Skywatchers

Newsletter of the China Lake Astronomical Society

Volume 57 No. 06 June 01, 2020

NEXT MEETING 7:30 p.m., Monday, June 01st, 2020 - Cancelled
Maturango Museum, 100 East Las Flores Avenue, Ridgecrest, California.

PROGRAM FOR THE June 01, 2020 7:30 PM MEETING - Cancelled

As this Newsletter goes to press the Club has not yet determined when our Meetings or Star Parties will resume. There are some ideas floating around but as yet nothing has been decided. The Maturango Museum is still closed and Red Rock Canyon is only opened to hikers and the Campground is closed and the volunteer docents are not yet allowed to be active. Hopefully things will change in the near future. That being said be careful and stay safe. Will notify everyone when we hear something.

STAR PARTY SCHEDULE FOR THE 2020 SEASON:

Star Parties will be held on the dates listed below. Star Parties are an activity where members and guests come together to view the skies. If you have a telescope, bring it; if not, come and look through someone else's. They are held at a site in the open desert south of Ridgecrest. To reach the site from Ridgecrest, go south on China Lake Boulevard 6.5 miles from its intersection with Ridgecrest Boulevard. Continue straight across Highway 395 and you will be on Brown Road (Old Highway 395). Follow Brown Road as it curves to the right and goes west. After 2.3 miles, there will be a 30-inch orange cone on the left. Turn left and follow the dirt road marked by 12-inch cones. The CLAS star party is south 0.5 mile along this road. Signs and cones will be put out about a half hour before viewing starts. All viewing is weather dependent.

Call Roger Brower 760-446-0454, 760-677-1143 or Keith Weisz 760-375-9114, for more information.

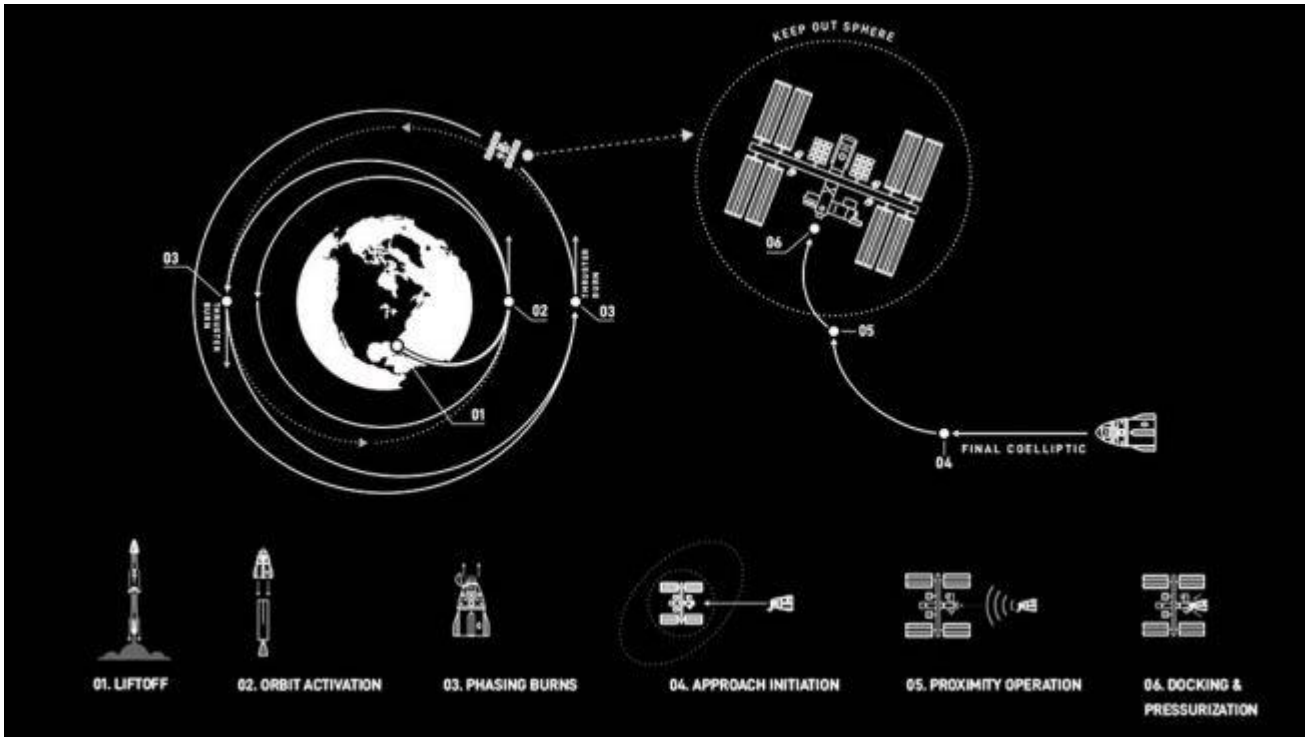
I have included the Star Party times and locations for the rest of the year despite at this time we have no plans yet to have them. Hopefully that will change in the near future.

