# Space News Update

— October 6, 2017 —

## Contents

## 1. VP Mike Pence Lays Out Administration's Plan to go back to the Moon

Looking to the future of space exploration, NASA's priorities are sometimes subject to change. In 2004, the Bush administration released it's "Vision for Space Exploration", which called for the development of rockets that would return astronauts to the Moon. This policy was later replaced by the NASA Authorization Act of 2010, which outlined plans to send humans to an asteroid by 2025 and to Mars in the 2030s.

Earlier today, on Thursday, October 5th, Vice President Mike Pence and several members of the Trump administration announced that their priorities have shifted once again. Instead of proceeding with NASA's proposed "Journey to Mars", the administration has set its sights on once again mounting crewed missions to the Moon and establishing a permanent presence on the lunar surface.

The announcement came during the inaugural meeting of the National Space Council, the newly-reestablished executive group that will be guiding US space policy in the coming years. Originally established in 1989 by then-president George H.W. Bush (and disbanded in 1993 by the Clinton administration), this council served the same purpose as the National Aeronautics and Space Council – which oversaw space policy between 1958 and 1973.

The meeting, titled "Leading the Next Frontier: An Event with the National Space Council", took place at the Smithsonian National Air and Space Museum's (NASM) Steven F. Udvar-Hazy Center in Chantilly, Virginia. The meeting was chaired by Vice President Mike Pence with the participation of NASA Administrator Robert Lightfoot, and was attended by Trump Administration cabinet members, senior officials, and aerospace industry leaders.

During the course of the meeting, which was live-streamed, Vice President Mike Pence laid out the administration's plans for returning astronauts to the Moon. Emphasizing the need to restore NASA and

America's leadership in space, Pence compared the current situation to the early years of the Space Race and the crowing achievement that was the Apollo 11 mission. As he said:

"*It is altogether fitting that we chose this week for the first meeting of the National Space Council. Yesterday marked the 60th anniversary of Sputnik, that 184-pound satellite that changed the course of history. On that day, six decades ago yesterday, the race for space began and the then-Soviet Union took an early lead. But the sight of that light blinking across that October sky spurred America to action. We refused to accept a future in space written by the enemies of freedom, and so the United States of America vowed to claim our rightful place as the undisputed leader in the exploration of the heavens. And twelve years later, with "one giant leap for mankind", America led in space.*

Moving to the present, Pence indicated that the reestablishment of he National Space Council would put an end to the ways in which space exploration has stalled in recent decades. He also indicated how a return to the Moon – a goal which diminished in important in the post-Apollo era – would recapture the spirit of the past and reinvigorate modern space exploration.

As he expressed during the course of the meeting, the way space exploration has stalled is in part due to the way in which the Moon (as a destination) has diminished in importance:

*"Our struggle to define the direction and purpose of America's space program dates back decades to the post-Apollo period. We had just won the race to the Moon and suddenly the question became, 'What should we do? Where should we go next?' In the debate that followed, sending Americans to the Moon was treated as a triumph to be remembered, but not repeated. Every passing year that the Moon remained squarely in the rear-view mirror further eroded our ability to return to the lunar domain and made it more likely that we would forget why we ever wanted to go in the first place."*

A renewed mission to the Moon, claimed Pence, will put an end to decades in which not a single NASA astronaut has ventured beyond Low Earth Orbit. He further indicated how after the retirement of the Space Shuttle Program, the US has been dependent on Russia to ferry astronauts to the International Space Station. He also voiced criticism for the Obama administration, claiming that it chose "capitulation" when it came to the space race.

While this new policy technically represents a break from the policy of the Obama administration, and a return to the policy of the Bush administration, Pence emphasized that returning to the Moon would be a stepping stone towards an eventual crewed mission to the Red Planet. This announcement also put an end to months of ambiguity regarding the Trump administration's space policy.

In the past, VP Pence has spoken about the need to return to the Moon and puts boots on Mars, but nothing definitive was said. This ambiguity, it is worth noting, has also been a source of anxiety for those at NASA, who were unsure about the future budget environment. And while this meeting did indicate that the Trump administration has a policy, many aspects of it were already in place before the administration took office.

After the meeting concluded, acting NASA Administrator Robert Lightfoot spoke of the results in a NASA press statement. In reference to the direction VP Pence had indicated for the agency, he said the following:

*"Specifically, NASA has been directed to develop a plan for an innovative and sustainable program of exploration with commercial and international partners to enable human expansion across the solar system, returning humans to the Moon for long-term exploration and utilization, followed by human missions to Mars and other destinations."*

Much of the details discussed at the meeting were already established as early as last September. It was at this time that the NASA Transition Authorization Act of 2016, a provisional measure that guaranteed short-

term stability for the agency by allocating $19.5 billion in funding for NASA for fiscal year 2017. Intrinsic to the Act was the cancellation for the NASA's Asteroid Robotic Redirect Missions(ARRM) in favor of a more cost-effective alternative.

As Lightfoot indicated, this would still be the case under the current administration's plan:

*"The recommendation to the president would modify the existing National Space Policy to provide focus and direction to some of NASA's current activities and plans, and remove a previous guideline that NASA should undertake a human mission to an asteroid as the next human spaceflight milestone beyond low-Earth orbit."*

Lighfoot also reiterated what Pence said during the meeting, how renewed missions to the Moon would ultimately assist NASA's efforts to mount crewed missions to Mars. These included the importance of cis-lunar space to the exploration of both the Moon and the Mars, as well as its use as a proving ground for future mission to Mars and beyond in the Solar System.

