact led scientists to theorize that many of the primary stars were in lower-mass binary systems, and they set out to prove it.

Looking for a binary companion after a supernova explosion is no easy task. First, it has to be at a relatively close distance to Earth for Hubble to see such a faint star. SN 2001ig and its companion are about at that limit. Within that distance range, not many supernovas go off. Even more importantly, astronomers have to know the exact position through very precise measurements.

In 2002, shortly after SN 2001ig exploded, scientists pinpointed the precise location of the supernova with the European Southern Observatory's Very Large Telescope (VLT) in Cerro Paranal, Chile. In 2004, they then followed up with the Gemini South Observatory in Cerro Pachón, Chile. This observation first hinted at the presence of a surviving binary companion.

Knowing the exact coordinates, Ryder and his team were able to focus Hubble on that location 12 years later, as the supernova's glow faded. With Hubble's exquisite resolution and ultraviolet capability, they were able to find and photograph the surviving companion--something only Hubble could do.

Prior to the supernova explosion, the orbit of the two stars around each other took about a year.

When the primary star exploded, it had far less impact on the surviving companion than might be thought. Imagine an avocado pit--representing the dense core of the companion star--embedded in a gelatin dessert--representing the star's gaseous envelope. As a shock wave passes through, the gelatin might temporarily stretch and wobble, but the avocado pit would remain intact.

In 2014, Fox and his team used Hubble to detect the companion of another Type IIb supernova, SN 1993J. However, they captured a spectrum, not an image. The case of SN 2001ig is the first time a surviving companion has been photographed. "We were finally able to catch the stellar thief, confirming our suspicions that one had to be there," said Filippenko.

Perhaps as many as half of all stripped-envelope supernovas have companions--the other half lose their outer envelopes via stellar winds. Ryder and his team have the ultimate goal of precisely determining how many supernovas with stripped envelopes have companions.

Their next endeavor is to look at completely stripped-envelope supernovas, as opposed to SN 2001ig and SN 1993J, which were only about 90 percent stripped. These completely stripped-envelope supernovas don't have much shock interaction with gas in the surrounding stellar environment, since their outer envelopes were lost long before the explosion. Without shock interaction, they fade much faster. This means that the team will only have to wait two or three years to look for surviving companions.

In the future, they also hope to use the James Webb Space Telescope to continue their search.

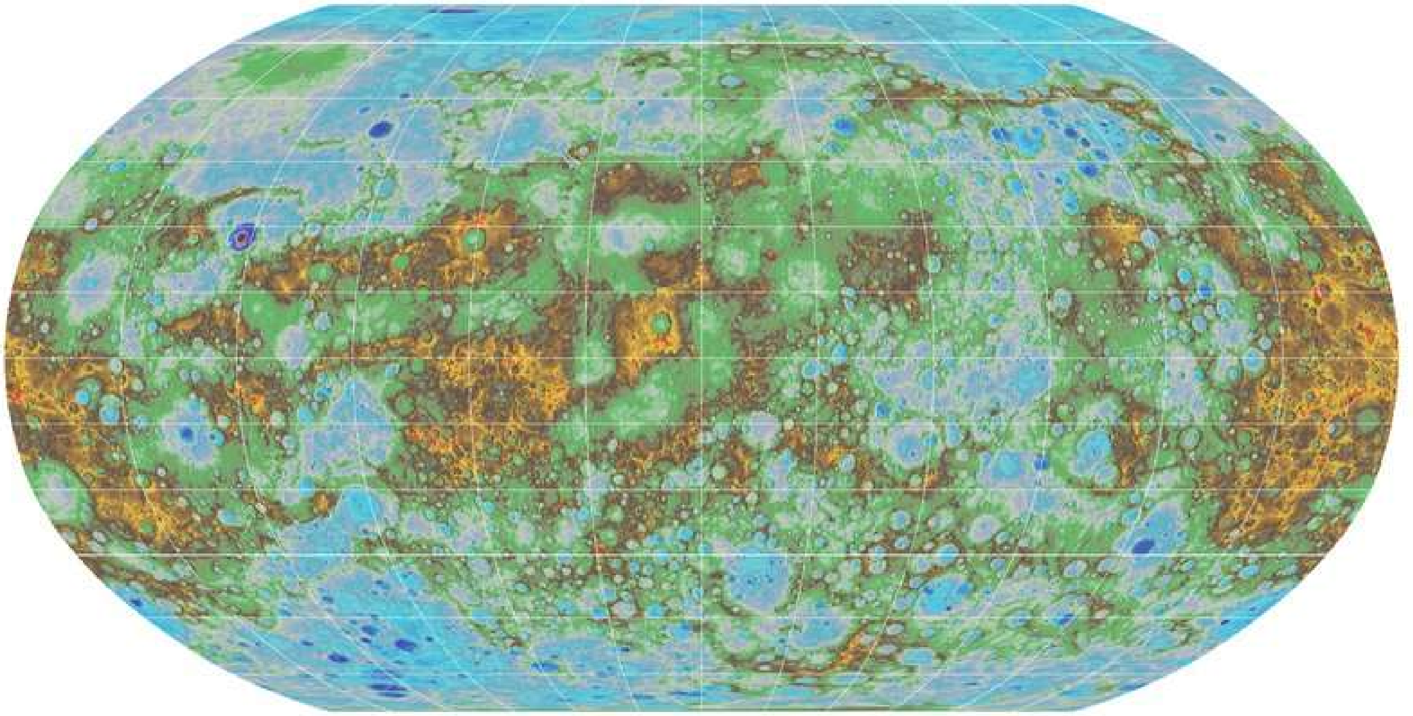
The paper on this team's current work was published on March 28, 2018 in the Astrophysical Journal.