Fri,	June 19th	Signs out at 8:30 p.m., Star viewing at 9:00 p.m. (New Moon – 2 days) **(TBA)**
Fri,	July 17th	Signs out at 8:30 p.m., Star viewing at 9:00 p.m. (New Moon – 3 days) **(TBA)**
Fri,	Aug 21st	Signs out at 8:00 p.m., Star viewing at 8:30 p.m. (New Moon +2 days) **(TBA)**
Fri,	Sept 18th	Signs out at 7:00 p.m., Star viewing at 7:30 p.m (New Moon + 1 Day) **(TBA)**
Sat,	Sept 19th	Red Rock Canyon – Visitors Center, Star viewing at Sundown**(TBA)**
Sat,	Oct 10th	Red Rock Canyon – Visitors Center, Star viewing at Sundown **(TBA)**
Fri,	Oct 16th	Signs out at 6:30 p.m., Star viewing at 7:00 p.m. (New Moon) **(TBA)**
Sat,	Oct 17th	Red Rock Canyon – Visitors Center, Star viewing at Sundown **(TBA)**
Sat,	Nov 07th	Red Rock Canyon – Visitors Center, Star viewing at Sundown **(TBA)**
Fri,	Nov 13th	Signs out at 6:00 p.m., Star viewing at 6:30 p.m. (New Moon – 2 days) **(TBA)**
Sat,	Nov 14th	Red Rock Canyon – Visitors Center, Star viewing at Sundown **(TBA)**

All Star Parties at the Brown Road site and Red Rock Campground are postponed until further notification..

Next CLAS Meeting: July 06th, 2020 at 7:30 PM. If conditions change for the better you will be notified if a meeting and program will be presented.

Space-X Dragon Spacecraft Launch Successful



By [Lisa Grossman]
MAY 27, 2020 AT 4:37 PM

UPDATED MAY 30, 2020 AT 3:55 PM

For the first time, humans are hurtling into Earth's orbit on a commercial rocket.

SpaceX's Crew Dragon spacecraft launched at 3:22 p.m. EDT from the Kennedy Space Center in Cape Canaveral, Fla., on May 30, to take U.S. astronauts Doug Hurley and Bob Behnken to the International Space Station (ISS).

"So rises a new era of American spaceflight, and with it the ambitions of a new generation continuing the dream," said NASA commentator Dan Huot shortly after launch.

Called Demo-2, the May 30 launch and flight will be the ultimate test of the spacecraft's systems and its ability to ferry a crew into orbit. The Falcon 9 rocket landed safely on a floating platform after carrying the astronauts to space.

The launch was originally scheduled for May 27, but was scrubbed due to bad weather less than 17 minutes before lift-off time. This time, the weather cooperated.

Astronauts have not launched to orbit from the United States since 2011, when NASA's space shuttle program ended (*SN: 6/3/11*). Since then, the Russian Soyuz spacecraft have been the only way for astronauts of any nationality to reach the ISS. (The Chinese space agency has its own rockets and crew vehicles, and had its own space station for a time, but is not a partner in the ISS.)

"It is absolutely our honor to be part of this huge effort to get the United States back into the launch business," said Hurley just before launch.

The launch marks an important transition in crewed space travel for NASA, shifting the government space agency from having complete control over U.S. launches to being just another customer of a private space flight company. That shift should end the U.S. space agency's reliance on Russia, though, and free NASA to focus on more complicated missions, such as sending humans to the moon and Mars.

"The reason you have NASA is to push the envelope, do things at the frontier," says astrophysicist Jonathan McDowell of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass. "Low-Earth orbit and the space station are no longer the frontier. So you just hire a trucking company."

In 2014, NASA partnered with private companies SpaceX and Boeing to develop new flight technology to bring astronauts into orbit and back. SpaceX is also working on a heavy lift rocket that may eventually be capable of taking humans to Mars (*SN: 2/6/18*).
In some ways, this shift is a natural evolution, McDowell says. NASA has hired private companies, including SpaceX, to launch satellites for years, and private manufacturing has been part of spacecraft development since the 1950s. But human space exploration has higher stakes.

"It has a much higher public profile, and much worse consequences, if things go wrong. So NASA has been understandably reluctant to take its hands off the wheel," McDowell says. "It has been a big attitude shift within NASA to get this far. But I think it is the right time to do it."

NASA provided funding and technical oversight to SpaceX in the development of the Crew Dragon. "What we're doing is unlike anything we've done before," NASA administrator Jim Bridenstine said in a NASA TV broadcast May 27. "We are not purchasing, owning and operating the hardware, we're turning to commercial industry…. We're really revolutionizing how we do spaceflight."

Financially, this was a good deal for the agency, according to an analysis by the Planetary Society published May 19. NASA's portion of the Crew Dragon development came to about $1.7 billion over the last nine years, far cheaper than every other crewed spacecraft project in the space agency's history. For instance, NASA spent $2.7 billion (adjusted for inflation) developing the Mercury spacecraft, the first human spaceflight program in the United States, from 1959 to 1961. The development of the space shuttle program cost $24.7 billion.

Before the planned launch, SpaceX and NASA ran the Crew Dragon spacecraft through a battery of tests, especially of the thruster system. An accident involving that system destroyed an uncrewed Dragon spacecraft in April 2019, pushing back the planned launch schedule. That explosion was likely caused by a propellant leak.

