Volume 50 Number 3 March 2024

The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

Coming Events

Monthly Meeting
March 24, 2024, 7:00PM
Baker Wetlands Discovery Center

Public Observing
March 24, 2024, 8:00PM
Baker Wetlands Discovery Center

Club Officers

President
Rick Heschmeyer email

AICOR
William Winkler email

NSN Coordinator
Howard Edin email

Faculty Advisor
Dr. Jennifer Delgado email.

Newsletter Editor
Chuck Wehner email

Inside This Issue

Report From the Officers

By Rick Heshmeyer

After a terrible observing month to start the year, February was warmer, with more clear nights (and days) than its predecessor. I mention days because our Sun has been very active, including a couple of huge sunspots that were visible, **with proper filters**, to the unaided eye!

For our February club meeting, Gary Hug, a member of the Northeast Kansas Amateur Astronomers' League, and a prolific asteroid and NEO observer/discoverer, gave the club an update about the most recent changes NEKAAL has made to the Tombaugh telescope at Farpoint Observatory titled "The 27-inch Tombaugh Reflector Revised (again)". There was also a quick discussion of a possible AAL visit to Farpoint in the future. More to come on this.

At the start of the meeting AAL member Parker Lessig spoke about some resources for the upcoming solar eclipse. One very useful site he mentioned, specifically for weather predictions, is https://eclipsophile.com Check it out!

For our March club meeting, AAL member Howard Edin will talk about the Global Meteor Network and his camera setup, which happens to be the only GMN station in Kansas. He will also discuss creating a new station.

In April, Dr. Humberto Campins, a mission scientist for the OSIRIS-Rex asteroid sample return mission, and a former AAL member, will reprise his February 2021 presentation concerning the mission with a talk about some of the initial scientific returns from the mission. He will be joining us via Zoom. I will send a link out to club members, so that everyone can join, live or online.

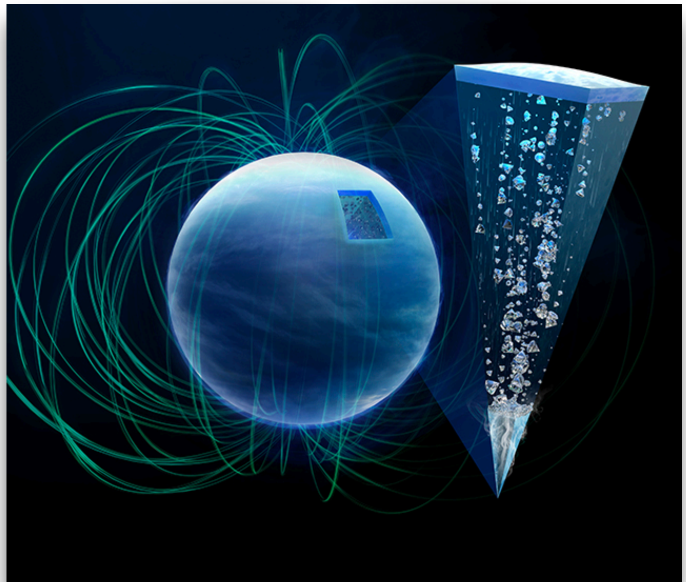
And do not forget that we are only a little more than one month away from the April 8, 2024 Total Solar Eclipse, whose path will travel from western Mexico northeast through 13 US states and eastern Canada. The KU Physics and Astronomy Department is planning a local event, so if you are in town and would like to help, here is your chance. As the details of the event are finalized, I will forward to the club.

Keep looking up!

Diamonds Could Be Raining From The Sky on Far More Planets Than We Realized

By David Nield

SCIENCEALERT, JANUARY 28, 2024



If it were ever possible to take a flight through the extreme conditions of Neptune's atmosphere, we might experience the fascinating phenomenon of diamond rain tapping at our window.

According to a new study by an international team of researchers, such a blizzard of bling could be relatively common throughout the Universe.

Carbon can link into a crystal on giant, icy gas planets like Neptune and Uranus because of the ultra-high temperatures and pressures deep down in the atmosphere. These conditions break up hydrocarbons like methane, allowing the carbon atoms within to connect with four others and make particles of solid diamond.

Based on the experiments outlined in the latest study, in which diamond-forming processes were simulated in lab conditions, the temperature and pressure thresholds for this kind of diamond formation are lower than scientists thought.

That would make diamond rain possible on smaller gas planets, so called 'mini-Neptunes'. There are plenty of these that we know about outside the Solar System.

These findings might also explain some mysteries about Uranus's and Neptune's magnetic fields.

"This groundbreaking discovery not only deepens our knowledge of our local icy planets, but also holds implications for understanding similar processes in exoplanets beyond our Solar System," says physicist Siegfried Glenzer from the SLAC National Accelerator Laboratory.

The team behind the new study used the European XFEL (X-Ray Free-Electron Laser) to monitor diamonds being formed from hydrocarbon compound polystyrene film, pushed to huge pressures between a vice-like setup.

This configuration allowed the team to get a longer look at the process than had been possible in previous

experiments. That drawn-out examination suggested that even though intense pressure and super-hot temperatures are still very much required, they might not have to be quite as extreme as previously thought.

In terms of planets, this suggests diamonds could form at a shallower depth than scientists have been estimating – and that would then mean the descending diamond particles, dragging gas and ice along with them, might be influencing the magnetic fields of these planets in a more direct way than we've previously understood.

Unlike Earth, ice planets like Neptune and Uranus don't have symmetrical magnetic fields. That's been something of a mystery up to this point – suggesting the magnetic fields aren't formed in the planetary core – and diamonds could help explain it.