The Hubble Space Telescope is a project of international cooperation between NASA and ESA (European Space Agency). NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the telescope. The Space Telescope Science Institute (STScI) in Baltimore, Maryland, conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy in Washington,

For the science paper, visit:
https://media.stsci.edu/preview/file/science_paper/file_attachment/321/Ryder_published_Apj_paper.pdf

Source: Spaceref.com Return to Contents

3. New Estimates of Mercury's Thin, Dense Crust



Mercury is small, fast and close to the sun, making the rocky world challenging to visit. Only one probe has ever orbited the planet and collected enough data to tell scientists about the chemistry and landscape of Mercury's surface. Learning about what is beneath the surface, however, requires careful estimation.

After the probe's mission ended in 2015, planetary scientists estimated Mercury's crust was roughly 22 miles thick. One University of Arizona scientist disagrees.

Using the most recent mathematical formulas, Lunar and Planetary Laboratory associate staff scientist Michael Sori estimates that the Mercurial crust is just 16 miles thick and is denser than aluminum. His study, "A Thin, Dense Crust for Mercury," will be published May 1 in *Earth and Planetary Science Letters* and is currently available online.

Sori determined the density of Mercury's crust using data collected by the Mercury Surface, Space Environment and Geochemistry Ranging (MESSENGER) spacecraft. He created his estimate using a formula developed by Isamu Matsuyama, a professor in the Lunar and Planetary Laboratory, and University of California Berkeley scientist Douglas Hemingway.

Sori's estimate supports the theory that Mercury's crust formed largely through volcanic activity. Understanding how the crust was formed may allow scientists to understand the formation of the entire oddly structured planet.

"Of the terrestrial planets, Mercury has the biggest core relative to its size," Sori said.

Mercury's core is believed to occupy 60 percent of the planet's entire volume. For comparison, Earth's core takes up roughly 15 percent of its volume. Why is Mercury's core so large?

"Maybe it formed closer to a normal planet and maybe a lot of the crust and mantle got stripped away by giant impacts," Sori said. "Another idea is that maybe, when you're forming so close to the sun, the solar winds blow away a lot of the rock and you get a large core size very early on. There's not an answer that everyone agrees to yet."

Sori's work may help point scientists in the right direction. Already, it has solved a problem regarding the rocks in Mercury's crust.

