Space News Update

— April 4, 2017 —

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1. NASA’s Cassini Mission Prepares for 'Grand Finale' at Saturn

NASA's Cassini spacecraft, in orbit around Saturn since 2004, is about to begin the final chapter of its remarkable story. On Wednesday, April 26, the spacecraft will make the first in a series of dives through the 1,500-mile-wide (2,400-kilometer) gap between Saturn and its rings as part of the mission’s grand finale.

"No spacecraft has ever gone through the unique region that we'll attempt to boldly cross 22 times," said Thomas Zurbuchen, associate administrator for the Science Mission Directorate at NASA Headquarters in Washington. "What we learn from Cassini’s daring final orbits will further our understanding of how giant planets, and planetary systems everywhere, form and evolve. This is truly discovery in action to the very end."

During its time at Saturn, Cassini has made numerous dramatic discoveries, including a global ocean that showed indications of hydrothermal activity within the icy moon Enceladus, and liquid methane seas on its moon Titan.

Now 20 years since launching from Earth, and after 13 years orbiting the ringed planet, Cassini is running low on fuel. In 2010, NASA decided to end the mission with a purposeful plunge into Saturn this year in order to protect and preserve the planet's moons for future exploration – especially the potentially habitable Enceladus.

But the beginning of the end for Cassini is, in many ways, like a whole new mission. Using expertise gained over the mission's many years, Cassini engineers designed a flight plan that will maximize the scientific value of sending the spacecraft toward its fateful plunge into the planet on Sept. 15. As it ticks off its terminal orbits during the next five months, the mission will rack up an impressive list of scientific achievements.

"This planned conclusion for Cassini's journey was far and away the preferred choice for the mission's scientists," said Linda Spilker, Cassini project scientist at NASA’s Jet Propulsion Laboratory (JPL) in Pasadena, California. "Cassini will make some of its most extraordinary observations at the end of its long life."

The mission team hopes to gain powerful insights into the planet's internal structure and the origins of the rings, obtain the first-ever sampling of Saturn's atmosphere and particles coming from the main rings, and capture the closest-ever views of Saturn's clouds and inner rings. The team currently is making final checks on the list of commands the robotic probe will follow to carry out its science observations, called a sequence, as it begins the finale. That sequence is scheduled to be uploaded to the spacecraft on Tuesday, April 11.

Cassini will transition to its grand finale orbits, with a last close flyby of Saturn's giant moon Titan, on Saturday, April 22. As it has many times over the course of the mission, Titan's gravity will bend Cassini's flight path. Cassini's orbit then will shrink so that instead of making its closest approach to Saturn just outside the rings, it will begin passing between the planet and the inner edge of its rings.

"Based on our best models, we expect the gap to be clear of particles large enough to damage the spacecraft. But we're also being cautious by using our large antenna as a shield on the first pass, as we determine whether it's safe to expose the science instruments to that environment on future passes," said Earl Maize, Cassini project manager at JPL. "Certainly there are some unknowns, but that's one of the reasons we're doing this kind of daring exploration at the end of the mission."

In mid-September, following a distant encounter with Titan, the spacecraft's path will be bent so that it dives into the planet. When Cassini makes its final plunge into Saturn's atmosphere on Sept. 15, it will send data from several instruments – most notably, data on the atmosphere's composition – until its signal is lost.

"Cassini's grand finale is so much more than a final plunge," said Spilker. "It's a thrilling final chapter for our intrepid spacecraft, and so scientifically rich that it was the clear and obvious choice for how to end the mission."