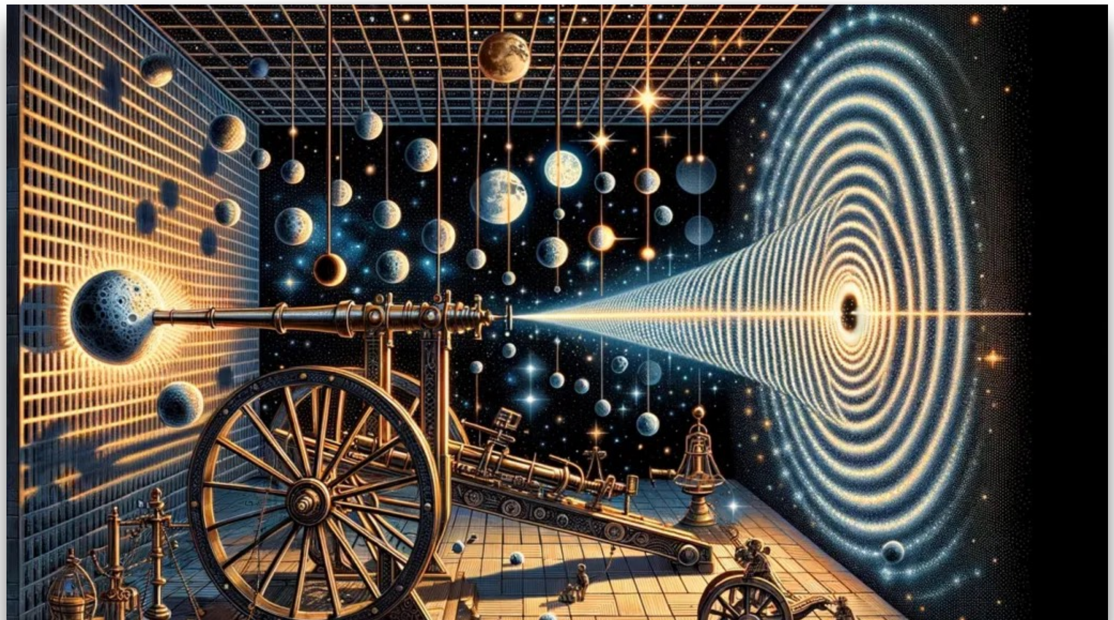
"It might kick off movements within the conductive ices found on these planets, influencing the generation of their magnetic fields," says physicist Mungo Frost, from the SLAC National Accelerator Laboratory.

Who knows – maybe one day we'll be able to do some actual field research in the demanding atmosphere of Neptune and Uranus, enabling us to see first-hand how this diamond rain is formed. ☀

A maverick physicist is building a case for scrapping quantum gravity

By Emily Conover

SCIENCENEWS, DECEMBER 8, 2023



A rift runs deep through the heart of physics. The general theory of relativity, which describes gravity, clashes with quantum physics. In an effort to seal that physics fissure, untold numbers of physicists have spent their careers working to build a theory of quantum gravity.

But one physicist is championing a radically different path. Jonathan Oppenheim thinks that gravity might be fundamentally classical, meaning it isn't quantum at all. It's an unconventional idea, to say the least.

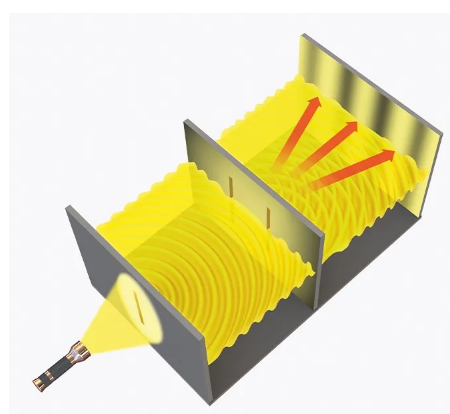
"When we started, maybe 99 percent of our colleagues thought we were crackpots and that's now down to maybe 70 percent," quips Oppenheim, of University College London.

All known forces except gravity are formulated in terms of quantum physics. The prevailing view is that gravity will need to assimilate with its quantum colleagues. But gravity is different, Oppenheim argues. While other forces evolve within a landscape of spacetime, gravity is the warping of spacetime itself. So, Oppenheim says, "it is pretty unclear that it should have a quantum nature, in my view."

Physicists have devised several "no-go" theorems that seemingly forbid a classical theory of gravity. Such theorems highlight inconsistencies, apparently fatal to the idea, that arise when classical gravity is applied to quantum particles. But it's possible to get around those prohibitions by adding some randomness to the way that spacetime bends in response to quantum particles, Oppenheim reports December 4 in *Physical Review X*.

Consider the famous double-slit experiment of quantum physics (*SN: 5/3/19*). Particles are sent toward a detector, separated by a barrier with two slits in it. When those particles arrive at the detector, they create a stripy pattern called an interference pattern.

That pattern arises because, in quantum physics, the particle isn't constrained to pass through one slit or the other. Instead, it can exist in a superposition, taking a quantum combination of both possible routes. If a scientist makes a measurement to determine which slit the particle passed through, that pattern disappears.



When particles, in this case particles of light called photons, are sent toward a barrier with two slits in it, the particles produce an interference pattern (stripes) due to quantum effects.

If a standard classical picture of gravity were correct, it would be possible to measure the gravitational field of that particle so precisely that you could determine which slit the particle went through. This possibility would destroy the interference pattern, even without actually doing the measurement. Because scientists do observe interference patterns in the lab, that's a big blow for a standard classical theory of gravity.