Mercury's Mysterious Rocks

When the planets and Earth's moon formed, their crusts were born from their mantles, the layer between a planet's core and crust that oozes and flows over the course of millions of years. The volume of a planet's crust represents the percentage of mantle that was turned into rocks.

Before Sori's study, estimates of the thickness of Mercury's crust led scientists to believe 11 percent of the planet's original mantle had been turned into rocks in the crust. For the Earth's moon – the celestial body closest in size to Mercury – the number is lower, near 7 percent.

"The two bodies formed their crusts in very different ways, so it wasn't necessarily alarming that they didn't have the exact same percentage of rocks in their crust," Sori said.

The moon's crust formed when less dense minerals floated to the surface of an ocean of liquid rock that became the body's mantle. At the top of the magma ocean, the moon's buoyant minerals cooled and hardened into a "flotation crust." Eons of volcanic eruptions coated Mercury's surface and created its "magmatic crust."

Explaining why Mercury created more rocks than the moon did was a scientific mystery no one had solved. Now, the case can be closed, as Sori's study places the percentage of rocks in Mercury's crust at 7 percent. Mercury is no better than the moon at making rocks.

Sori solved the mystery by estimating the crust's depth and density, which meant he had to find out what kind of isostasy supported Mercury's crust.

Determining Density and Depth

The most natural shape for a planetary body to take is a smooth sphere, where all points on the surface are an equal distance from the planet's core. Isostasy describes how mountains, valleys and hills are supported and kept from flattening into smooth plains.

There are two main types isostasy: Pratt and Airy. Both focus on balancing the masses of equally sized slices of the planet. If the mass in one slice is much greater than the mass in a slice next to it, the planet's mantle will ooze, shifting the crust on top of it until the masses of every slice are equal.

Pratt isostasy states that a planet's crust varies in density. A slice of the planet that contains a mountain has the same mass as a slice that contains flat land, because the crust that makes the mountain is less dense than the crust that makes flat land. In all points of the planet, the bottom of the crust floats evenly on the mantle.

Until Sori completed his study, no scientist had explained why Pratt isostasy would or wouldn't support Mercury's landscape. To test it, Sori needed to relate the planet's density to its topography. Scientists had already constructed a topographic map of Mercury using data from MESSENGER, but a map of density didn't exist. So Sori made his own using MESSENGER's data about the elements found on Mercury's surface.

"We know what minerals usually form rocks, and we know what elements each of these minerals contain. We can intelligently divide all the chemical abundances into a list of minerals," Sori said of the process he used to determine the location and abundance of minerals on the surface. "We know the densities of each of these minerals. We add them all up, and we get a map of density."

Sori then compared his density map with the topographic map. If Pratt isostasy could explain Mercury's landscape, Sori expected to find high-density minerals in craters and low-density minerals in mountains; however, he found no such relationship. On Mercury, minerals of high and low density are found in mountains and craters alike.

With Pratt isostasy disproven, Sori considered Airy isostasy, which has been used to make estimates of Mercury's crustal thickness. Airy isostasy states that the depth of a planet's crust varies depending on the topography.

"If you see a mountain on the surface, it can be supported by a root beneath it," Sori said, likening it to an iceberg floating on water.

The tip of an iceberg is supported by a mass of ice that protrudes deep underwater. The iceberg contains the same mass as the water it displaces. Similarly, a mountain and its root will contain the same mass as the mantle material being displaced. In craters, the crust is thin, and the mantle is closer to the surface. A wedge of the planet containing a mountain would have the same mass as a wedge containing a crater.

"These arguments work in two dimensions, but when you account for spherical geometry, the formula doesn't exactly work out," Sori said.

The formula recently developed by Matsuyama and Hemingway, though, does work for spherical bodies like planets. Instead of balancing the masses of the crust and mantle, the formula balances the pressure the crust exerts on the mantle, providing a more accurate estimate of crustal thickness.

Sori used his estimates of the crust's density and Hemingway and Matsuyama's formula to find the crust's thickness. Sori is confident his estimate of Mercury's crustal thickness in its northern hemisphere will not be disproven, even if new data about Mercury is collected. He does not share this confidence about Mercury's crustal density.