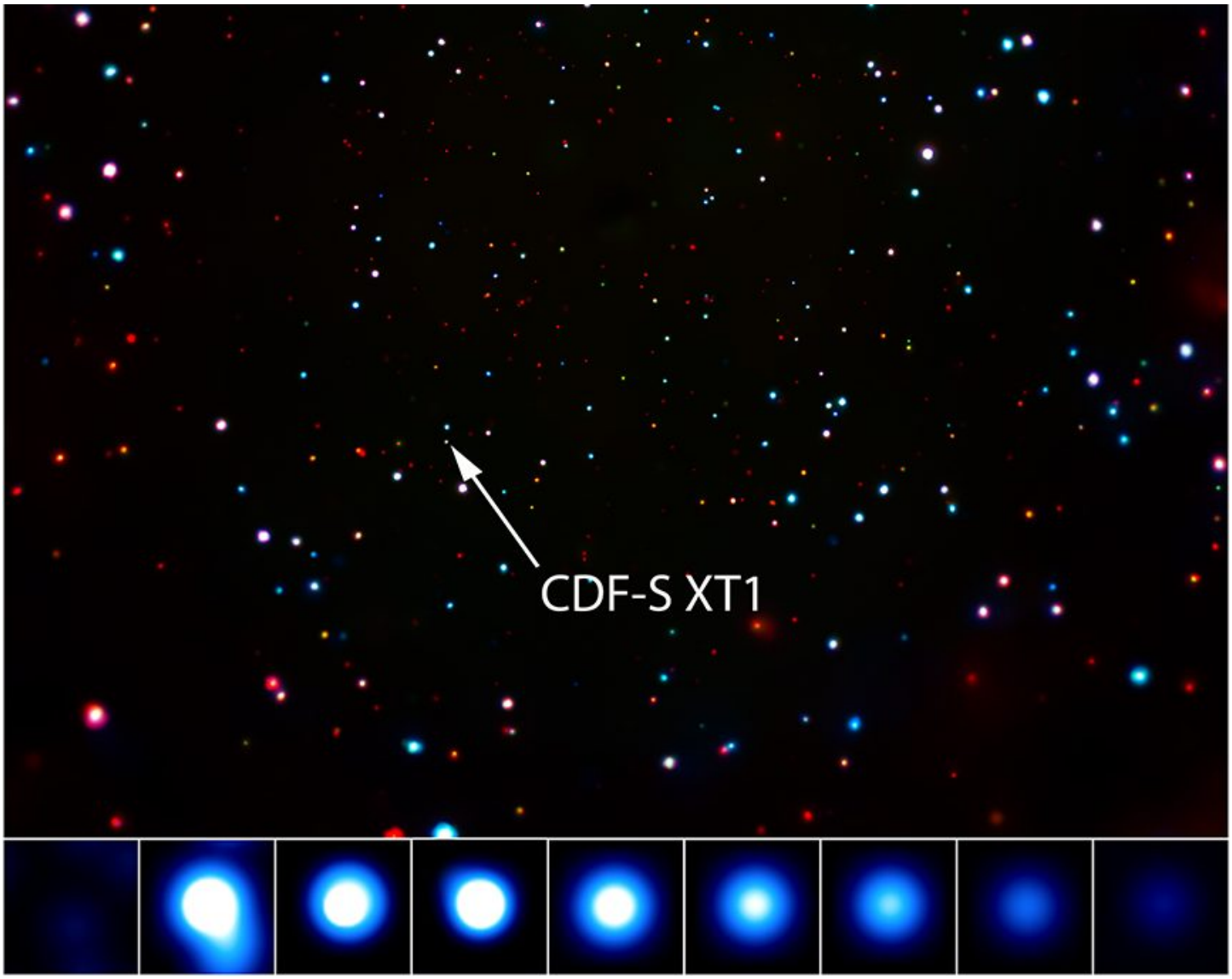
Resources on Cassini's grand finale, including images and video, are available at:

https://saturn.jpl.nasa.gov/mission/grand-finale/grand-finale-resources

An animated video about Cassini's Grand Finale is available at: **https://youtu.be/xrGAQCq9BMU**

Source: NASA Return to Contents

2. Cosmic Blast of X-rays Inexplicably Outshines All of a Galaxy's Stars



Astronomers have detected what was likely an extremely destructive explosive event, about 10.7 billion light years from Earth. A mysterious, sudden, and bright flash of X-rays was observed by the Chandra X-ray Observatory, producing a thousand times more energy than all the stars in the galaxy where the event took place. But then the outburst disappeared within a day.

The event, named CDF-S XT1, has properties that do not match any other known cosmic phenomenon, such as a gamma ray burst or supernova, and scientists are still working to understand the origin and parameters of this puzzling explosion.

"We may have observed a completely new type of cataclysmic event," said Kevin Schawinski of ETH Zurich in Switzerland, co-author of a new paper that provides the known details of this enigma, in a statement. "Whatever it is, a lot more observations are needed to work out what we're seeing."

Chandra captured this bright, transient X-ray source during a 13-hour observing session on October 1, 2014.

“We had never anticipated that our observations would capture such a rare, fast transient,” said lead author Franz Bauer of the Pontifical Catholic University of Chile in Santiago, Chile, writing in a blog post on the

Chandra website. “After convincing ourselves that it was not some weird instrumental effect, we reported it to the astronomy community… to encourage follow-up observations at other wavelengths and gain more clues as to the origin of this unique event.”

Bauer and his team thought they’d be lucky, because the Very Large Telescope (VLT) in Chile had also imaged this field that same night, about 80 minutes into the X-ray outburst. But they were disappointed — and intrigued — to find that no new optical source was visible.

The region in the sky where this event took place is part what is known as the Chandra Deep Field-South (CDF-S) — similar to the Hubble Deep Field images — where Chandra has taken several long and deep observations of this area, resulting in an exposure time equivalent to seven million seconds, or about 81 days. However, a look at archival Chandra data showed that no previous X-ray source had come from this area prior to October 2014.

Other follow-up observations with other optical telescopes and ultimately the Hubble Space Telescope, covering a span of days to months, also came up empty, finding nothing associated with the X-ray transient.

"Ever since discovering this source, we've been struggling to understand its origin," Bauer said. "It's like we have a jigsaw puzzle but we don't have all of the pieces."

Bauer and his team said the lack of “smoking gun evidence” in other wavelengths rules out the usual suspects for what this bright X-ray object might be.