"Based on a number of conversations I've had with the council," he said, "we have highlighted a number of initiatives underway in this important area, including a study of an orbital gateway or outpost that could support a sustained cadence of robotic and human missions, as well as ensuing human missions to the lunar and Mars surfaces, and other destinations."

While this latest announcement does confirm what many have suspected for some time – that the Trump administration would prioritize lunar exploration – much ambiguity remains. While Pence emphasized that the re-establishment of the NSC was intrinsic to restoring American leadership in space, very little appears to have changed since the NASA Transition Authorization Act of 2016.

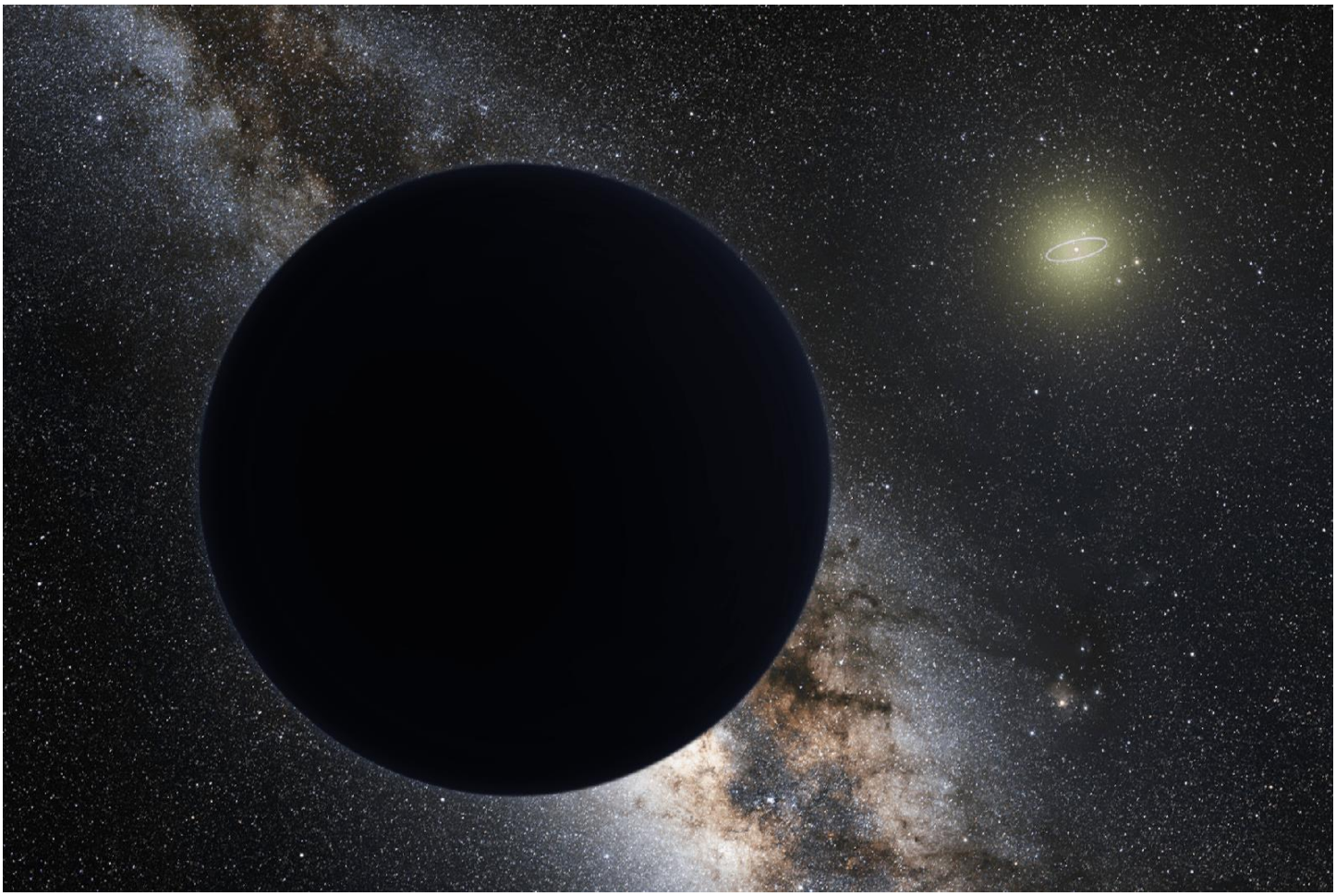
What's more, despite Pence's claims of "capitulation" on behalf of the Obama administration, much of the current administration's policy represents a continuation of the NASA Authorization Act of 2010. These include the use of the Space Launch System (SLS), the Orion spacecraft, and the restoration of domestic launch capability. In short, much of the Trump administration's plans to restore American leadership in space are piggybacking on the accomplishments of the Obama administration.

Beyond that, the creation of the Deep Space Gateway appears unaffected, since its existence is central to both renewed mission to the Moon and for crewed missions to Mars. And the long-term plan for the exploration of Mars appear to still be intact. So in many ways, this latest announcement is not much in the way of news, but also good news.

When it comes to organizations like NASA and space exploration in general, continuity is not only preferable.

Source: Universe Today Return to Contents

## 2. The Super-Earth that Came Home for Dinner



It might be lingering bashfully on the icy outer edges of our solar system, hiding in the dark, but subtly pulling strings behind the scenes: stretching out the orbits of distant bodies, perhaps even tilting the entire solar system to one side.