MESSENGER collected much more data on the northern hemisphere than the southern, and Sori predicts the average density of the planet's surface will change when density data is collected over the entire planet. He already sees the need for a follow-up study in the future.

The next mission to Mercury will arrive at the planet in 2025. In the meantime, scientists will continue to use MESSENGER data and mathematical formulas to learn everything they can about the first rock from the sun.

Explore further: Geologists identify the mineralogy of Mercury

More information: Michael M. Sori. A thin, dense crust for Mercury, *Earth and Planetary Science Letters* (2018). DOI: 10.1016/j.epsl.2018.02.033

Journal reference: Earth and Planetary Science Letters

Source: Phys.org

Return to Contents

The Night Sky

Friday, April 27

• Keep an eye on the changing pattern of Venus, Aldebaran, and the Pleiades in late twilight. Every day the stars slide a little farther to the lower right, while Venus stays at nearly the same altitude (as seen from the world's mid-northern latitudes).

• On the opposite side of the sky, look below the bright Moon for Spica. Jupiter rises far to their lower left.

Saturday, April 28

• Now Spica shines to the right of the Moon during evening. Jupiter rises in twilight, to the Moon's lower left.

Sunday, April 29

• The full Moon shines above Jupiter after dark. They may look like companions, but Jupiter is 1,700 times farther away. It's currently 27 light-minutes distant, compared to the Moon's 1.3 light-seconds.

Monday, April 30

• Now Jupiter shines to the right or upper right of the Moon after nightfall.

Tuesday, May 1

• May has sprung, but wintry Sirius still twinkles very low in the west-southwest toward the end of twilight — far to the left of much brighter Venus. How much longer into the spring can you keep Sirius in view? In other words, what will be its date of "heliacal setting" as seen by you?

Source: Sky & Telescope

Return to Contents

ISS Sighting Opportunities

For Denver: No sighting opportunities

Date	Visible	Max Height	Appears	Disappears
Sun Apr 29, 5:11 AM	2 min	11°	10° above SE	10° above ESE
Tue May 1, 5:01 AM	4 min	27°	11° above SSW	21° above E

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

NASA-TV Highlights

(all times Eastern Daylight Time)

Friday, April 27

12 p.m., SpaceCast Weekly (all channels)

12:30 p.m., Replay of The Swearing-In of NASA Administrator Jim Bridenstine (all channels)

2 p.m., Replay of The Swearing-In of NASA Administrator Jim Bridenstine (all channels)

3 p.m., Replay of SpaceCast Weekly (all channels)

4 p.m., Replay of The Swearing-In of NASA Administrator Jim Bridenstine (all channels)

6 p.m., Replay of The Swearing-In of NASA Administrator Jim Bridenstine (all channels)

7 p.m., Replay of SpaceCast Weekly (all channels)

8 p.m., Replay of The Swearing-In of NASA Administrator Jim Bridenstine (all channels)

10 p.m., Replay of The Swearing-In of NASA Administrator Jim Bridenstine (all channels)

11 p.m., Replay of SpaceCast Weekly (NTV-1 (Public))

Monday, April 30

1 p.m., Pre-Launch Briefing on NASA's Next Earth-Observing Mission: The Gravity Recovery and Climate Experiment Follow-On (GRACE-FO) Mission (all channels)