The first event that comes to mind is a gamma-ray burst (GRB), which is an extremely energetic explosion triggered either by the collapse of a massive star or by the merger of a neutron star with another neutron star or a black hole. After an initial flash of gamma rays, a longer-lived "afterglow" is usually emitted at longer wavelengths (X-ray, ultraviolet, and optical, for example), but no other wavelengths were detected either before or after the X-ray burst.

The researchers said two possible explanations for the CDF-S X-ray source are a GRB that is not pointed toward Earth, or a GRB that lies beyond the small host galaxy. A third possibility is that a medium-sized black hole shredded a white dwarf star.

"None of these ideas fits the data perfectly," said co-author Ezequiel Treister, also from Pontifical Catholic University, "but then again, we've rarely if ever seen any of the proposed possibilities in actual data, so we don't understand them well at all."

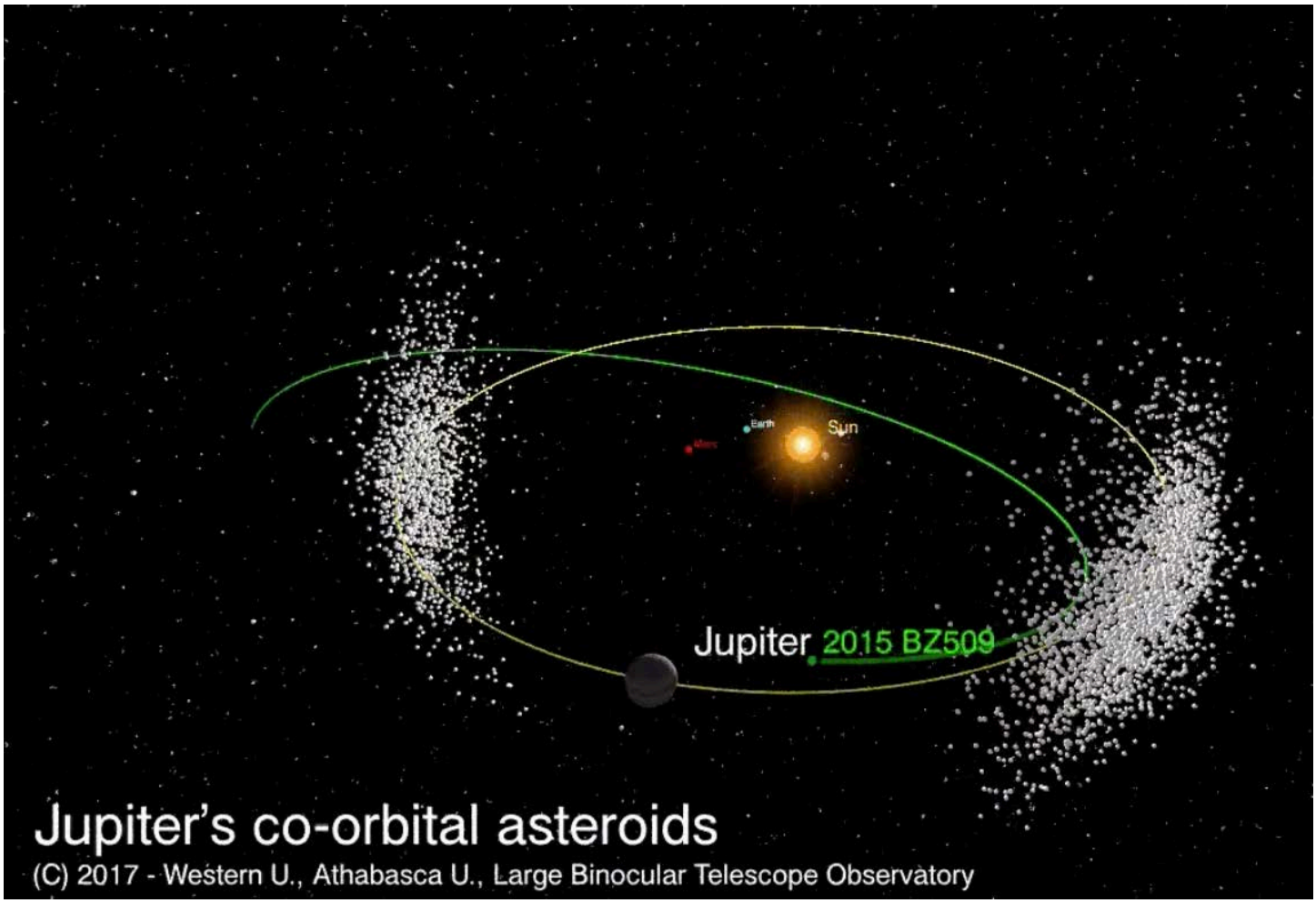
While they still don't have the final answers, the team continues to try to explain the object. It has begun highly targeted searches through the Chandra archive as well as through archives of the European Space Agency's XMM-Newton space observatory and NASA's Swift satellite, hoping to uncover more examples of this type of variable object, which has gone unnoticed until now.