But the randomness baked into Oppenheim's theory means that, instead of a particle having a determined gravitational field, the field fluctuates. That means, unlike for the standard version of classical gravity, it's not possible to determine which slit a particle went through by precisely measuring its gravitational field. Particles can pass through the slits in a superposition, and the interference pattern is saved, restoring the possibility gravity could be classical.

Experiments can test this theory by searching for evidence of those random gravitational fluctuations, Oppenheim and colleagues report December 4 in Nature Communications. "Essentially, you very precisely measure the response of a mass to a gravitational field," says study coauthor Zach Weller-Davies, who completed the work at the Perimeter Institute for Theoretical Physics in Waterloo, Canada.

This is not the first time scientists have proposed a way to make classical gravity comport with quantum physics. But Oppenheim has been "leading a renaissance," says physicist Vivishek Sudhir of MIT. Sudhir hopes to test the theory with another type of experiment, measuring the correlations between the motions of two masses that interact gravitationally, he and a colleague report September 16 at arXiv.org.

However, the theory has features some physicists might find unsatisfying. For example, the randomness involved means that the theory is not reversible: Unlike other theories, there's no way to start from the endpoint of an interaction and trace its steps backward.

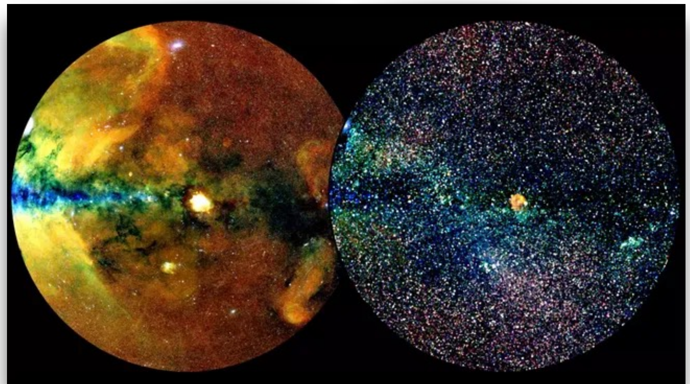
Still, even some quantum gravity believers think that the work has merit.

"The reason why this work is interesting for me is not really because I would believe that gravity is classical," says Flaminia Giacomini of ETH Zurich. The result, she says, is interesting regardless of whether gravity is found to be classical or quantum. That's because, in order for an experiment to confidently proclaim that gravity is quantum, scientists need to understand the possibilities for classical gravity. "Only in that way will we be able to prove in a strong way that gravity is not compatible with a classical description." ☀

More than 900,000 stars, galaxies and black holes revealed in most detailed X-ray map of the universe ever

By Brandon Specktor

LIVESCIENCE, FEBRUARY 2, 2024



The sky section of the eROSITA All-Sky Survey catalog in two different representations. The left image shows extended X-ray emission, while the right image shows point-like X-ray sources.

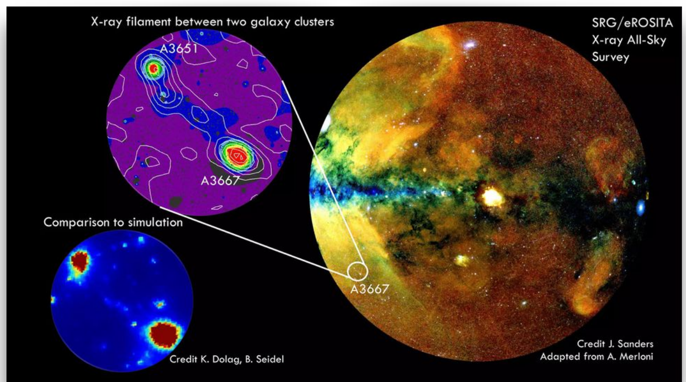
Scientists using the eROSITA X-ray telescope have released a trove of data that reveals more than 900,000 objects in space, including 700,000 supermassive black holes and other 'exotic' objects.

Astronomers have unveiled the largest and most detailed X-ray map of the universe ever created. The newly released data reveal the light of more than 700,000 monster black holes, a mysterious "bridge" of gas connecting distant galaxies, and hundreds of thousands of other "exotic" deep-space objects.

The massive new X-ray data release comes courtesy of the eROSITA All-Sky Survey, a mission to scan the entire sky from December 2019 to June 2020 using the eROSITA X-ray telescope. In that time, the survey detected more than 170 million X-ray photons (particles of light) in the sky, which astronomers later identified as roughly 900,000 distinct objects in space, most of which are supermassive black holes, according to a statement from the Max Planck Society in Germany, which helped manage the mission.

"These are mind-blowing numbers for X-ray astronomy," Andrea Merloni, eROSITA principal investigator and lead author of a new paper describing the breadth of the mission's findings, said in the statement. "We've detected more sources in 6 months than the big flagship missions XMM-Newton and Chandra have done in nearly 25 years of operation," Merloni added, referring to the X-ray telescopes currently operated by the European Space Agency and NASA, respectively.

X-rays are a form of high-energy radiation that's invisible to the naked eye. Most X-ray emissions in space come from concentrations of extremely hot gases, which can arise from massive galaxy clusters; the remnants of supernova explosions, like the famous Crab Nebula; or active black holes that can outshine entire galaxies as hot, fast-moving matter plummets into their insatiable maws. Studying cosmic X-rays can not only suss out massive, high-energy objects like these but also reveal the overarching structure of the universe itself.