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

Return to Contents

Space Calendar

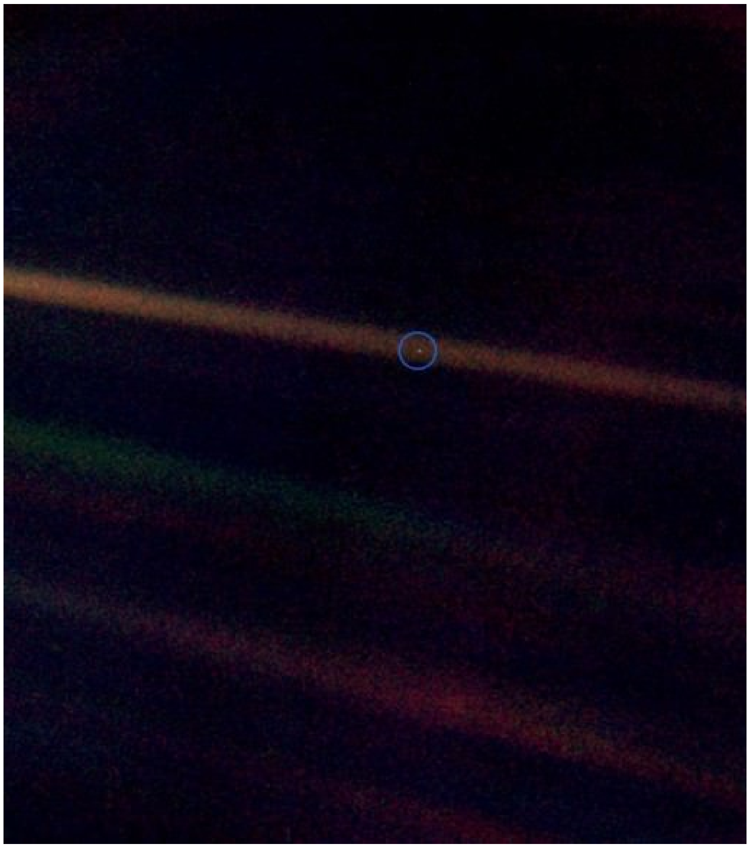
- Apr 27 - Comet P/2011 CR42 (Catalina) At Opposition (1.539 AU)
- Apr 27 - Comet 313P/Gibbs At Opposition (2.713 AU)
- Apr 27 - Apollo Asteroid 2018 GH5 Near-Earth Flyby (0.031 AU)
- Apr 27 - Apollo Asteroid 2018 GB2 Near-Earth Flyby (0.044 AU)
- Apr 27 - Apollo Asteroid 444193 (2005 SE71) Near-Earth Flyby (0.062 AU)
- Apr 27 - Amor Asteroid 194126 (2001 SG276) Near-Earth Flyby (0.084 AU)
- Apr 27 - Apollo Asteroid 5786 Talos Closest Approach To Earth (0.792 AU)
- Apr 27 - Asteroid 3773 Smithsonian Closest Approach To Earth (1.423 AU)
- Apr 27 - Asteroid 8146 Jimbell Closest Approach To Earth (1.955 AU)
- Apr 27 - Philip Abelson's 105th Birthday (1913)
- Apr 28 - Moon Occults Asteroid 21 Lutetia
- Apr 28 - Comet P/2017 B4 (PANSTARRS) Closest Approach To Earth (2.914 AU)
- Apr 28 - Comet 202P/Scotti At Opposition (3.199 AU)
- Apr 28 - Comet 191P/McNaught At Opposition (3.968 AU)
- Apr 28 - Comet P/2008 WZ96 (LINEAR) At Opposition (4.122 AU)
- Apr 28 - Amor Asteroid 2018 GO2 Near-Earth Flyby (0.061 AU)
- Apr 28 - NEW [Apr 27] Apollo Asteroid 2018 HH2 Near-Earth Flyby (0.062 AU)
- Apr 28 - Asteroid 1818 Brahms Closest Approach To Earth (1.252 AU)
- Apr 28 - Asteroid 16481 Thames Closest Approach To Earth (2.135 AU)
- Apr 28 - 15th Anniversary (2003), Galaxy Evolution Explorer (GALEX) Launch
- Apr 28 - Eugene Shoemaker's 90th Birthday (1928)
- Apr 28 - Eberhard Rees' 110th Birthday (1908)
- Apr 29 - Mercury At Its Greatest Western Elongation (27 Degrees)
- Apr 29 - NEW [Apr 27] Comet P/2018 H2 (PANSTARRS) Closest Approach To Earth (1.210 AU)
- Apr 29 - Comet 45P/Honda-Mrkos-Pajdusakova At Opposition (3.554 AU)
- Apr 29 - Comet P/2017 D4 (PANSTARRS) At Opposition (4.139 AU)
- Apr 29 - Apollo Asteroid 2013 US3 Near-Earth Flyby (0.026 AU)
- Apr 29 - Aten Asteroid 2002 JR100 Near-Earth Flyby (0.028 AU)
- Apr 29 - Apollo Asteroid 2018 GO4 Near-Earth Flyby (0.030 AU)
- Apr 29 - Apollo Asteroid 2018 GY1 Near-Earth Flyby (0.034 AU)
- Apr 29 - Amor Asteroid 2018 FV4 Near-Earth Flyby (0.045 AU)
- Apr 29 - NEW [Apr 27] Apollo Asteroid 2018 HK2 Near-Earth Flyby (0.060 AU)
- Apr 29 - NEW [Apr 25] Amor Asteroid 2018 HT1 Near-Earth Flyby (0.073 AU)
- Apr 29 - Asteroid 4659 Roddenberry Closest Approach To Earth (1.878 AU)
- Apr 29 - Asteroid 4749 Ledzepplin Closest Approach To Earth (2.315 AU)
- Apr 29 - Asteroid 5870 Baltimore Closest Approach To Earth (2.948 AU)
- Apr 29 - Kuiper Belt Object 2014 FC69 At Opposition (83.748 AU)
- Apr 29 - Nikolai Budarin's 65th Birthday (1953)
- Apr 29 - Harold Urey's 125th Birthday (1893)
- Apr 30 - Moon Occults Asteroid 16 Psyche
- Apr 30 - Comet 169P/NEAT Perihelion (0.604 AU)
- Apr 30 - Comet C/2017 K1 (PANSTARRS) Closest Approach To Earth (6.259 AU)
- Apr 30 - Comet C/2017 K1 (PANSTARRS) At Opposition (6.259 AU)
- Apr 30 - Comet C/2015 XY1 (Lemmon) Perihelion (7.928 AU)
- Apr 30 - NEW [Apr 27] Amor Asteroid 2018 HF2 Near-Earth Flyby (0.048 AU)
- Apr 30 - Asteroid 42981 Jenniskens Closest Approach To Earth (1.176 AU)
- Apr 30 - Asteroid 2700 Baikonur Closest Approach To Earth (1.981 AU)
- Apr 30 - Asteroid 2801 Huygens Closest Approach To Earth (2.082 AU)