Researchers are also looking toward future X-ray observations by Chandra and other X-ray telescopes that may also reveal the same phenomenon from other objects. If the X-ray source was caused by a GRB triggered by the merger of a neutron star with a black hole or another neutron star, then gravitational waves would also have been produced, so current and future gravitational wave observatories may lend clues.

“Unfortunately there is no ‘smoking gun’ evidence that favors one scenario over the other here,” Bauer wrote, “and thus our only remaining chance to understand the CDF-S transient is to find similar events in old or new data.”

Source: Seeker Return to Contents

3. Wrong-way asteroid plays 'chicken' with Jupiter



For at least a million years, an asteroid orbiting the "wrong" way around the sun has been playing a cosmic game of chicken with giant Jupiter and with about 6,000 other asteroids sharing the giant planet's space, says a report published in the latest issue of *Nature*.

The asteroid, nicknamed Bee-Zed, is the only one in this solar system that's known both to have an opposite, retrograde orbit around the sun while at the same time sharing a planet's orbital space, says researcher and co-author Paul Wiegert of Western's Department of Physics and Astronomy.

All but 82 of the million or so known asteroids in our solar system travel around the sun in what's called a prograde motion: that is, counter-clockwise when visualized from above. But asteroid 2015 BZ509 ("Bee-Zed" for short) circles clockwise, in a retrograde motion—moving against the flow of all other asteroids in the giant planet's orbital entourage.

Put another way, it's as if Jupiter is a monster truck on a track circling the sun, and the asteroids in Jupiter's orbit are sub-compact cars all whizzing along in the same direction. Bee-Zed is the rogue—driving around the track in the wrong direction—steering between the 6,000 other cars and swerving around the monster truck. And it does so every single lap, and has done so for thousands of laps for a million years or more.

So how does it avoid colliding with Jupiter? Jupiter's gravity actually deflects the asteroid's path at each pass so as to allow both to continue safely on their way, Wiegert says.

Little is known about the asteroid, which was discovered in January, 2015. It has a diameter of about three kilometers and it may have originated from the same place as Halley's comet, which also has a retrograde orbit. The team hasn't been able to determine yet if Bee-Zed is an icy comet or a rocky asteroid.

But their analysis—based on complex calculations and on observations through the Large Binocular Camera on the Large Binocular Telescope in Mt. Graham, Arizona, during a span of 300 days—show Bee-Zed is somehow able to maintain a stable orbit even as an outlier.

The calculations conducted by the team show the orbit has been stable for at least a million years and will be stable for at least a million more. Learning more about the asteroid provides another intriguing glimpse into previously unknown and unmapped features of our solar system. "The detective work has just begun," he said.

Source: Phys.org Return to Contents

The Night Sky

Tuesday, April 4

• Now the Moon forms a huge, nearly vertical line with Procyon and Sirius below it in early and mid-evening.

Wednesday, April 5

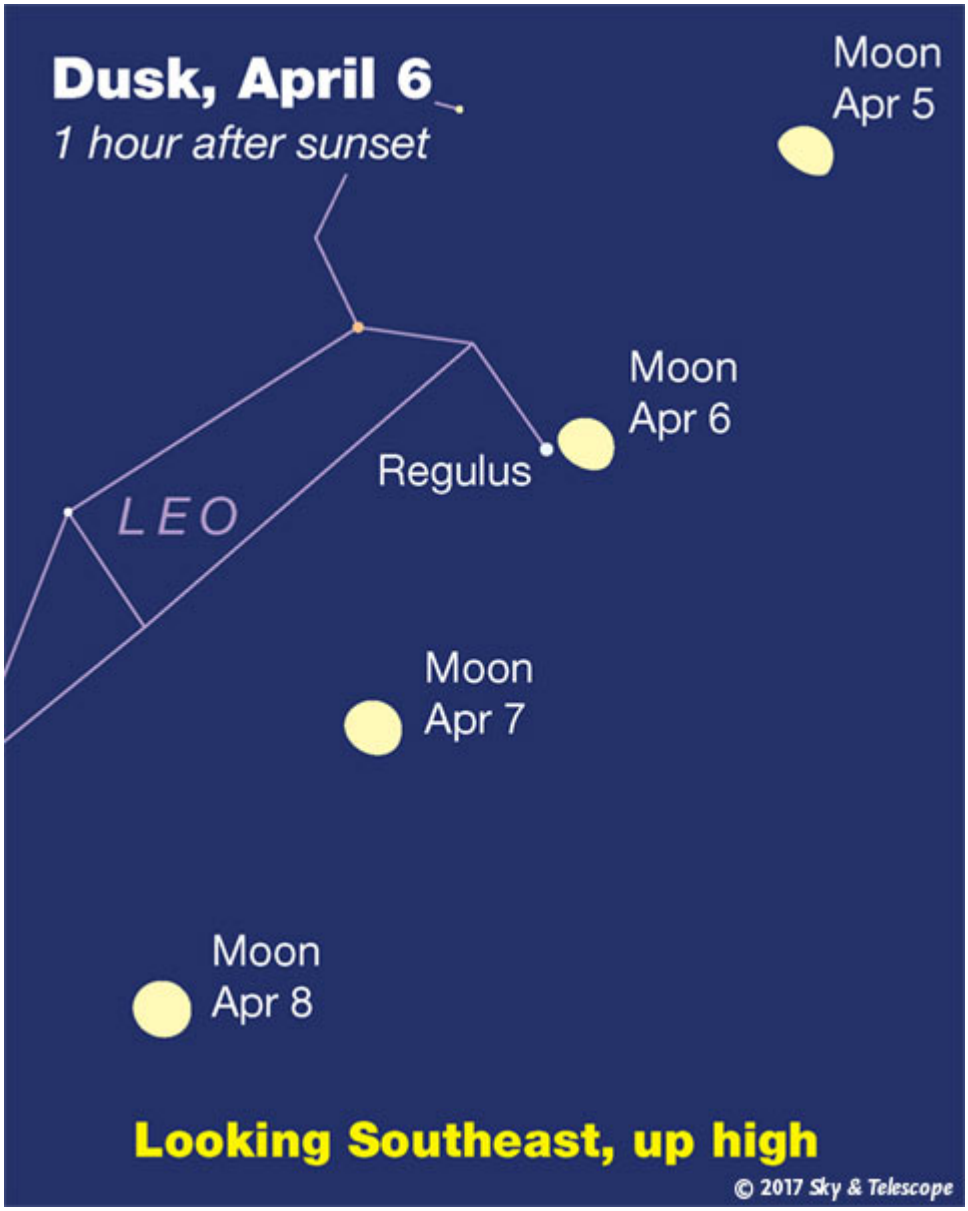
• Near the end of twilight at this time of year, Arcturus, the bright "Spring Star" climbing in the east (well to the left of brighter Jupiter), shines at the same height as Sirius, the brighter "Winter Star" descending in the southwest (for skywatchers at mid-northern latitudes).