An eROSITA X-ray image with the newly discovered filament between two galaxy clusters more than 42 million light-years apart.

One of the most intriguing new discoveries to come from the survey is an enormous "filament," or bridge, of hot gas connecting two clusters of galaxies across more than 42 million light-years (more than 400 times the length of the Milky Way). The filament is thought to be a piece of the cosmic web — the vast superhighway of gas that feeds all galaxies in the universe and reveals the empty voids where elusive dark matter is thought to dwell. (The research has yet to be peer-reviewed.)

In addition to releasing the latest batch of data, researchers from the project have submitted more than 50 papers to scientific journals discussing a small fraction of eROSITA's new findings. This fresh ream of astronomical reading material adds to more than 200 papers already published on prior eROSITA discoveries, the researchers said.

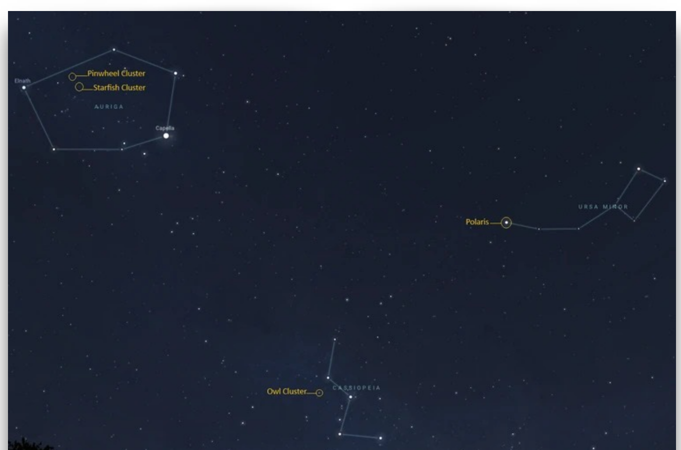
The full data release, along with free tools for reading it, are available courtesy of the eROSITA website. More data and scientific papers based on it are expected in the near future. In the meantime, eROSITA will continue stargazing from its home aboard the Spectrum-Roentgen-Gamma (SRG) space observatory, operated jointly by Germany and Russia.

Constant Companions: Circumpolar Constellations, Part I

By Kat Troche

NASANIGHTSKYNOTES, FEBRUARY 2024

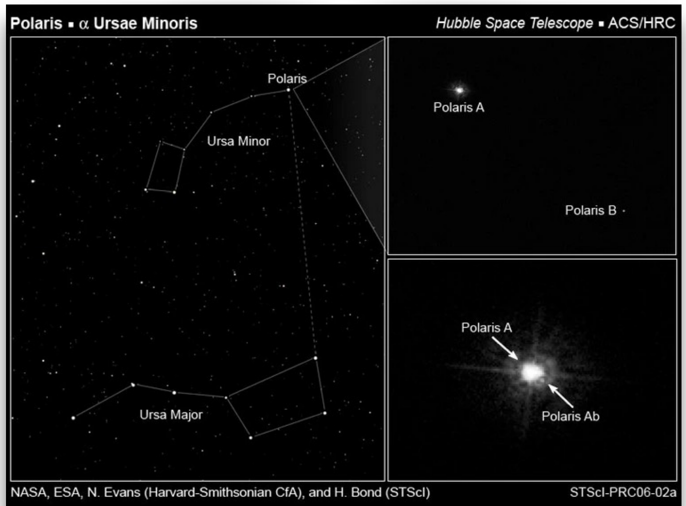
Winter in the northern hemisphere offers crisp, clear (and cold!) nights to stargazers, along with betterviews of several circumpolar constellations. What does circumpolar mean when referring toconstellations? This word refers to constellations that surround the north and south celestial poles withoutever falling below the horizon. Depending on your latitude, you will be able to see up to nine circumpolarconstellations in the northern hemisphere. Today, we'll focus on three that have gems within: Auriga,Cassiopeia, and Ursa Minor. These objects can all be spotted with a pair of binoculars or a small tomedium-sized telescope.



The counterclockwise circumpolar constellations Auriga, Cassiopeia, and Ursa Minor in the night sky, with four objects circled in yellow labeled: Pinwheel Cluster, Starfish Cluster, Owl Cluster, and Polaris.

- **The Pinwheel Cluster:** Located near the edge of Auriga, this open star cluster is easy to spotwith a pair of binoculars or small telescope. At just 25 million years old, it contains no red giant stars and looks similar to the Pleiades. To find this, draw a line between the stars Elnath in Taurus and Menkalinan in Auriga. You will also find the **Starfish Cluster** nearby.

- **The Owl Cluster:** Located in the ‘W’ or ‘M’ shaped constellation Cassiopeia, is the open star cluster known as the **Owl Cluster**. Sometimes referred to as the E.T. Cluster or Dragonfly Cluster, this group of stars never sets below the horizon and can be spotted with binoculars or a small telescope.



A black and white image from the Hubble Telescope of the Polaris star system, showing three stars: Polaris A, Ab, and Polaris B.