If a planet is there, it's extremely distant and will stay that way (with no chance -- in case you're wondering -- of ever colliding with Earth, or bringing "days of darkness").It is a possible "Planet Nine" -- a world perhaps 10 times the mass of Earth and 20 times farther from the sun than Neptune. The signs so far are indirect, mainly its gravitational footprints, but that adds up to a compelling case nonetheless.

One of its most dedicated trackers, in fact, says it is now harder to imagine our solar system without a Planet Nine than with one.

"There are now five different lines of observational evidence pointing to the existence of Planet Nine," said Konstantin Batygin, a planetary astrophysicist at Caltech in Pasadena, California, whose team may be closing in. "If you were to remove this explanation and imagine Planet Nine does not exist, then you generate more problems than you solve. All of a sudden, you have five different puzzles, and you must come up with five different theories to explain them."

Batygin and his co-author, Caltech astronomer Mike Brown, described the first three breadcrumbs on Planet Nine's trail in a January 2016 paper, published in the Astronomical Journal. Six known objects in the distant Kuiper Belt, a region of icy bodies stretching from Neptune outward toward interstellar space, all have elliptical orbits pointing in the same direction. That would be unlikely -- and suspicious -- enough. But these orbits also

are tilted the same way, about 30 degrees "downward" compared to the pancake-like plane within which the planets orbit the sun.

Breadcrumb number three: Computer simulations of the solar system with Planet Nine included show there should be more objects tilted with respect to the solar plane. In fact, the tilt would be on the order of 90 degrees, as if the plane of the solar system and these objects formed an "X" when viewed edge-on. Sure enough, Brown realized that five such objects already known to astronomers fill the bill.

Two more clues emerged after the original paper. A second article from the team, this time led by Batygin's graduate student, Elizabeth Bailey, showed that Planet Nine could have tilted the planets of our solar system during the last 4.5 billion years. This could explain a longstanding mystery: Why is the plane in which the planets orbit tilted about 6 degrees compared to the sun's equator?

"Over long periods of time, Planet Nine will make the entire solar-system plane precess or wobble, just like a top on a table," Batygin said.

The last telltale sign of Planet Nine's presence involves the solar system's contrarians: objects from the Kuiper Belt that orbit in the opposite direction from everything else in the solar system. Planet Nine's orbital influence would explain why these bodies from the distant Kuiper Belt end up "polluting" the inner Kuiper Belt.

"No other model can explain the weirdness of these high-inclination orbits," Batygin said. "It turns out that Planet Nine provides a natural avenue for their generation. These things have been twisted out of the solar system plane with help from Planet Nine and then scattered inward by Neptune."

The remaining step is to find Planet Nine itself. Batygin and Brown are using the Subaru Telescope at Mauna Kea Observatory in Hawaii to try to do just that. The instrument is the "best tool" for picking out dim, extremely distant objects lost in huge swaths of sky, Batygin said.

But where did Planet Nine come from? Batygin says he spends little time ruminating on its origin -- whether it is a fugitive from our own solar system or, just maybe, a wandering rogue planet captured by the sun's gravity.

"I think Planet Nine's detection will tell us something about its origin," he said.

Other scientists offer a different possible explanation for the Planet Nine evidence cited by Batygin. A recent analysis based on a sky mapping project called the Outer Solar System Origins Survey, which discovered more than 800 new "trans-Neptunian objects," suggests that the evidence also could be consistent with a random distribution of such objects. Still, the analysis, from a team led by Cory Shankman of the University of Victoria, could not rule out Planet Nine.

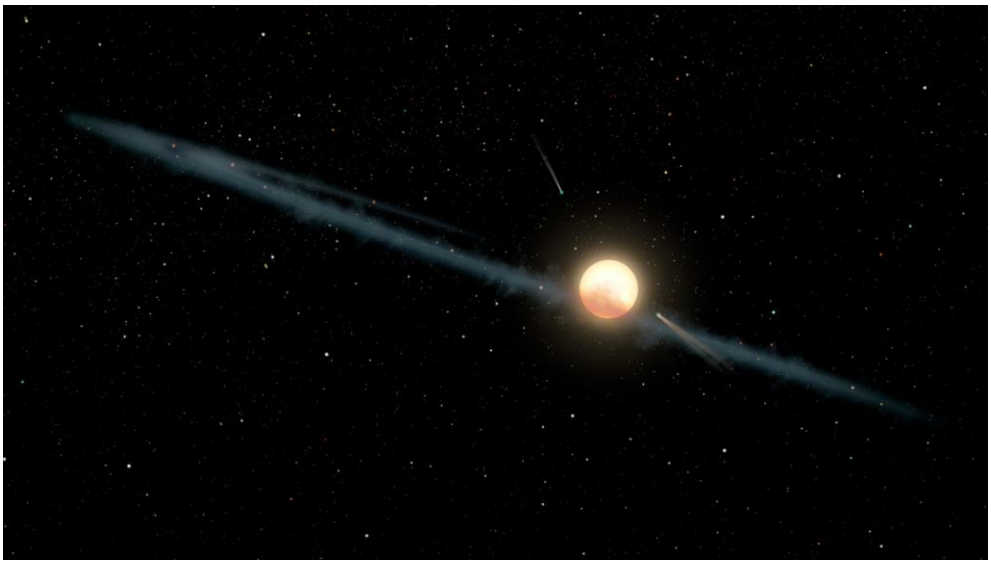
If Planet Nine is found, it will be a homecoming of sorts, or at least a family reunion. Over the past 20 years, surveys of planets around other stars in our galaxy have found the most common types to be "super Earths" and their somewhat larger cousins -- bigger than Earth but smaller than Neptune.