Thursday, April 6

• The waxing gibbous Moon pairs with Regulus, the leading light of Leo. How soon in twilight can you first spot Regulus? Watch them cross the sky together through the night. They set just before the beginning of Friday's dawn.

Friday, April 7

• Jupiter is at opposition, in the opposite direction from the Sun as seen from Earth. It climbs into grand view in the southeast through the evening, with slightly bluer Spica below it.



This is, however, Jupiter's most distant opposition since 2005; it's magnitude –2.5 and in a telescope appears 44.2 arcseconds across its equator. Jupiter reaches almost 50″ wide at the maxima of its opposition cycle. This last occurred in 2010 and will again in 2022.

Source: Sky & Telescope

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ISS Sighting Opportunities

For Denver:

Date	Visible	Max Height	Appears	Disappears
Tue Apr 4, 9:04 PM	< 1 min	10°	10° above N	10° above N
Wed Apr 5, 8:11 PM	1 min	10°	10° above NNW	10° above N
Wed Apr 5, 9:47 PM	< 1 min	13°	10° above NNW	13° above N
Thu Apr 6, 8:55 PM	2 min	11°	10° above N	10° above NNE
Fri Apr 7, 8:03 PM	1 min	10°	10° above N	10° above NNE
Fri Apr 7, 9:39 PM	1 min	18°	11° above NNW	18° above N

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

NASA-TV Highlights

(all times Eastern Daylight Time)

3 p.m., Tuesday, April 4 - NASA News Briefing – Cassini Grand Finale Preview (all channels)

6 p.m., 8 p.m., Tuesday, April 4 - Replay of the NASA News Briefing – Cassini Grand Finale Preview (all channels)

7 p.m., 11 p.m., Tuesday, April 4 - Replay of the NASA Television Video File B-Roll Feed of Training of ISS Expedition 51-52 Flight Engineer Jack Fischer of NASA (all channels)

11 p.m., Tuesday, April 4 - Replay of the ISS Expedition 50 Educational In-Flight Event with the Betsy Ross Elementary School in Anaheim, California and ISS Commander Shane Kimbrough and Flight Engineer Peggy Whitson of NASA (NTV-1 (Public))

7 a.m., Wednesday, April 5 - ISS Expedition 50 VIP Call from U.S. Senator Joni Ernst (R-IA) to Space Station Flight Engineer Peggy Whitson of NASA (starts at 7:20 a.m.) (all channels)

10:30 a.m., Wednesday, April 5 - ISS Expedition 50 In-Flight Interview with KTRK-TV, Houston and ISS Commander Shane Kimbrough and Flight Engineer Peggy Whitson of NASA (starts at 10:40 a.m.) (all channels)

12 p.m., Wednesday, April 5 - Video File of the ISS Expedition 51-52 Crew's Departure from the Gagarin Cosmonaut Training Center in Star City, Russia for the Baikonur Cosmodrome in Kazakhstan (Fischer, Yurchikhin) (all channels)

7 p.m., Wednesday, April 5 - Replay of the NASA Television Video File B-Roll Feed of Training of ISS Expedition 51-52 Flight Engineer Jack Fischer of NASA (all channels)