Preflight testing also included flight simulations for the astronauts and 27 tests of the parachute system, used to help the capsule carrying returning astronauts back to Earth set down safely. That's fewer parachute tests than normal, NASA associate administrator Steve Jurczyk said in a May 22 news briefing. But he has "high confidence that they will function as we need them to when Bob and Doug return."

This mission has a neat resonance for the astronauts, who have both flown on two space shuttle missions — and especially for Hurley, who was on the final flight of the space shuttle in July of 2011.

"It's a great honor to be part of this mission," Hurley said in a May 1 news briefing. His excitement is tempered by a sense of responsibility. "You just want to be methodical about everything you do," he said. "This is the first flight of a vehicle, and we want to make sure we've chased down everything we need to."

Hurley and Behnken spent the two weeks before launch in quarantine to ensure that they don't bring any infections or illnesses to the ISS, including the new coronavirus. That's standard practice that was in place before the spread of COVID-19, says NASA spokesperson Stephanie Schierholz.

NASA adhered to recommendations from the Centers for Disease Control and Prevention on infection control for the coronavirus before the astronauts went into quarantine, she adds. That included "cleaning of surfaces, social distancing, emphasizing hand hygiene, encouraging NASA team members who are sick to stay home and limiting contact with crew members." The astronauts have also been tested at least twice for COVID-19.

NASA maintains a pharmacy onboard the space station, and has plans in place to sequester astronauts from their crewmates if anyone does get sick. There are no plans to send coronavirus tests to the space station.

The coronavirus pandemic also means that the Kennedy Space Center is closed to the general public. But before the May 27 launch was scrubbed, crowds had gathered along nearby beaches and roads to watch the lift-off.

Once in orbit, the astronauts will test the spacecraft's environmental control systems, the displays and the maneuvering thrusters. The spacecraft is designed to dock with the space station automatically, but the crew can take over manually if necessary.

If all goes to schedule, the astronauts will reach the space station on the morning of May 31. The mission won't be considered over until the astronauts return in the same Crew Dragon capsule after a yet-to-be-determined amount of time, probably between one and three months.

Once the craft is certified to be safe and operational, Crew Dragons will carry up to four astronauts to the ISS at a time on NASA missions. NASA hopes that the new transportation will help boost human presence on the ISS, and continue research that can be done only in space.

For his part, Behnken is excited to be launching from the Florida coast again, which was routine when he and Hurley joined the NASA astronaut corps in 2000. "Generations of people, who maybe didn't get a chance to see a space shuttle launch, getting a chance again to see human spaceflight from our own backyard, if you will, is pretty exciting to be a part of," he said.

Source: https://www.sciencenews.org/article/spacex-nasa-astronaut-launch-milestone-commercial-spaceflight

Hydrogen ice? Unheard-of composition could explain 'Oumuamua's weirdness.

'Oumuamua may have started out with a lot of hydrogen ice.
The weirdness of our solar system's first known interstellar visitor stems from a very unusual composition, a new study suggests.
That visitor is 'Oumuamua, which zoomed through Earth's neighborhood in the fall of 2017 and is now streaking toward the dark depths of the outer solar system. The interloper puzzled researchers shortly after its detection, and the air of mystery surrounding the object hasn't dissipated. 'Oumuamua's oddness is multilayered. For starters, it seems to be cigar- or pancake-shaped, which is definitely not the norm for space rocks that astronomers are familiar with.
'Oumuamua's oddness is multilayered. For starters, it seems to be cigar- or pancake-shaped, which is definitely not the norm for space rocks that astronomers are familiar with. 'Oumuamua also displayed non-gravitational acceleration, movement not caused by the tug of the sun or any other big cosmic object. Comets frequently display such movement as they heat up and begin spouting jets, but 'Oumuamua never sported a cometary tail or coma, as far as researchers could tell.
Finally, spotting 'Oumuamua in the first place is a bit strange, considering how huge space is and how incomplete our search for such bodies has been to date. The detection implies that the population of 'Oumuamua-like objects out there is enormous — unless the visitor targeted our system somehow.

And there has indeed been some speculation that 'Oumuamua could be an alien spacecraft. Avi Loeb, the chair of Harvard University's astronomy department, has suggested the visitor may be a solar-sailing probe, perhaps a defunct one. We should at least keep our minds open to the possibility, Loeb has stressed.
The new study doesn't invoke aliens, but it nonetheless makes the case that 'Oumuamua is pretty special.

"We show that it was likely composed of hydrogen ice," study co-author Greg Laughlin, a professor of astronomy at Yale University in Connecticut, said in a statement. "This is a new type of object, but it looks like there may be many more of them showing up going forward."

Hydrogen is the most abundant element in the universe, but we don't often see it in solid form; that requires extremely cold temperatures. But such temperatures exist in the coldest cores of giant molecular clouds, nurseries that give rise to stars and their associated planetary systems, said Laughlin and lead author Daryl Seligman, who was a Yale grad student but is now at the University of Chicago.

The duo's modeling work suggests that bodies rich in hydrogen ice could form in these cores — and that such bodies would behave much as 'Oumuamua did when it cruised through the inner solar system.

"As 'Oumuamua passed close to the sun and received its warmth, melting hydrogen would have rapidly boiled off the icy surface, providing the observed acceleration and also winnowing 'Oumuamua down to its weird, elongated shape — much as a bar of soap becomes a thin sliver after many uses in the shower," Laughlin said.