Source: JPL Space Calendar

Return to Contents

Food for Thought

If We're Searching for Earth 2.0, Would We Know It When We Find It?



In the past few decades, there has been an explosion in the number of extra-solar planets that have been discovered. As of April 1st, 2018, a total of 3,758 exoplanets have been confirmed in 2,808 systems, with 627 systems having more than one planet. In addition to expanding our knowledge of the Universe, the purpose of this search has been to find evidence of life beyond our Solar System.

In the course of looking for habitable planets, astronomers have used Earth as a guiding example. But would we recognize a truly "Earth-like" planet if we saw one? This question was addressed in a recent paper by two professors, one of whom is an exoplanet-hunter and the other, an Earth science and astrobiology expert. Together, they consider what advances (past and future) will be key to the search for Earth 2.0.

The paper, titled "Earth as an Exoplanet", recently appeared online. The study was conducted by Tyler D. Robinson, a former NASA Postdoctoral Fellow and an assistant professor from Northern Arizona University, and Christopher T. Reinhard – an assistant professor from the Georgia Institute of Technology's School of of Earth and Atmospheric Studies.

For the sake of their study, Robinson and Reinhard focus on how the hunt for habitable and inhabited planets beyond our Solar System commonly focuses on Earth analogs. This is to be expected, since Earth is the only planet that we know of that can support life. As Professor Robinson told Universe Today via email:

"Earth is – currently! – our only example of a habitable and an inhabited world. Thus, when someone asks, "What will a habitable exoplanet look like?" or "What will a life-bearing exoplanet look like?", our best option is to point to Earth and say, "Maybe it will look a lot like this." While many studies have hypothesized other habitable planets (e.g., water-covered super-Earths), our leading example of a fully-functioning habitable planet will always be Earth."