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

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Space Calendar

- Apr 04 - SES-15 Soyuz-STB Fregat-MT Launch
- Apr 04 - GSAT 9 GSLV Mk.2 Launch
- Apr 04 - Comet 103P/Hartley At Opposition (2.083 AU)
- Apr 04 - Comet P/2003 T12 (SOHO) At Opposition (2.809 AU)
- Apr 04 - NEW [Mar 31] Comet C/2017 E3 (PANSTARRS) Perihelion (5.895 AU)
- Apr 04 - Apollo Asteroid 2017 EB3 Near-Earth Flyby (0.035 AU)
- Apr 04 - NEW [Mar 30] Apollo Asteroid 2017 FA102 Near-Earth Flyby (0.036 AU)
- Apr 04 - NEW [Mar 28] Apollo Asteroid 2017 FQ91 Near-Earth Flyby (0.038 AU)
- Apr 04 - NEW [Mar 30] Apollo Asteroid 2017 FM101 Near-Earth Flyby (0.018 AU)
- Apr 04 - Asteroid 13513 Manilla Closest Approach To Earth (1.025 AU)
- Apr 04 - Asteroid 130 Elektra (2 Moons) Closest Approach To Earth (2.841 AU)
- Apr 04 - 20th Anniversary (1997), STS-83 Launch (Space Shuttle Columbia)
- Apr 04 - Karl Reinmuth's 125th Birthday (1892)
- Apr 05 - Cassini, Distant Flyby of Atlas, Pandora & Epimetheus
- Apr 05 - Comet 73P-AP/Schwassmann-Wachmann At Opposition (1.158 AU)
- Apr 05 - Asteroid 249 Ilse Occults HIP 102485 (4.1 Magnitude Star)
- Apr 05 - NEW [Mar 30] Aten Asteroid 2017 FX101 Near-Earth Flyby (0.025 AU)
- Apr 05 - NEW [Apr 03] Amor Asteroid 2017 FR128 Near-Earth Flyby (0.049 AU)
- Apr 05 - Asteroid 13010 Germantitov Closest Approach To Earth (2.252 AU)
- Apr 05 - 20th Anniversary (1997), Galileo, Ganymede 7 Flyby
- Apr 06 - Cassini, Distant Flyby of Titan
- Apr 06 - Comet C/2017 C1 (NEOWISE) At Opposition (1.103 AU)
- Apr 06 - Apollo Asteroid 2017 FU64 Near-Earth Flyby (0.010 AU)
- Apr 06 - NEW [Apr 03] Apollo Asteroid 2017 FW128 Near-Earth Flyby (0.013 AU)
- Apr 06 - NEW [Apr 01] Apollo Asteroid 2017 FO127 Near-Earth Flyby (0.029 AU)
- Apr 06 - Amor Asteroid 2017 DC38 Near-Earth Flyby (0.038 AU)
- Apr 06 - Aten Asteroid 2014 FN38 Near-Earth Flyby (0.064 AU)
- Apr 06 - Asteroid 21088 Chelyabinsk Closest Approach To Earth (1.270 AU)
- Apr 06 - Asteroid 1432 Ethiopia Closest Approach To Earth (1.823 AU)
- Apr 06 - Asteroid 85386 Payton Closest Approach To Earth (1.990 AU)
- Apr 06 - Asteroid 2421 Nininger Closest Approach To Earth (2.390 AU)
- Apr 06 - Kuiper Belt Object 2014 FT71 At Opposition (46.773 AU)
- Apr 06 - Donald Douglas' 125th Birthday (1892)
- Apr 06 - 2665th Anniversary (648 BC), Earliest Total Solar Eclipse Recorded by the Greeks
- Apr 07 - Moon Occults Regulus
- Apr 07 - Moon Occults Asteroid 16 Psyche
- Apr 07 - Jupiter At Opposition
- Apr 07 - Comet 73P-AH/Schwassmann-Wachmann Perihelion (0.973 AU)
- Apr 07 - Comet 245P/WISE Closest Approach To Earth (2.207 AU)
- Apr 07 - Comet 329P/LINEAR-Catalina At Opposition (3.594 AU)
- Apr 07 - Comet 215P/NEAT At Opposition (3.655 AU)
- Apr 07 - NEW [Mar 31] Apollo Asteroid 2017 FS102 Near-Earth Flyby (0.020 AU)
- Apr 07 - NEW [Mar 30] Apollo Asteroid 2017 FN101 Near-Earth Flyby (0.026 AU)
- Apr 07 - Asteroid 4464 Vulcano Closest Approach To Earth (1.034 AU)
- Apr 07 - Asteroid 27596 Maldives Closest Approach To Earth (2.048 AU)
- Apr 07 - Asteroid 13586 Copenhagen Closest Approach To Earth (2.061 AU)