If he and Seligman are right, such "hydrogen comets" should be quite common, and studying them could shed light on star and planet formation.

"Their presence would be an accurate probe of the conditions in the dark recesses of star-forming clouds and provide a critical new clue for understanding the earliest phases of the still-mysterious processes that generate the birth of stars and their accompanying planets," Laughlin said.

The new study has been accepted for publication in The Astrophysical Journal Letters. You can read a preprint of it for free at arXiv.org.
The new study is not the last word on 'Oumuamua; there are other potential explanations for its weirdness. There's the alien idea, for example, and a recently advanced hypothesis that 'Oumuamua is a fragment of a larger body that was torn apart during a close flyby of its native star.
'Oumuamua has long since passed out of astronomers' sight. But scientists are hopeful of seeing many more objects like it in the near future, especially after the Vera C. Rubin Observatory gets up and running in Chile. And the interstellar-visitor count now stands at two, after the detection of an object known as Comet Borisov in August 2019. Borisov is not as odd as 'Oumuamua; it is quite recognizably a comet.

- Why was 'Oumuamua so weird? New research tries to track its origins.
- 'Oumuamua and Borisov are just the beginning of an interstellar object bonanza
- Could life on Earth have come from another star system?

Source: https://www.space.com/oumuamua-interstellar-visitor-hydrogen-ice.html

A New Idea on the Tanguska Event

A mysterious blast in 1908, thought to have been caused by a meteor, flattened a Siberian taiga forest. This photo was taken in 1938, during an expedition by Russian mineralogist Leonid Kulik, investigating the event. A

mysterious blast in 1908, thought to have been caused by a meteor, flattened a Siberian taiga forest. This photo was taken in 1938, during an expedition by Russian mineralogist Leonid Kulik, investigating the event. (Image: © Sovfoto/Universal Images Group via Getty Images)

More than a century ago, something exploded in the sky above Siberia, breaking windows and creating a shining ball of light – but was it a meteor impact? A new Russian study suggests a very strange alternative.The Tunguska event, in 1908, is described as the largest impact event in recorded history, destroying 80 million trees over an area of 800 square miles in the Siberian forest.But mysteriously, no impact crater was ever found, even though there are fragments of rock that could be meteoric in origin, Science Alert reported.Researchers have suggested that nothing actually hit the ground at all, and instead, a large iron asteroid flew through Earth's atmosphere before flying off into space.

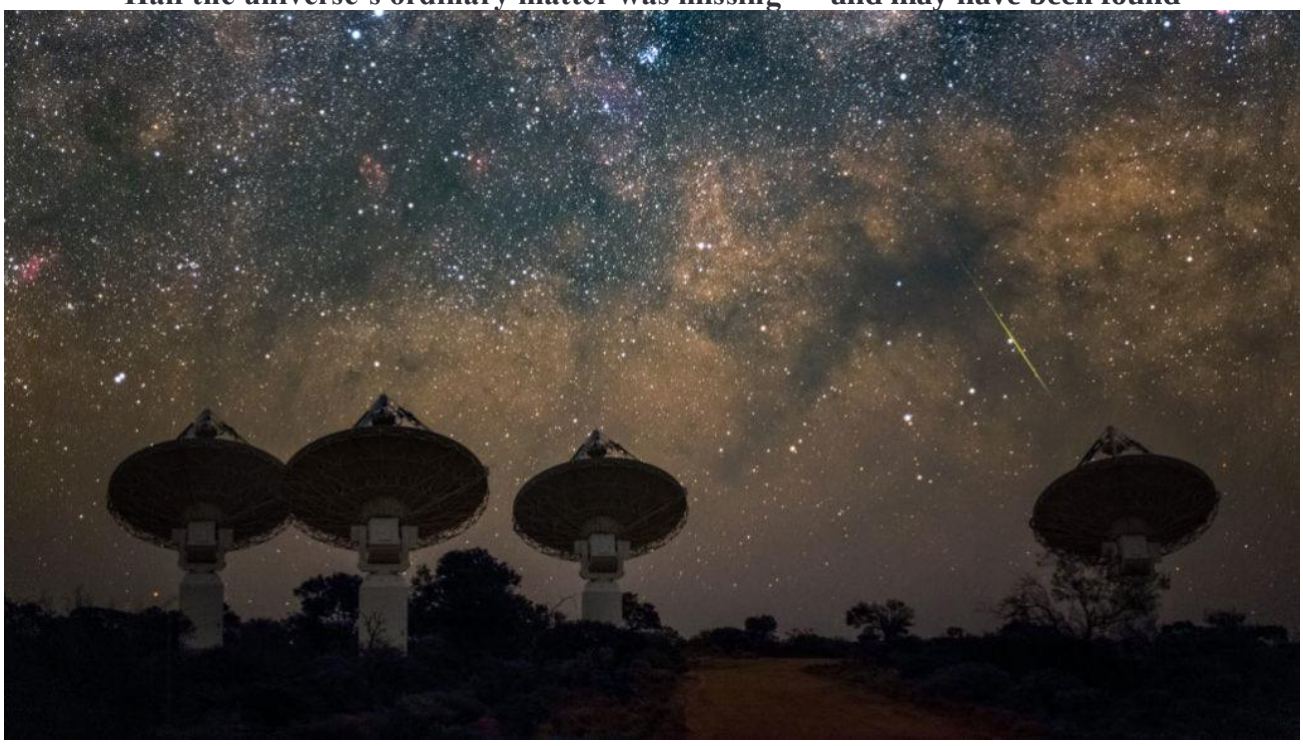
The team, led by Daniil Khrenikov, wrote: "We have studied the conditions of through passage of asteroids with diameters of 200, 100, and 50 metres, consisting of three types of materials – iron, stone, and water ice, across the Earth's atmosphere."The researchers said it's possible that an iron asteroid could have passed through the atmosphere and continued into space.