Yet these common, garden-variety planets are conspicuously absent from our solar system. Weighing in at roughly 10 times Earth's mass, the proposed Planet Nine would make a good fit.

Planet Nine could turn out to be our missing super Earth.

Source: JPL Return to Contents

## 3. Mysterious dimming of Tabby's Star may be caused by dust



One of the most mysterious stellar objects may be revealing some of its secrets at last.

Called KIC 8462852, also known as Boyajian's Star, or Tabby's Star, the object has experienced unusual dips in brightness—NASA's Kepler space telescope even observed dimming of up to 20 percent over a matter of days. In addition, the star has had much subtler but longer-term enigmatic dimming trends, with one continuing today. None of this behavior is expected for normal stars slightly more massive than the Sun. Speculations have included the idea that the star swallowed a planet that it is unstable, and a more imaginative theory involves a giant contraption or "megastructure" built by an advanced civilization, which could be harvesting energy from the star and causing its brightness to decrease.

A new study using NASA's Spitzer and Swift missions, as well as the Belgian AstroLAB IRIS observatory, suggests that the cause of the dimming over long periods is likely an uneven dust cloud moving around the star. This flies in the face of the "alien megastructure" idea and the other more exotic speculations.

The smoking gun: Researchers found less dimming in the infrared light from the star than in its ultraviolet light. Any object larger than dust particles would dim all wavelengths of light equally when passing in front of Tabby's Star.

"This pretty much rules out the alien megastructure theory, as that could not explain the wavelength-dependent dimming," said Huan Meng, at the University of Arizona, Tucson, who is lead author of the new study published in The *Astrophysical Journal*. "We suspect, instead, there is a cloud of dust orbiting the star with a roughly 700-day orbital period."

**Why Dust is Likely**

We experience the uniform dimming of light often in everyday life: If you go to the beach on a bright, sunny day and sit under an umbrella, the umbrella reduces the amount of sunlight hitting your eyes in all wavelengths. But if you wait for the sunset, the sun looks red because the blue and ultraviolet light is scattered away by tiny particles.The new study suggests the objects causing the long-period dimming of Tabby's Star can be no more than a few micrometers in diameter (about one ten-thousandth of an inch).

From January to December 2016, the researchers observed Tabby's Star in ultraviolet using Swift, and in infrared using Spitzer. Supplementing the space telescopes, researchers also observed the star in visible light

during the same period using AstroLAB IRIS, a public observatory with a 27-inch-wide (68 centimeter) reflecting telescope located near the Belgian village of Zillebeke.

Based on the strong ultraviolet dip, the researchers determined the blocking particles must be bigger than interstellar dust, small grains that could be located anywhere between Earth and the star. Such small particles could not remain in orbit around the star because pressure from its starlight would drive them farther into space. Dust that orbits a star, called circumstellar dust, is not so small it would fly away, but also not big enough to uniformly block light in all wavelengths. This is currently considered the best explanation, although others are possible.

**Collaboration with Amateur Astronomers**

Citizen scientists have had an integral part in exploring Tabby's Star since its discovery. Light from this object was first identified as "bizarre" and "interesting" by participants in the Planet Hunters project, which allows anyone to search for planets in the Kepler data. That led to a 2016 study formally introducing the object, which is nicknamed for Tabetha Boyajian, now at Louisiana State University, Baton Rouge, who was the lead author of the original paper and is a co-author of the new study. The recent work on long-period dimming involves amateur astronomers who provide technical and software support to AstroLAB.

Several AstroLAB team members who volunteer at the observatory have no formal astronomy education. Franky Dubois, who operated the telescope during the Tabby's Star observations, was the foreman at a seat belt factory until his retirement. Ludwig Logie, who helps with technical issues on the telescope, is a security coordinator in the construction industry. Steve Rau, who processes observations of star brightness, is a trainer at a Belgian railway company.

Siegfried Vanaverbeke, an AstroLAB volunteer who holds a Ph.D. in physics, became interested in Tabby's Star after reading the 2016 study, and persuaded Dubois, Logie and Rau to use Astrolab to observe it.

"I said to my colleagues: 'This would be an interesting object to follow,'" Vanaverbeke recalled. "We decided to join in."

University of Arizona astronomer George Rieke, a co-author on the new study, contacted the AstroLAB group when he saw their data on Tabby's Star posted in a public astronomy archive. The U.S. and Belgium groups teamed up to combine and analyze their results.

**Future Exploration**

While study authors have a good idea why Tabby's Star dims on a long-term basis, they did not address the shorter-term dimming events that happened in three-day spurts in 2017. They also did not confront the mystery of the major 20-percent dips in brightness that Kepler observed while studying the Cygnus field of its primary mission. Previous research with Spitzer and NASA's Wide-field Infrared Survey Explorer suggested a swarm of comets may be to blame for the short-period dimming. Comets are also one of the most common sources of dust that orbits stars, and so could also be related to the long-period dimming studied by Meng and colleagues.

Now that Kepler is exploring other patches of sky in its current mission, called K2, it can no longer follow up on Tabby's Star, but future telescopes may help unveil more secrets of this mysterious object.

"Tabby's Star could have something like a solar activity cycle. This is something that needs further investigation and will continue to interest scientists for many years to come," Vanaverbeke said.