The authors therefore consider how observations made by spacecraft of the Solar System have led to the development of approaches for detecting signatures of habitability and life on other worlds. These include the Pioneer 10 and 11 missions and Voyager 1 and 2 spacecraft, which conducted flybys of many Solar System bodies during the 1970s.

These missions, which conducted studies on the planets and moons of the Solar System using photometry and spectroscopy allowed scientists to learn a great deal about these bodies' atmospheric chemistry and composition, as well as meteorlogical patterns and chemistry. Subsequent missions have added to this by revealing key details about the surface details and geological evolution of the Solar planets and moons.

In addition, the *Galileo* probe conducted flybys of Earth in December of 1990 and 1992, which provided planetary scientists with the first opportunity to analyze our planet using the same tools and techniques that had previously been applied throughout the Solar System. It was also the *Voyager 1* probe that took a distant image of Earth, which Carl Sagan referred to as the "Pale Blue Dot" photo.

However, they also note that Earth's atmosphere and surface environment has evolved considerably over the past 4.5 billion years ago. In fact, according to various atmospheric and geological models, Earth has resembled many environments in the past that would be considered quite "alien" by today's standards. These include Earth's many ice ages and the earliest epochs, when Earth's primordial atmosphere was the product of volcanic outgassing.

As Professor Robinson explained, this presents some complications when it comes to finding other examples of "Pale Blue Dots":

"The key complication is being careful to not fall into the trap of thinking that Earth has always appeared the way it does today. So, our planet actually presents a huge array of options for what a habitable and/or inhabited planet might look like."

In other words, our hunt for Earth analogs could reveal a plethora of worlds which are "Earth-like", in the sense that they resemble a previous (or future) geological period of Earth. These include "Snowball Earth's", which would be covered by glacial sheets (but could still be life-bearing), or even what Earth looked like during the Hadean or Archean Eons, when oxygenic photosynthesis had not yet taken place.

This would also have implications when it comes to what kinds of life would be able to exist there. For instance, if the planet is still young and its atmosphere was still in its primordial state, life could be strictly in microbial form. However, if the planet was billions of years old and in an interglacial period, more complex life forms may have evolved and be roaming the Earth.

Robinson and Reinhard go on to consider what future developments will aid in the spotting of "Pale Blue Dots". These include next-generation telescopes like the James Webb Space Telescope (JWST) – scheduled for deployment in 2020 – and the Wide-Field Infrared Survey Telescope(WFIRST), which is currently under development. Other technologies include concepts like Starshade, which is intended to eliminate the glare of stars so that exoplanets can be directly imaged.

"Spotting true Pale Blue Dots – water-covered terrestrial worlds in the habitable zone of Sun-like stars – will require advancements in our ability to "directly image" exoplanets," said Robinson. "Here, you use either optics inside the telescope or a futuristic-sounding "starshade" flying beyond the telescope to cancel out the light of a bright star thereby enabling you to see a faint planet orbiting that star. A number of different research groups, including some at NASA centers, are working to perfect these technologies."

Once astronomers are able to image rocky exoplanets directly, they will at last be able to study their atmospheres in detail and place more accurate constraints on their potential habitability. Beyond that, there may come a day when we will be able to image the surfaces of these planets, either through extremely sensitive telescopes or spacecraft missions (such as Project Starshot).