They wrote: "The conditions of this passage with a subsequent exit into outer space with the preservation of a substantial fraction of the initial mass have been found."The results obtained support our idea explaining one of the long-standing problems of astronomy – the Tunguska phenomenon, which has not received reasonable and comprehensive interpretations to date.

"We argue that the Tunguska event was caused by an iron asteroid body, which passed through the Earth's atmosphere and continued to the near-solar orbit."In an interview with The Siberian Times, Dr Sergei Karpov, of the Kirensky Physics Institute in Krasnoyarsk, said the theory of an iron asteroid "passing through" answered several unsolved questions.He said: "At present, there are over 100 hypotheses about the nature of the Tunguska phenomenon. They include the fall of a small asteroid measuring several dozen metres consisting of typical asteroid materials, either metal or stone, as well as ice."We calculated trajectory characteristics of space from 50 to 200 metres in diameter, and our modelling shows that it could not consist of rock or ice because, on the contrast with iron, such bodies fall apart quick because of colossal aerodynamic pressure in the atmosphere.

Source: Rob Rough Yahoo News UK May 05, 2020

Half the universe's ordinary matter was missing — and may have been found



The long-sought matter appears to have been hiding in the gaps between galaxies

At long last, all of the universe's ordinary matter seems to be present and accounted for.

Astronomers have taken a new census of matter in the universe by examining how bright flashes of radio waves from other galaxies, called fast radio bursts, are distorted by particles on their way to Earth. This analysis shows that about half of the universe's ordinary matter, which has eluded detection for decades, is lurking in intergalactic space, researchers report online May 27 in *Nature*.

The mystery of the missing matter has vexed cosmologists for some 20 years. This elusive material isn't the invisible, unidentified dark matter that makes up most of the mass in the universe. It's ordinary matter, composed of garden-variety particles called baryons, such as protons and neutrons (*SN: 10/11/17*).

Observations of light emitted when the universe was young indicate that baryons should make up roughly 5 percent of all the mass and energy in the cosmos. But in the modern universe, all the matter that astronomers can easily see, like the stars and gas in galaxies, adds up to only about half of the expected amount of matter.

Scientists have long suspected the missing matter is hiding between galaxies, along filaments of gas strung between galaxy clusters in a vast cosmic web (*SN: 1/20/14*). "But we haven't been able to detect it very well, because it's really, really diffuse, and it's not shining brightly," says Jason Hessels, an astrophysicist at the University of Amsterdam not involved in the new work.

Some intergalactic matter is detectable by how it absorbs the light of distant, bright objects called quasars (*SN: 10/25/02*). But the only way to take inventory of all the baryons hanging out in intergalactic space relies on mysterious blasts of radio waves from other galaxies, possibly generated by energetic activity around neutron stars or black holes (*SN: 2/7/20).*

Even though no one knows what causes these blasts, called fast radio bursts or FRBs, they can make useful baryon detectors (*SN: 7/25/14*). A burst's high-frequency, high-energy radio waves zip through intergalactic matter faster than its low-frequency waves. The more intergalactic matter that a radio burst's waves pass through, the farther its lower-frequency waves fall behind — creating a detectable smear in the radio signal by the time it reaches Earth.

Astrophysicist J. Xavier Prochaska of the University of California, Santa Cruz and colleagues examined five fast radio bursts from five galaxies, all detected by the Australian Square Kilometre Array Pathfinder (*SN: 6/27/19*). For each FRB, the researchers compared the arrival times of radio waves of different frequencies to tally up the number of baryons that the burst encountered on its journey through intergalactic space. Then, using the distance between the FRB's host galaxy and the Milky Way, Prochaska's team could calculate the baryon density along that path.

The average density of matter between the Milky Way and each of the five FRB host galaxies came out to about one baryon per cubic meter. The material in the Milky Way is about 1 million times as dense as that, Prochaska says, making the intergalactic stuff "a very wispy medium." But all that wispy material, taken together, is enough to account for all the universe's missing matter — bringing ordinary matter up to about 5 percent of the modern universe's overall matter and energy, the researchers say.

Astrophysicist J. Michael Shull of the University of Colorado Boulder cautions that "five is an awfully small number" of FRB observations from which to draw conclusions about the number of baryons throughout the modern universe. But "once they get their error bars beaten down with many, many more bursts … I think that will really be the nail in the coffin on this baryon problem," he says.

Using more fast radio bursts as cosmic weigh stations will also be useful for pinpointing exactly where all the matter in the universe is located, says Shami Chatterjee, a radio astronomer at Cornell University not involved in the work.