Source: Phys.org Return to Contents

# The Night Sky

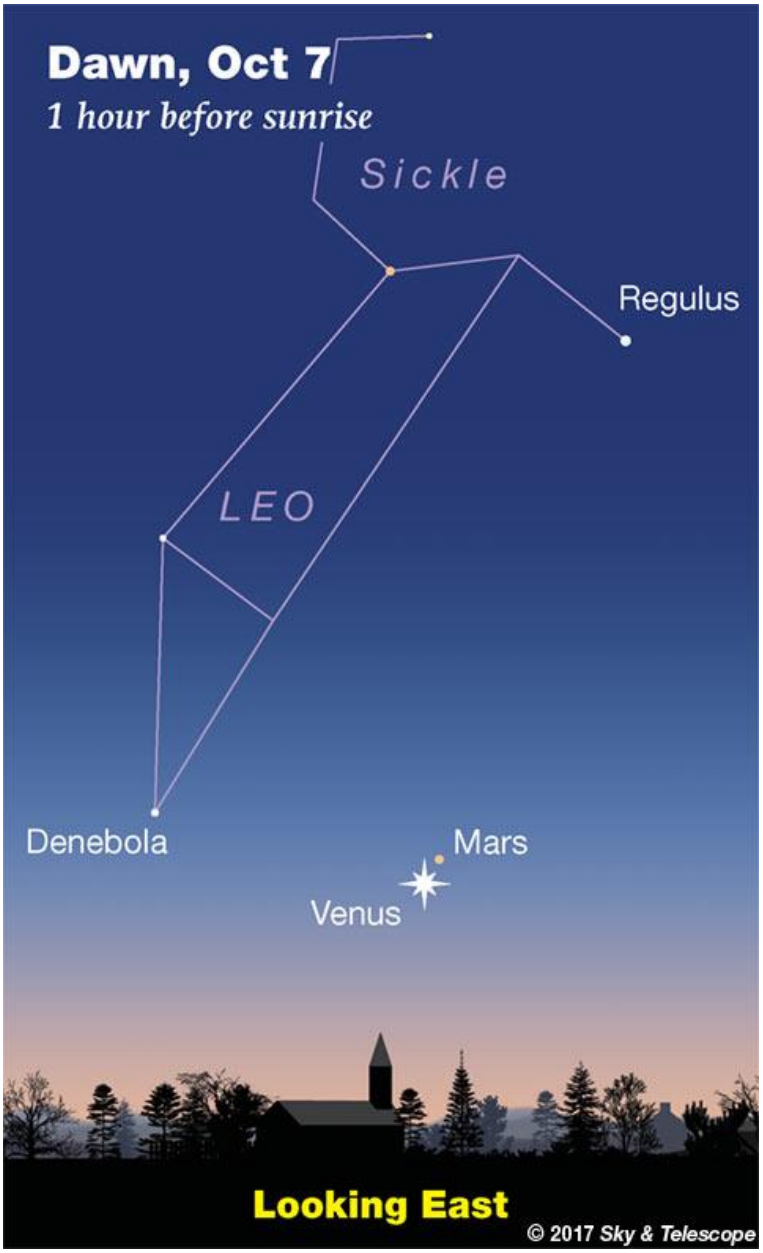
**Friday, October 6**
• The Moon, just past full, rises in the east in late twilight. As night arrives, look for the two brightest stars of Aries to the Moon's upper left by about a fist and a half at arm's length. The stars are 4° apart (less than half a fist) and lined up almost horizontally. Can you see that the brighter one — Hamal, on the left — has an orange tint?

**Saturday, October 7**
• The Great Square of Pegasus balances on its corner high in the east at nightfall. For your location, when it is *exactly* balanced? That is, when it the Square's top corner exactly above its bottom corner? It'll be sometime after the end of twilight, depending on both your latitude and longitude. Try lining up the stars with the vertical edge of a building.

**Sunday, October 8**
• The starry W of Cassiopeia stands high in the northeast after dark. The right-hand side of the W (the brightest side) is tilted up.

Look along the second segment of the W counting down from the top. Notice the dimmer naked-eye star partway along that segment. That's Eta Cassiopeiae, magnitude 3.4, a Sun-like star just 19 light-years away with an orange-dwarf companion. It's a lovely binary pair in a telescope, with an easy separation of 20 arcseconds.

Left of Eta Cas along the segment is a fainter, much wider pair: Upsilon$^1$ and Upsilon$^2$ Cassiopeiae, separation 0.3° (1,200 arcseconds). This pair consists of two orange giants, and they're unrelated to each other; they're 200 and 400 light-years from us.




• The waning gibbous Moon rises in midevening with the Pleiades to its upper left and Aldebaran and the Hyades to its lower left.

**Monday, October 9**
• As the last of twilight fades away, look above the northeast horizon — far below Cassiopeia — for bright Capella on the rise. How high you'll find it depends on your latitude. The farther north you are, the higher it will be.

**Tuesday, October 10**
• Sometime around when nightfall is complete, you'll find zero-magnitude Arcturus low in the west-northwest at the same height as zero-magnitude Capella in the northeast. When this happens, turn to the south-southeast, and there will be 1st-magnitude Fomalhaut at the same height too — if you're at latitude 43° north. Seen from south of that latitude Fomalhaut will appear higher; from north of there it will be lower.