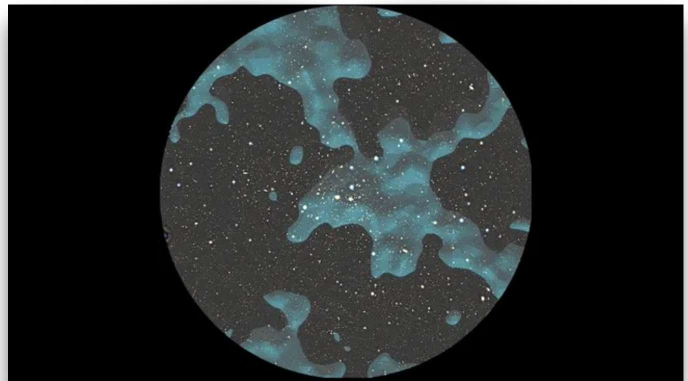
Polaris: Did you know that Polaris is a triple star system? Look for the North Star on the edge of Ursa Minor, and with a medium-sized telescope, you should be able to separate two of the three stars. This star is also known as a Cepheid variable star, meaning that it varies in brightness, temperature and diameter. It’s the closest one of its kind to Earth, making it a great target for study and conceptual art.

Up next, catch the King of the Planets before its gone for the season with our upcoming mid-month article on the Night Sky Network page through NASA's website! ☀

Dark matter detected dangling from the cosmic web for 1st time

By Robert Lea

SPACE.COM, FEBRUARY 13, 2023



Dark matter in the Coma Cluster. Dark matter represented by green clouds over the Coma Cluster and distant galaxies as seen by Subaru Telescope.

Dark matter, indirectly detected in a cluster of thousands of galaxies, could help scientists test theories of cosmic evolution.

For the first time, astronomers have detected dark matter hanging from massive filaments that stretch across the universe and form a "cosmic web" that trap galaxies like morning dew on a spiderweb.

Researchers from Yonsei University in Seoul, South Korea, used the Subaru Telescope — an 8.2-meter optical-infrared telescope near the summit of Maunakea in Hawaii — and an effect that gravity has on light to indirectly observe dark matter sitting on cosmic web filaments in the Coma Cluster.

This marks the first-ever detection of dark matter on the cosmic web, and could help confirm how this structure — with strands that run for tens of millions of light-years — has influenced the evolution of the universe.

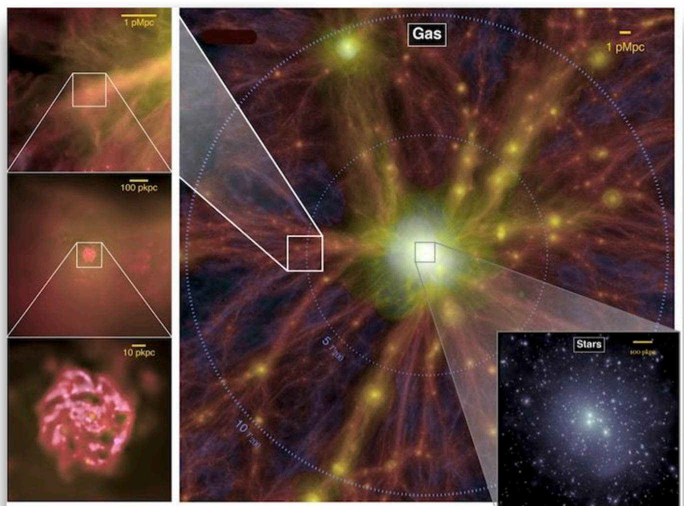
Also known as Abell 1656, the Coma Cluster is a collection of over a thousand galaxies and is located some 321 million light-years away from us in the direction of the constellation Coma Berenices. Because of this tremendous size and relative proximity, the Coma Cluster is an ideal place for scientists to hunt dark matter on cosmic web strands.

Related: James Webb Space Telescope could target tiny bright galaxies to shine light on dark matter

The cosmic web is a network of filaments, made up of matter, that feed gas into galaxies, helping them grow. This web also helps channel galaxies together, leading them to cluster.

The main filaments of the cosmic web are themselves the walls of galaxy superclusters, with the wall corresponding with the Coma Cluster known as the "great wall." The great wall was actually the first superlarge structure in the universe to be discovered.

Clusters of galaxies are believed to gather at points where filaments intersect, but these filaments are believed to terminate between galaxies and form what're called "intracluster filaments." Dark matter is expected to run along these cosmic web filaments dangling from those intracluster filaments.



A computer simulation of galaxies embedded with filaments of gas that make up the cosmic web. (Image credit: Yannick Bahé)

Dark matter as a cosmic scaffold

Though the cosmic web, the largest structure in the universe, has been known about for decades, astronomers have only seen the faint glow of its gas filaments when they have been illuminated by bright regions at the hearts of galaxies powered by feeding supermassive black holes. Those active black holes are called quasars.

Last year, the Keck Cosmic Web Imager, also atop Maunakea, caught the first direct light emanating from wispy web filaments that cross one another and stretch across the darkest corners of space. These are filaments that sit isolated between galaxies, in the largest and most hidden portions of the cosmic web.

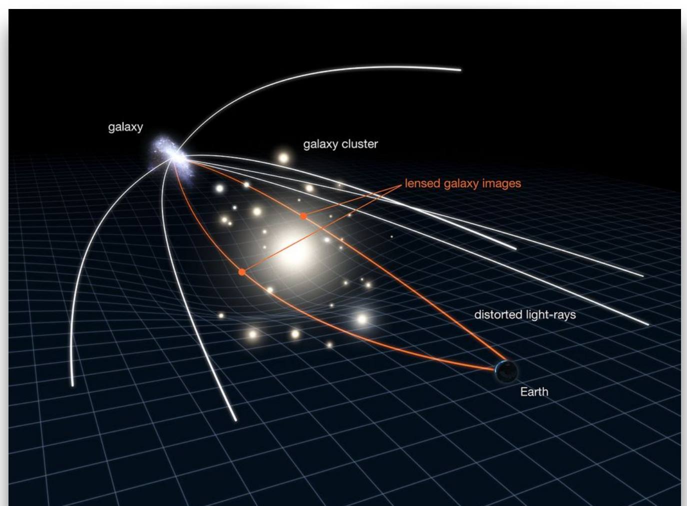
"Seeing" the location of dark matter around these cosmic web strands is a completely different story, however.