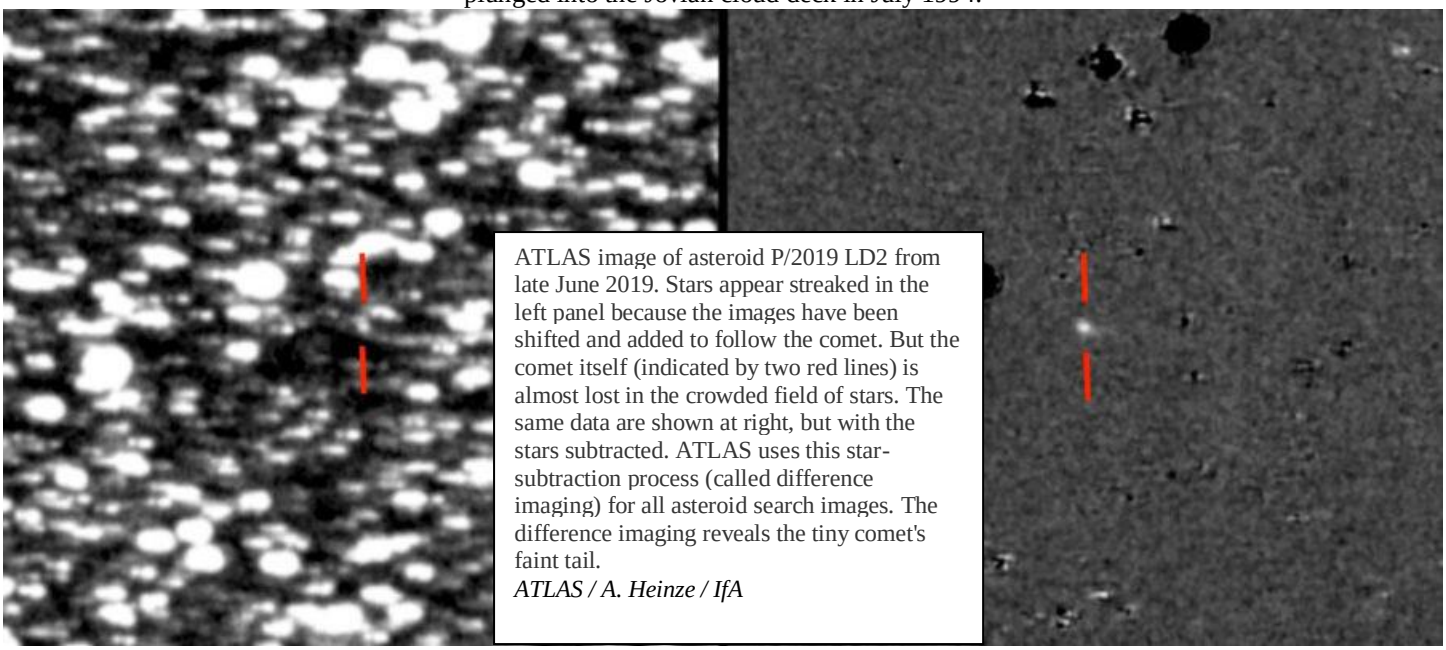
Right now, all the researchers can say about the lost-and-found matter is that it's between galaxies. But with thousands of FRB observations, astronomers could start teasing out the slight variations in baryon density along the sight lines between the Milky Way and other galaxies to map out the cosmic web, Chatterjee says.

Source: Article By Maria Temming MAY 27, 2020 AT 11:00 AM. HTTPS://WWW.SCIENCENEWS.ORG/ARTICLE/UNIVERSE-MISSING-MATTER-FOUND-FAST-RADIO-BURSTS

JUPITER HAS TRAPPED A COMET IN A BIZARRE ORBIT

Astronomers have discovered a comet trapped in a weird orbit near Jupiter.

Jupiter has captured an icy comet from the outer solar system in a bizarre orbit that will bring it back to within 3 million kilometers of the giant planet in 2063. The only Sun-orbiting objects known to come closer were the fragments of Comet Shoemaker-Levy 9, which plunged into the Jovian cloud deck in July 1994.



ATLAS image of asteroid P/2019 LD2 from late June 2019. Stars appear streaked in the left panel because the images have been shifted and added to follow the comet. But the comet itself (indicated by two red lines) is almost lost in the crowded field of stars. The same data are shown at right, but with the stars subtracted. ATLAS uses this star-subtraction process (called difference imaging) for all asteroid search images. The difference imaging reveals the tiny comet's faint tail.
ATLAS / A. Heinze / IfA

A CENTAUR, NOT A TROJAN

A year ago, NASA's asteroid-hunting ATLAS project in Hawai'i discovered 2019 LD2, and further observations showed it was a comet. New observations this spring confirmed it as a periodic comet and placed its orbit near Jupiter, leading Larry Denneau (University of Hawaii) to announce May 20th that P/2019 LD2 was the first comet among the Trojans. This family of several thousand asteroids shares Jupiter's orbit but stays steady at about 60° ahead or behind of the planet. The discovery of a comet among Trojan asteroids was surprising because most of them are thought to have been captured in the solar system's early years — any ices ought to have evaporated long ago.