Source: JPL Space Calendar

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Food for Thought

Mars' Trojans Show Remains of Ancient Planetoid

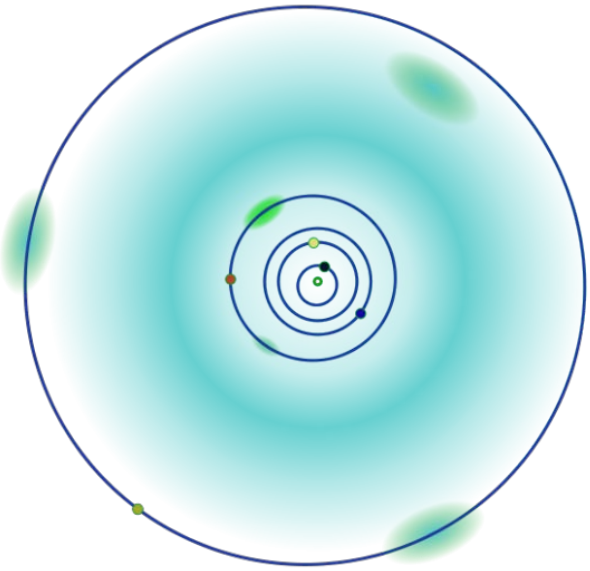


Diagram of Jupiter and the inner Solar System, showing the Jupiter and Martian Trojans (light green) and the Main Belt (teal). Credit: Wikipedia Commons/AndrewBuck

Trojan asteroids are a fascinating thing. Whereas the most widely known are those that orbit Jupiter (around its L4 and L5 Lagrange Points), Venus, Earth, Mars, Uranus and Neptune have populations of these asteroids as well. Naturally, these rocky objects are a focal point for a lot of scientific research, since they can tell us much about the formation and early history of the Solar System.

And now, thanks to an international team of astronomers, it has been determined that the Trojan asteroids that orbit Mars are likely the remains of a mini-planet that was destroyed by a collision billions of years ago. Their findings are detailed in a paper that will be published in *The Monthly Notices of the Royal Astronomical Society* later this month.

For the sake of their study, the team – which was led by Galin Borisov and Apostolos Christou of the Armagh Observatory and Planetarium in Northern Ireland, examined the composition of Marian Trojans. This consisted of using spectral data obtained by the XSHOOTER spectrograph on the Very Large Telescope (VLT) and photometric data from the National Astronomical Observatory's two-meter telescope, and the William Herschel Telescope.

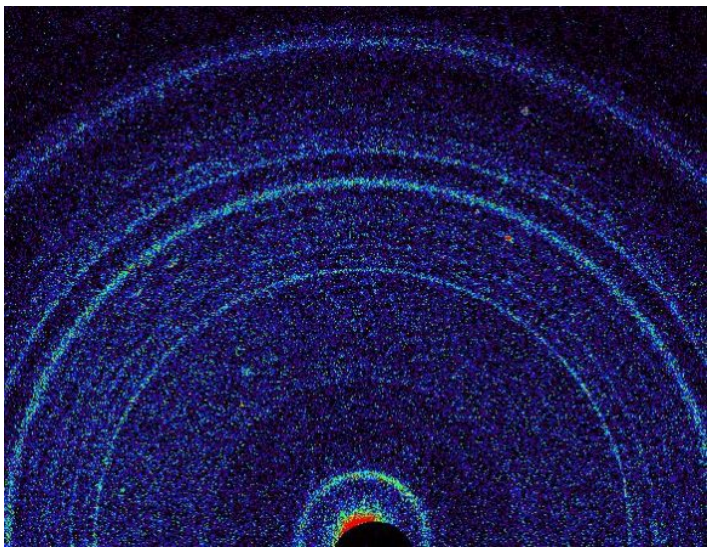
Specifically, they examined two members of the Eureka family – a group of Martian Trojans located at the planet's L5 point. It is here that eight of Mars' nine known Trojans exist in stable orbits (the other being at L4), and which are named after the first Martian Trojan ever discovered – 5261 Eureka. Like all Trojans, the Eurekas are thought to have orbited Mars ever since the formation of the Solar System.

In fact, astronomers have suspected for some time that the Martian Trojans could be the survivors of an early generation of planetesimals from which the inner Solar System formed. As Dr. Christou told Universe Today via email:

"[The Trojan family] is unique in the Solar System, in more ways than one. Unlike every other family that exists in the Main Asteroid Belt between Mars and Jupiter, it is made up of olivine-rich asteroids. Also, the asteroids are < 2km across, much smaller than we can see at other families, basically because they are much

closer to the Earth than other asteroids. Finally, it is the closest family we know to the Sun, and this has implications on how it formed in that the tiny but continuous action of sunlight may have played a role."

After combining spectrographic and photometric data on these asteroids, the team found that they were rich in the mineral olivine – a magnesium iron silicate that is a primary component of the Earth's mantle and (it is believed) other terrestrial planets. This was unusual find as far as asteroids go, but it was even more interesting when compared to 5261 Eureka itself – which also has an olivine-rich composition.