That's because, despite making up an estimated 85% of all the matter in the universe, dark matter is invisible because it doesn't interact with light like everyday matter that comprises stars and dust does.

Dark matter's dominance over everyday matter also means it dominates the filaments of the cosmic web, forming an invisible scaffold along which the universe's structure takes shape.

However, even though dark matter doesn't interact with light, it does interact with gravity — and this interaction impacts the movement of everyday matter and light that we can see.

The team behind this research took advantage of this concept, using it to detect dark matter on cosmic web filaments threaded throughout the Coma Cluster.



A diagram shows how light from a background source is curved by mass, generating an effect called gravitational lensing

Albert Einstein's 1915 theory of gravity, called general relativity, suggests that objects with mass cause the fabric of spacetime to curve. In turn, the theory explains, what we perceive as gravity arises from this curvature. Furthermore, when light from a background source passes through this curvature, its path gets diverted.

This can lead to background sources appearing to shift in the sky, to be amplified, or in some extreme cases, even to appear at multiple points in the same image. This is called gravitational lensing.

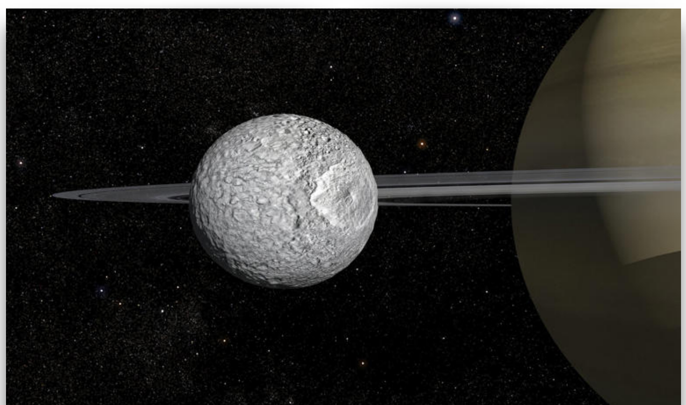
So, using light from galaxies and stars behind the Coma Cluster and assisted by the high sensitivity, high resolution and wide field of view of the Subaru telescope's Hyper Suprime-Cam (HSC), the team detected a weak lensing effect of the dark matter component of intracluster filaments for the first time.

This first-ever detection of dark matter on terminal segments of the cosmic web helps to further confirm the existence of the large-scale structure spreading across the universe.

The team's results were published in January in the journal Nature Astronomy. ☀

Mimas' surprise: Tiny moon of Saturn holds young ocean beneath icy shell

Sciencenews, February 7, 2024



Summary:

Saturn's moon Mimas harbors a global ocean beneath its icy shell, discovered through analysis of its orbit by Cassini spacecraft data. This ocean formed just 5-15 million years ago, making Mimas a prime candidate for studying early ocean formation and potential for life. This discovery suggests life-essential conditions might exist on seemingly inactive moons, expanding our search for life beyond Earth.

Hidden beneath the heavily cratered surface of Mimas, one of Saturn's smallest moons, lies a secret: a global ocean of liquid water. This astonishing discovery, led by Dr. Valéry Lainey of the Observatoire de Paris-PSL and published in the journal *Nature*, reveals a "young" ocean formed just 5 to 15 million years ago, making Mimas a prime target for studying the origins of life in our Solar System.

"Mimas is a small moon, only about 400 kilometers in diameter, and its heavily cratered surface gave no hint of the hidden ocean beneath," says Dr Nick Cooper, a co-author of the study and Honorary Research Fellow in the Astronomy Unit of the School of Physical and Chemical Sciences at Queen Mary University of London. "This discovery adds Mimas to an exclusive club of moons with internal oceans, including Enceladus and Europa, but with a unique difference: its ocean is remarkably young, estimated to be only 5 to 15 million years old."

This young age, determined through detailed analysis of Mimas's tidal interactions with Saturn, suggests the ocean formed recently, based on the discovery of an unexpected irregularity in its orbit. As a result, Mimas provides a unique window into the early stages of ocean formation and the potential for life to emerge.

"The existence of a recently formed liquid water ocean makes Mimas a prime candidate for study, for researchers investigating the origin of life," explains Dr Cooper. The discovery was made possible by analysing data from NASA's Cassini spacecraft, which meticulously studied Saturn and its moons for over a decade. By closely examining the subtle changes in Mimas's orbit, the researchers were able to infer the presence of a hidden ocean and estimate its size and depth.

Dr Cooper continues: "This has been a great team effort, with colleagues from five different institutions and three different countries coming together under the leadership of Dr Valéry Lainey to unlock another fascinating and unexpected feature of the Saturn system, using data from the Cassini mission."