Source: Sky & Telescope

Return to Contents

# ISS Sighting Opportunities

## For Denver:

| Date | Visible | Max Height | Appears | Disappears |
|---|---|---|---|---|
| Fri Oct 6, 7:33 PM | 1 min | 10° | 10° above N | 10° above NNE |
| Sat Oct 7, 8:17 PM | 1 min | 14° | 11° above NNW | 14° above N |
| Sun Oct 8, 7:25 PM | 3 min | 12° | 10° above N | 10° above NE |
| Sun Oct 8, 9:00 PM | < 1 min | 10° | 10° above NW | 10° above NW |
| Mon Oct 9, 8:09 PM | 2 min | 21° | 11° above NNW | 21° above N |
| Tue Oct 10, 7:16 PM | 4 min | 16° | 10° above NNW | 13° above NE |
| Tue Oct 10, 8:53 PM | < 1 min | 15° | 12° above NW | 15° above NW |

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

# NASA-TV Highlights

**(all times Eastern Daylight Time)**

**1 p.m., 7 p.m., Friday, October 6 -** The Smithsonian National Air and Space Museum Presents – "What's New in Aerospace?" From Hurricanes to Your Street Corner: Photography from Space (all channels)
**3 p.m., 8 p.m., Friday, October 6 -** Replay of Vice President Mike Pence and the first meeting of the National Space Council at the Smithsonian National Air and Space Museum's Steven F. Udvar-Hazy Center (NTV-1 (Public))
**6 p.m., Friday, October 6 -** Replay of SpaceCast Weekly (all channels)
**7 a.m., 10:30 a.m., 3:30 p.m., 8:30 p.m., Saturday, October 7 -** Replay of SpaceCast Weekly (all channels)
**8 a.m., 1 p.m., 6 p.m., 9 p.m., Saturday, October 7 -** Replay of Vice President Mike Pence and the first meeting of the National Space Council at the Smithsonian National Air and Space Museum's Steven F. Udvar-Hazy Center (NTV-1 (Public))
**11 a.m., 4 p.m., Saturday, October 7 -** Replay of The Smithsonian National Air and Space Museum Presents – "What's New in Aerospace?" From Hurricanes to Your Street Corner: Photography from Space (NTV-1 (Public))
**12 p.m., 5 p.m., Saturday, October 7 -** Von Karman Lecture Series - Volcanologists Paradise (Replay) (NTV-1 (Public))
**7 a.m., 12 p.m., 4 p.m., 8 p.m., Sunday, October 8 -** Replay of Vice President Mike Pence and the first meeting of the National Space Council at the Smithsonian National Air and Space Museum's Steven F. Udvar-Hazy Center (NTV-1 (Public))
**9:30 a.m., 2:30 p.m., 6:30 p.m., Sunday, October 8 -** Replay of SpaceCast Weekly (all channels)
**10 a.m., 3 p.m., Sunday, October 8 -** Replay of The Smithsonian National Air and Space Museum Presents – "What's New in Aerospace?" From Hurricanes to Your Street Corner: Photography from Space (NTV-1 (Public))
**11 a.m., 7 p.m., Sunday, October 8 -** Von Karman Lecture Series - Volcanologists Paradise (Replay) (NTV-1 (Public))
**6:30 a.m., Tuesday, October 10 -** Coverage of ISS Expedition 53 U.S. Spacewalk #45 (Spacewalk begins at 8:05 a.m. ET, expected to last 6 ½ hours; Bresnik and Vande Hei) (all channels)