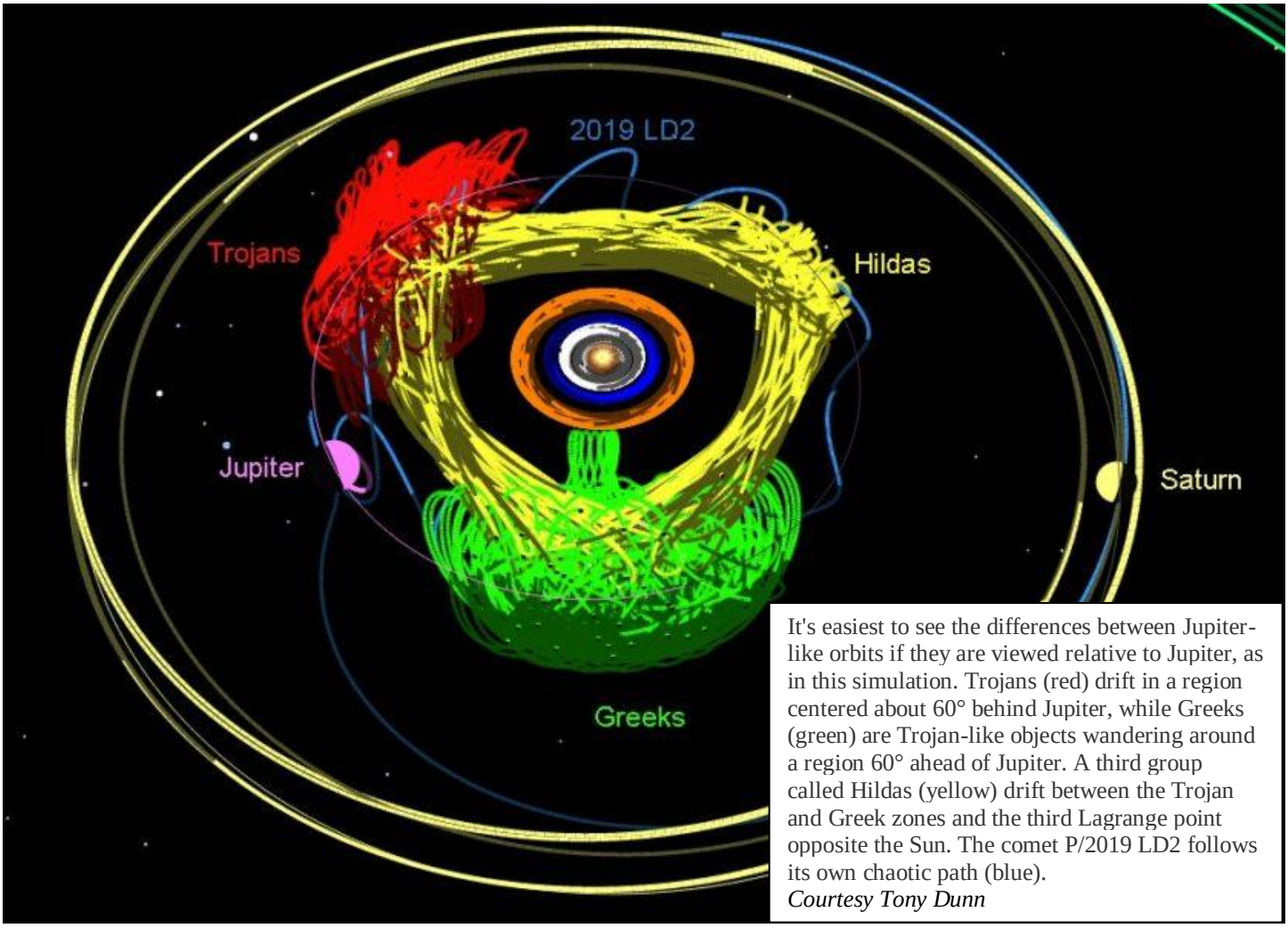
However, when amateur astronomer Sam Deen used software on the Jet Propulsion Laboratory's solar-system dynamics website to calculate the object's orbit, he found P/2019 LD2 recently had a close encounter with Jupiter that left its orbit unstable. The model showed that the comet had likely been a Centaur, part of a family of outer solar system asteroids, with an orbit reaching out to Saturn. Then, on February 17, 2017, it passed about 14 million kilometers from Jupiter, an encounter that sent the comet on a wild ride and inserted it into an odd Jupiter-like orbit.

Yet although the swing past Jupiter put P/2019 LD2 into a Jupiter-like orbit, it didn't move it near to one of the two Lagrange points where the combination of gravitational forces from Jupiter and the Sun hold Trojan asteroids. Instead of being 60° — one-sixth of the giant planet's orbit — from Jupiter, P/2019 LD2 is only 21° ahead of Jupiter. The model predicts the comet will drift to no more than 30° ahead before the two begin converging again.

FUTURE PASSES

The comet will then pass within about 18 million km on May 13, 2028. That will alter the orbit again, Deen wrote on the Minor Planet Mailing List. That makes P/2019 LD2 a Jupiter-family comet — but not a Jupiter Trojan, as the Hawaii group now acknowledges. Project Pluto's Find_Orb model gives similar results to JPL's model.