The discovery of Mimas's young ocean has significant implications for our understanding of the potential for life beyond Earth. It suggests that even small, seemingly inactive moons can harbor hidden oceans capable of supporting life-essential conditions. This opens up exciting new avenues for future exploration, potentially leading us closer to answering the age-old question: are we alone in the universe? ☀

The Backyard Observer, March 2024

By Rik Heschmeyer

CANCER

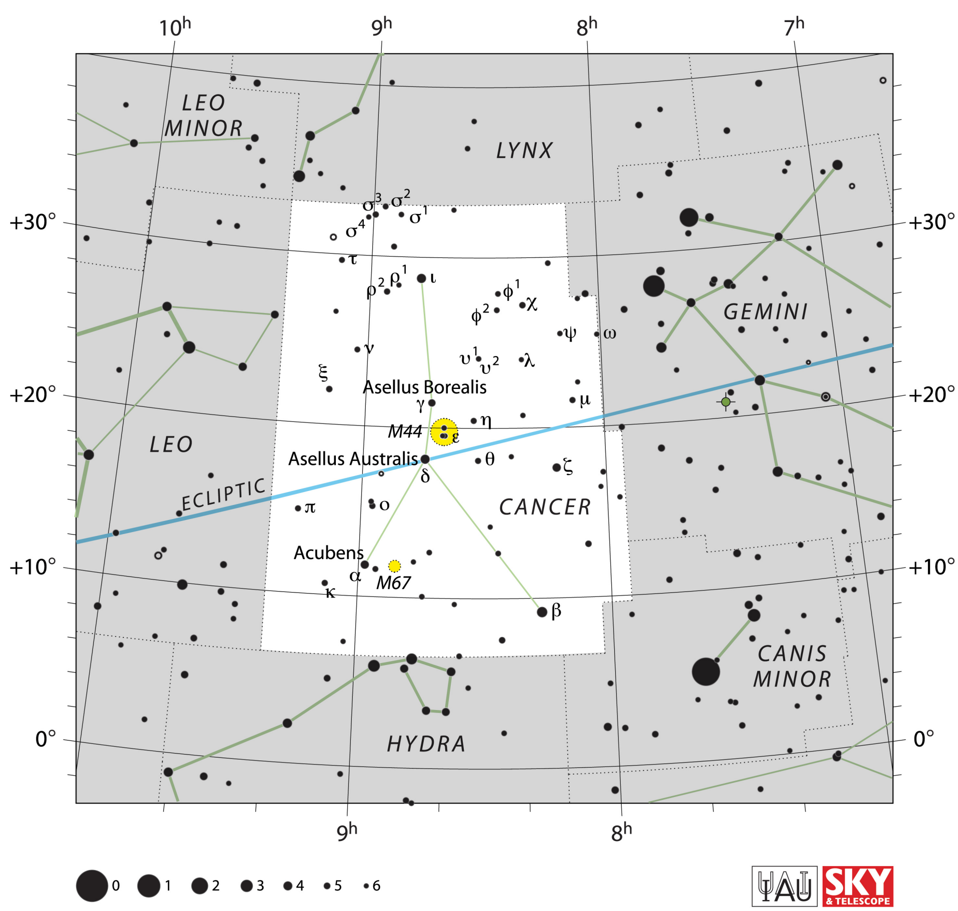
This month's constellation, Cancer, the Crab, lies between Gemini, the Twins, and Leo, the Lion (next month's constellation). Even though Cancer is a zodiacal constellation, it is a rather inconspicuous grouping of stars compared to the plethora of bright stars found in many of the other winter constellations, but like many of its neighboring, cold-weather constellations, it contains some fine open clusters.

Zeta Cancri is an unusual triple-star system composed of three yellow suns. The widest components are easy to discern in nearly any telescope, but the close central pair requires medium- to large-aperture telescopes to split.

Iota 1 Cancri is an interesting double star and is particularly well-suited for small telescopes. The two stars, at a distance of about 300 light years, form a beautiful color contrast test. Some observing guides call the pair yellow and blue while some describe them as orange and green. What colors do you see? (HINT: Many observers see blue stars as green when they are viewed close to yellow or orange stars.

Messier 44 is an open cluster visible to the naked eye on clear nights from dark locations as a faint nebulous area. The cluster's name is Praesepe, from the Latin for manger. In more modern times it is also known as the Beehive Cluster. It was included in a star atlas produced by Hipparchus in 129 A.D. It is one of the brightest and nearest open clusters in the night sky. It is best observed with binoculars, or your telescope's finder scope, due to its large size, about three times the diameter of the Moon! As a result the entire cluster cannot be seen in a telescope's low power field of view. Both its distance, at 550 light years, and its age, at 400 million years old, make it a good counterpoint to the other open cluster in Cancer, M67.