The first X-ray view of Martian soil by Curiosity rover at the "Rocknest" (October 17, 2012), showing traces of feldspar, pyroxenes, and olivine. Credit: NASA/JPL-Caltech/Ames

Given that the Eureka asteroids also have similar orbits, the team concluded that every member of this family is likely to have a common composition – and hence, a common origin. These findings could have drastic implications for both the origin of Martian Trojans, and the origin of the inner Solar System. As Dr. Christou explained:

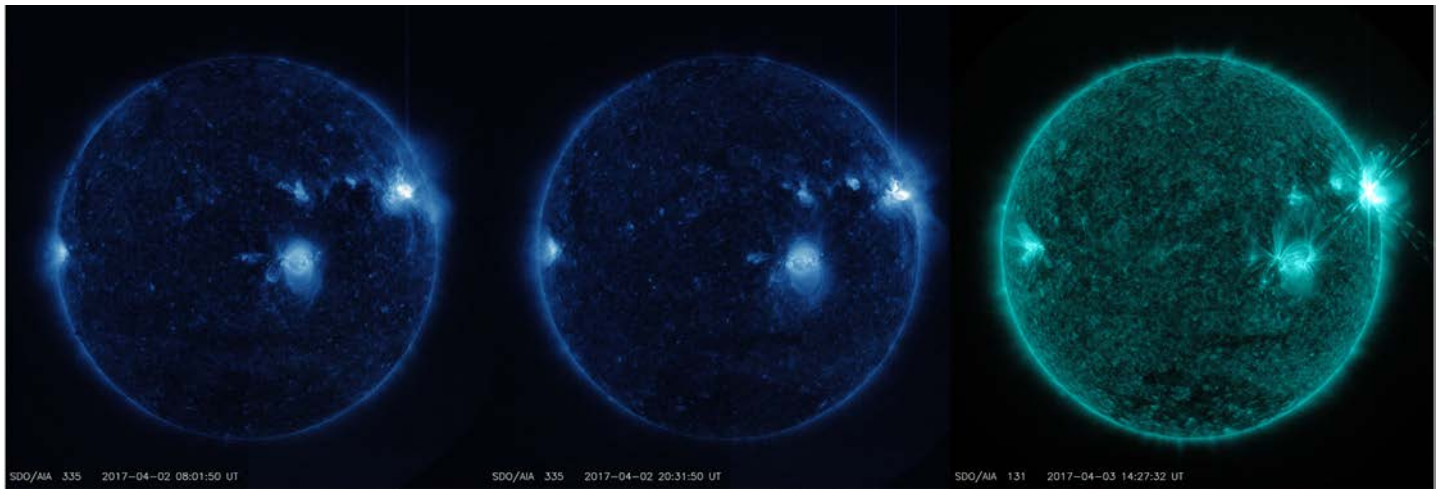
"The presence of asteroids with exposed olivine on their surfaces constrains the sequence of events that led to Mars' formation. Olivine forms within objects that grew large enough to differentiate into a crust, mantle and core. Therefore, these objects must have formed before Mars did and were available to participate in Mars' formation. To expose the olivine, it is necessary to break these objects up through collisions. Our ongoing work indicates that this is unlikely to have happened after the Solar System settled down in its current configuration, therefore there must have been period of intense collisional evolution during the planet formation process."

In other words, if Mars formed from several types of material that was mixed together, these asteroids would be samples of the original source – i.e. planetesimals. By examining these asteroids further, scientists will be able to learn more about the process through which Mars came to be and (as Christou says) help us "unscramble the Martian omelette."

This research is also likely to reveal much about the formation of Earth and the other terrestrial planets of the Solar System. Similar efforts will be made with NASA's upcoming Lucy mission, which is scheduled to launch in October of 2021. Between 2027 and 2033, this probe will study Jupiter's Trojan population, obtaining information on six of the asteroid's geology, surface features, compositions, masses and densities to learn more about their origins.

Source: Universe Today Return to Contents

Space Image of the Week



Solar Dynamics Observatory Captured Trio of Solar Flares April 2-3

The sun emitted a trio of mid-level solar flares on April 2-3, 2017. The first peaked at 4:02 a.m. EDT on April 2, the second peaked at 4:33 p.m. EDT on April 2, and the third peaked at 10:29 a.m. EDT on April 3. NASA's Solar Dynamics Observatory, which watches the sun constantly, captured images of the three events. Solar flares are powerful bursts of radiation. Harmful radiation from a flare cannot pass through Earth's atmosphere to physically affect humans on the ground, however — when intense enough — they can disturb the atmosphere in the layer where GPS and communications signals travel.

To see how this event may affect Earth, please visit NOAA's Space Weather Prediction Center at http://spaceweather.gov, the U.S. government's official source for space weather forecasts, alerts, watches and warnings.

The first April 2 flare was classified as an M5.3 flare, while the second April 2 was an M5.7 flare. The April 3 flare was classified as an M5.8 flare. M-class flares are a tenth the size of the most intense flares, the X-class flares. The number provides more information about its strength. An M2 is twice as intense as an M1, an M3 is three times as intense, etc.

Updates will be provided as needed.

Source: NASA

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