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

Return to Contents

# Space Calendar

- Oct 06 - UPDATED [Oct 05] NROL-52/ Quasar 21 Atlas 5 Launch
- Oct 06 - Comet 73P-BQ/Schwassmann-Wachmann Closest Approach To Earth (1.772 AU)
- Oct 06 - Comet 73P-N/Schwassmann-Wachmann Closest Approach To Earth (1.789 AU)
- Oct 06 - Comet C/2017 S2 (PANSTARRS) Closest Approach To Earth (2.643 AU)
- Oct 06 - Comet 124P/Mrkos At Opposition (3.915 AU)
- Oct 06 - Asteroid 277 Elvira Occults HIP 116323 (5.9 Magnitude Star)
- Oct 06 - Apollo Asteroid 2011 TB4 Near-Earth Flyby (0.065 AU)
- Oct 06 - Apollo Asteroid 2017 GS6 Near-Earth Flyby (0.078 AU)
- Oct 06 - Aten Asteroid 2004 TD10 Near-Earth Flyby (0.084 AU)
- Oct 06 - Aten Asteroid 5381 Sekmet Closest Approach To Earth (0.649 AU)
- Oct 06 - Asteroid 5819 Lauretta Closest Approach To Earth (1.285 AU)
- Oct 06 - Asteroid 35978 Arlington Closest Approach To Earth (1.458 AU)
- Oct 06 - Asteroid 9325 Stonehenge Closest Approach To Earth (1.552 AU)
- Oct 06 - Asteroid 15550 Sydney Closest Approach To Earth (1.672 AU)
- Oct 06 - Asteroid 671 Carnegia Closest Approach To Earth (2.044 AU)
- Oct 06 - Nevil Maskelyne's 285th Birthday (1732)
- Oct 07 - UPDATED [Oct 03] Echostar 105/SES-11 Falcon 9 Launch
- Oct 07 - Comet 73P-W/Schwassmann-Wachmann At Opposition (0.928 AU)
- Oct 07 - NEW [Sep 30] Comet P/2017 S5 (ATLAS) Closest Approach To Earth (1.257 AU)
- Oct 07 - Comet 73P-AX/Schwassmann-Wachmann Closest Approach To Earth (1.815 AU)
- Oct 07 - Comet P/2016 P1 (PANSTARRS) At Opposition (3.049 AU)
- Oct 07 - Asteroid 3 Juno Occults 2UCAC 27345728 (12.2 Magnitude Star)
- Oct 07 - Asteroid 916 America Closest Approach To Earth (0.829 AU)
- Oct 07 - Asteroid 293909 Matterhorn Closest Approach To Earth (1.854 AU)
- Oct 07 - Kuiper Belt Object 2008 ST291 At Opposition (59.580 AU)
- Oct 07 - Space Day 2017, Worcester, United Kingdom
- Oct 07 - 15th Anniversary (2002), STS-112 Launch (Space Shuttle Atlantis, International Space Station)
- Oct 07 - 15th Anniversary (2002), Founding of the B612 Foundation
- Oct 07 - Donald Machholz's 65th Birthday (1952)
- Oct 07 - Franz Suess' 150th Birthday (1867)
- Oct 08 - Asteroid 56678 Alicewessen Closest Approach To Earth (1.740 AU)
- Oct 08 - 25th Anniversary (1992), Pioneer Venus' Burnup in Venus' Atmosphere
- Oct 09 - UPDATED [Oct 05] VRSS 2 (Antonio Jose de Sucre) CZ-2D Launch
- Oct 09 - Draconids Meteor Shower Peak
- Oct 09 - Moon Occults Aldebaran
- Oct 09 - Comet 73P-BO/Schwassmann-Wachmann Closest Approach To Earth (1.862 AU)
- Oct 09 - Comet 73P-BN/Schwassmann-Wachmann Closest Approach To Earth (1.872 AU)
- Oct 09 - Comet 232P/Hill At Opposition (3.118 AU)
- Oct 09 - Apollo Asteroid 2017 SZ11 Near-Earth Flyby (0.054 AU)
- Oct 09 - Asteroid 134346 Pinatubo Closest Approach To Earth (0.922 AU)
- Oct 09 - Asteroid 300221 Brucebills Closest Approach To Earth (1.682 AU)
- Oct 09 - Asteroid 51825 Davidbrown Closest Approach To Earth (1.807 AU)
- Oct 09 - Asteroid 230975 Rogerfederer Closest Approach To Earth (1.881 AU)
- Oct 09 - Asteroid 15371 Steward Closest Approach To Earth (1.924 AU)
- Oct 09 - Asteroid 16046 Gregnorman Closest Approach To Earth (2.407 AU)
- Oct 09 - 25th Anniversary (1992), Peekskill Meteorite Fall (Hit Car in New York)
- Oct 09 - Yury Usachev's 60th Birthday (1957)
- Oct 10 - Michibiki 4 (QZS-4) H-2A Launch
- Oct 10 - Comet 73P-BK/Schwassmann-Wachmann Closest Approach To Earth (1.895 AU)

- Oct 10 - Comet 73P-J/Schwassmann-Wachmann Closest Approach To Earth (1.909 AU)
- Oct 10 - Comet 89P/Russell At Opposition (2.018 AU)
- Oct 10 - Asteroid 16897 (1998 DH10) Occults HIP 20804 (5.9 Magnitude Star)
- Oct 10 - Apollo Asteroid 2014 DQ Near-Earth Flyby (0.082 AU)
- Oct 10 - Asteroid 30857 Parsec Closest Approach To Earth (0.999 AU)
- Oct 10 - Asteroid 2001 Einstein Closest Approach To Earth (1.146 AU)
- Oct 10 - Asteroid 264020 Stuttgart Closest Approach To Earth (1.495 AU)
- Oct 10 - Asteroid 8623 Johnnygalecki Closest Approach To Earth (2.474 AU)
- Oct 10 - 50th Anniversary (1967), Enactment of the Outer Space Treaty
- Oct 10 - Michael Disney's 80th Birthday (1937)

Source: JPL Space Calendar Return to Contents

# Food for Thought

## New Study Proposes a Giant, Space-Based Solar Flare Shield for Earth

In today's modern, fast-paced world, human activity is very much reliant on electrical infrastructure. If the power grids go down, our climate control systems will shut off, our computers will die, and all electronic forms of commerce and communication will cease. But in addition to that, human activity in the 21st century is also becoming increasingly dependent upon the infrastructure located in Low Earth Orbit (LEO).

Aside from the many telecommunications satellites that are currently in space, there's also the International Space Station and a fleet of GPS satellites. It is for this reason that solar flare activity is considered a serious hazard, and mitigation of it a priority. Looking to address that, a team of scientists from Harvard University recently released a study that proposes a bold solution – placing a giant magnetic shield in orbit.

The study – which was the work of Doctor Manasavi Lingam and Professor Abraham Loeb from the Harvard Smithsonian Center for Astrophysicist (CfA) – recently appeared online under the title "Impact and Mitigation Strategy for Future Solar Flares". As they explain, solar flares pose a particularly grave risk in today's world, and will become an even greater threat due to humanity's growing presence in LEO.

Solar flares have been a going concern for over 150 years, ever since the famous Carrington Event of 1859. Since that time, a great deal of effort has been dedicated to the study of solar flares from both a theoretical and observational standpoint. And thanks to the advances that have been made in the past 200 years in terms of astronomy and space exploration, much has been learned about the phenomena known as "space weather".

At the same time, humanity's increased reliance on electricity and space-based infrastructure have also made us more vulnerable to extreme space weather events. In fact, if the Carrington event were to take place today, it is estimated that it would cause global damage to electric power grids, satellites communications, and global supply chains.

The cumulative worldwide economic losses, according to a 2009 report by the Space Studies Board ("Severe Space Weather Events–Understanding Societal and Economic Impacts"), would be $10 trillion, and recovery would take several years. And yet, as Professor Loeb explained to Universe Today via email, this threat from space has received far less attention than other possible threats.