Another amateur, Tony Dunn, also found similar results. He illustrated the orbit using his own model to shows the path of the object as seen from Jupiter.



It's easiest to see the differences between Jupiter-like orbits if they are viewed relative to Jupiter, as in this simulation. Trojans (red) drift in a region centered about 60° behind Jupiter, while Greeks (green) are Trojan-like objects wandering around a region 60° ahead of Jupiter. A third group called Hildas (yellow) drift between the Trojan and Greek zones and the third Lagrange point opposite the Sun. The comet P/2019 LD2 follows its own chaotic path (blue).
Courtesy Tony Dunn

The 2028 encounter will shift the comet from an orbit close to a 1:1 resonance with Jupiter to one near a 2:3 resonance. But that orbit won't last, because it will put P/2019 LD2 on course for a much closer planetary encounter."From Jupiter's perspective the comet will appear to slowly move around the Sun before coming back," Deen says. In January 2063, it will pass some 3 million kilometers from Jupiter, just outside the orbits of its Galilean satellites — close enough to cause a major redirection of the comet's orbit.

2063 AND BEYOND

Where P/2019 LD2 will go from there is unclear. The orbital uncertainties are large enough to make the results of that encounter difficult to predict, says Bill Gray of Project Pluto. "It could get tossed almost anywhere," he says, depending on how close it comes to Jupiter. The closer the encounter, the more dramatic the results could be.

Another wild card, Gray says, is that comets eject gas from various points on their surfaces, and it is very hard to model the impact of the resulting non-gravitational effects on their orbits. Such effects could enhance or diminish the effect of Jupiter's gravitational force and could send it veering off in an unexpected direction. Strong forces can also fragment a comet, as happened to Shoemaker-Levy 9 before its impact.

The 2063 approach should yield new insight into a process that has helped shape the solar system: intense interactions between planetesimals and the gravitational giant of the solar system. The event should give us "a detailed look at the dynamics that convert Centaurs and long-period comets into short-period comets," says Deen. "Odds are that we'll have some spacecraft orbiting Jupiter by then that will be able to visit the interplanetary visitor up close." That would give a much better view of the action than we had for Shoemaker-Levy 9, when the collision itself happened on the side of Jupiter hidden from terrestrial observers and spacecraft. Source: skyandtelescope.org/astronomy-news/jupiter-has-trapped-a-comet-in-a-bizarre-orbit/

June Celestial Calendar

1. Venus moves to the morning sky this month where it will be visible in the east before sunrise the last couple of weeks.
2. Mercury remains in the evening sky this month where it can be seen in the west the first half of the month.
3. Jupiter and Saturn both rise around midnight and remain close the whole month.
4. Mars rises in the southeast at 2 AM on the first and 1 AM on the last of the month.

June 03	Moon at Perigee (354366 km)
June 04	**D ζ-Perseids** Meteor Shower (not visible)
	Double Jupiter Transit
	Mercury Greatest Eastern Elongation 24°
June 05	Full Moon
June 05	Penumbral Lunar Eclipse: Visible from Australia, Antartica. ***Not visible From North America.***
June 08	***Jupiter 2° North of the Moon***
June 09	***Saturn 3° North of the Moon***
June 11	***Double Jupiter Transit***
June 12	***Mars 1.7° South of the Moon***
June 13	Last Quarter Moon
June 15	Moon at Apogee (404595 km)
June 17	***Uranus 4° North of Moon***
June 18	***Double Jupiter Transit***
June 19	***Venus 0.7° S. of Moon Occultation***
June 20	**Solstice** *21hr 44m 2:44 PM (P.S.T)*
June 21	New Moon
	Annular Solar Eclipse: Visible only from Africa, Saudia Arabia, India & China. Not Visible in North America
June 28	First Quarter Moon
June 30	Moon at Perigee (368958 km)

Roger Brower

2020 ROYAL ASTRONOMICAL SOCIETY HANDBOOKS AND CALENDARS

The group rate price for a single copy if you buy **in person** from CLAS is $27.00 for the handbook and $10.00

for the calendar. Calendar and Handbook are sold together for the combined price of $35.00. **Available NOW.**

MEMBERSHIP INFORMATION

Basic CLAS dues are $25.00 per year - due in January. Students and Skywatchers Newsletter are FREE. Members also receive discounted rates for Astronomy Magazine and /or Sky and Telescope Magazine.

The fee schedule is as follows: Verify current magazine prices with Roger!

Basic membership $25.00 per year.
Membership with Astronomy magazine is $59.00 per year.
Membership with Sky and Telescope magazine is $58.00 per year.
Membership with both S & T and Astronomy is $92.00 per year.

Send your Check or Money Order to:

Roger Brower, Treasurer, China Lake Astronomical Society, P.O. Box 1783, Ridgecrest, CA 93556.

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Meetings of the China Lake Astronomical Society are held at the Maturango Museum at 7:30 p.m. on the first Monday evening of each month, except when the first Monday is a holiday.

WESTERN AMATEUR ASTRONOMERS WEB SITE http://www.waa.av.org/
New! CHINA LAKE ASTRONOMICAL SOCIETY WEB SITE http://chinalakeastro.org/