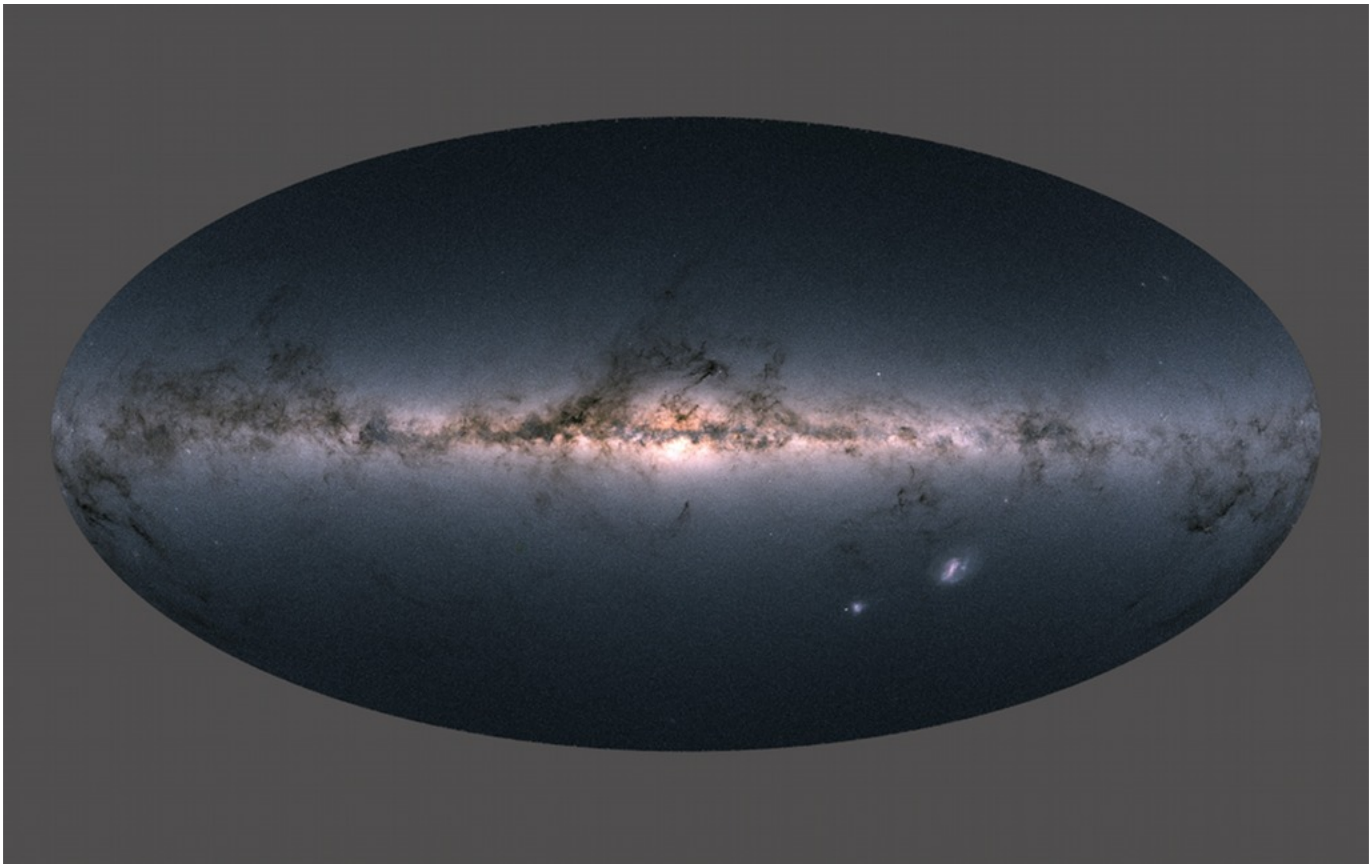
Whether or not we find another "Pale Blue Dot" remains to be seen. But in the coming years, we may finally get a good idea of just how common (or rare) our world truly is.

Further Reading: arXiv

Source: Universe Today

Return to Contents

Space Image of the Week



Gaia's Milky Way

Explanation This grand allsky view of our Milky Way and nearby galaxies is not a photograph. It's a map based on individual measurements for nearly 1.7 *billion* stars. The astronomically rich data set used to create it, the sky-scanning Gaia satellite's second data release, includes remarkably precise determinations of position, brightness, colour, and parallax distance for 1.3 billion stars. Of course, that's about 1 percent of the total number of stars in the Milky Way. The flat plane of our galaxy still dominates the view. Home to most Milky Way stars it stretches across the center of Gaia's stellar data map. Voids and rifts along the galactic plane correspond to starlight-obscuring interstellar dust clouds. At lower right are stars of the Large and Small Magellanic Clouds, neighboring galaxies that lie just beyond the Milky Way.

Source: APOD

Return to Contents