"In terms of risk from the sky, most of the attention in the past was dedicated to asteroids," said Loeb. "They killed the dinosaurs and their physical impact in the past was the same as it will be in the future, unless their orbits are deflected. However, solar flares have little biological impact and their main impact is on technology. But a century ago, there was not much technological infrastructure around, and technology is growing exponentially. Therefore, the damage is highly asymmetric between the past and future."

To address this, Lingham and Loeb developed a simple mathematical model to assess the economic losses caused by solar flare activity over time. This model considered the increasing risk of damage to technological infrastructure based on two factors. For one, they considered the fact that the energy of a solar flares increases with time, then coupled this with the exponential growth of technology and GDP.

What they determined was that on longer time scales, the rare types of solar flares that are very powerful become much more likely. Coupled with humanity's growing presence and dependence on spacecraft and satellites in LEO, this will add up to a dangerous conjunction somewhere down the road. Or as Loeb explained:

*"We predict that within ~150 years, there will be an event that causes damage comparable to the current US GDP of ~20 trillion dollars, and the damage will increase exponentially at later times until technological development will saturate. Such a forecast was never attempted before. We also suggest a novel idea for how to reduce the damage from energetic particles by a magnetic shield. This was my idea and was not proposed before."*

To address this growing risk, Lingham and Loeb also considered the possibility of placing a magnetic shield between Earth and the Sun. This shield would be placed at the Earth-Sun Lagrange Point 1, where it would be able to deflect charged particles and create an artificial bowshock around Earth. In this sense, this shield would protect Earth's in a way that is similar to what its magnetic field already does, but to greater effect.

Based on their assessment, Lingham and Loeb indicate that such a shield is technically feasible in terms of its basic physical parameters. They were also able to provide a rudimentary timeline for the construction of this shield, not to mention some rough cost assessments. As Loeb indicated, such a shield could be built before this century is over, and at a fraction of the cost of what would be incurred from solar flare damage.

"The engineering project associated with the magnetic shield that we propose could take a few decades to construct in space," he said. "The cost for lifting the needed infrastructure to space (weighting 100,000 tons) will likely be of order 100 billions of dollars, much less than the expected damage over a century."

Interestingly enough, the idea of using a magnetic shield to protect planets has been proposed before. For example, this type of shield was also the subject of a presentation at this year's "Planetary Science Vision 2050 Workshop", which was hosted by NASA's Planetary Science Division (PSD). This shield was recommended as a means of enhancing Mars' atmosphere and facilitating crewed mission to its surface in the future.

During the course of the presentation, titled "A Future Mars Environment for Science and Exploration", NASA Director Jim Green discussed how a magnetic shield could protect Mars' tenuous atmosphere from solar wind.

This would allow it to replenish over time, which would have the added benefit of warming Mars up and allowing liquid water to again flow on its surface. If this sounds similar to proposals for terraforming Mars, that's because it is!

Beyond Earth and the Solar System, the implications for this study are quite overwhelming. In recent years, many terrestrial planets have been found orbiting within nearby M-type (aka. red dwarf) star systems. Because of the way these planets orbit closely to their respective suns, and the variable and unstable nature of M-type stars, scientists have expressed doubts about whether or not these planets could actually be habitable.

In short, scientists have ventured that over the course of billions of years, rocky planets that orbit close to their suns, are tidally-locked with them, and are subject to regular solar flares would lose their atmospheres. In this respect, magnetic shields could be a possible solution to creating extra-solar colonies. Place a large shield in orbit at the L1 Lagrange point, and you never have to worry again about powerful magnetic storms ravaging the planet!

On top of that, this study offers a possible resolution to the Fermi Paradox. When looking for sign of Extra-Terrestrial Intelligence (ETI), it might make sense to monitor distant stars for signs of an orbiting magnetic shield. As Prof. Leob explained, such structures may have already been detected around distant stars, and could explain some of the unusual observations astronomers have made:

*"The imprint of a shield built by another civilization could involve the changes it induces in the brightness of the host star due to occultation (similar behavior to Tabby's star) if the structure is big enough. The situation could be similar to Dyson's spheres, but instead of harvesting the energy of the star the purpose of the infrastructure is to protect a technological civilization on a planet from the flares of its host star."*

It is a foregone conclusion that as time and technology progress, humanity's presence in (and reliance on) space will increase. As such, preparing for the most drastic space weather events the Solar System can throw at us just makes sense. And when it comes to the big questions like "are we alone in the Universe?", it also makes sense to take our boldest concepts and proposals and consider how they might point the way towards extra-terrestrial intelligence.

Source: Universe Today Return to Contents

# Space Image of the Week

**Pluto's Bladed Terrain**
**Image Credit:** NASA, Johns Hopkins Univ./APL, Southwest Research Institute

**Explanation:** Imaged during the New Horizons spacecraft flyby in July 2015, Pluto's bladed terrain is captured in this close-up of the distant world. The bizarre texture belongs to fields of skyscraper-sized, jagged landforms made almost entirely of methane ice, found at extreme altitudes near Pluto's equator. Casting dramatic shadows, the tall, knife-like ridges seem to have been formed by sublimation. By that process, condensed methane ice turns directly to methane gas without passing through a liquid phase during Pluto's warmer geological periods. On planet Earth, sublimation can also produce standing fields of knife-like ice sheets, found along the high plateau of the Andes mountain range. Known as penitentes, those bladed structures are made of water ice and at most a few meters tall.

Source: APOD

Return to Contents