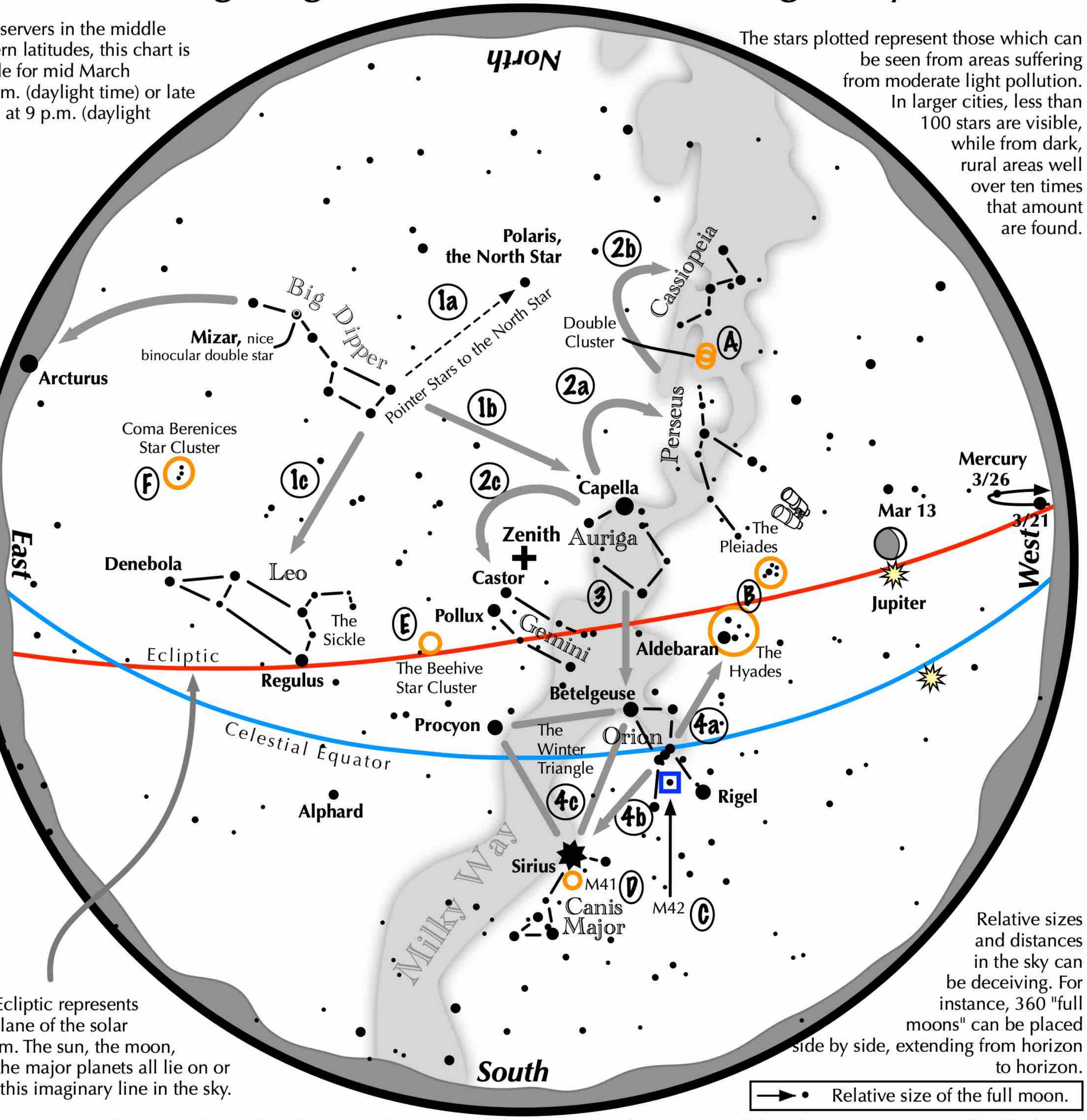
Messier 67 could not differ more from its constellation neighbor M44. It is much older, with an estimated age of 10 billion years old. And it is much farther away at a distance of 2600 light years. And finally, unlike most open clusters that lie in the plane of the galaxy, M67 lies 1200 light years above the galaxy disk. All these factors make M67 one of the most interesting clusters in the night sky. The cluster can be seen in a pair of binoculars as a round, hazy patch. A small telescope is needed to resolve individual stars within the cluster. Studies conducted with large, professional, telescopes have found several hundred member stars in the cluster, many of which are too dim to observe in amateur telescopes. When you observe M67 pay close attention to star colors. Upon close inspection stars of yellow, gold, and orange can be seen.



Navigating the mid to late March Night Sky

For observers in the middle northern latitudes, this chart is suitable for mid March at 8 p.m. (daylight time) or late March at 9 p.m. (daylight time).

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.



The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

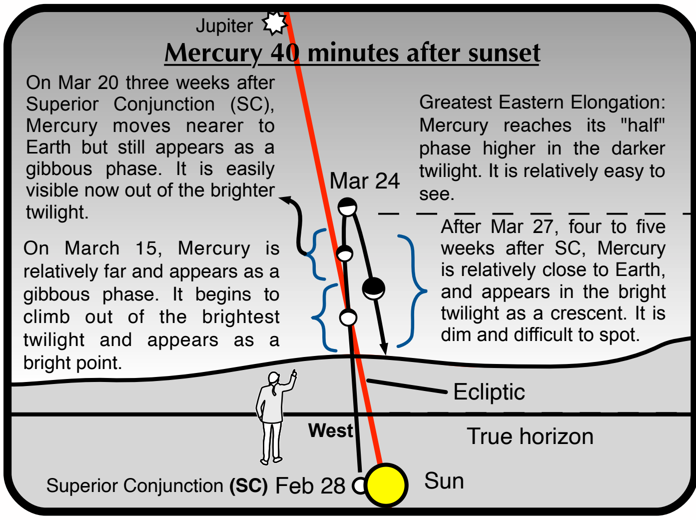
Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

Navigating the March night sky: Simply start with what you know or with what you can easily find.

1. Above the northeast horizon rises the Big Dipper. Draw a line from its two end bowl stars upwards to the North Star. Its top bowl stars point west to Capella in Auriga, nearly overhead. Leo reclines below the Dipper's bowl.
2. From Capella jump northwestward along the Milky Way to Perseus, then to the "W" of Cassiopeia. Next jump southeastward from Capella to the twin stars of Castor and Pollux in Gemini.
3. Directly south of Capella stands the constellation of Orion with its three Belt Stars, its bright red star Betelgeuse, and its bright blue-white star Rigel.
4. Use Orion's three Belt stars to point northwest to the red star Aldebaran and the Hyades star cluster, then to the Pleiades star cluster. Travel southeast from the Belt stars to the brightest star in the night sky, Sirius. It is a member of the Winter Triangle.

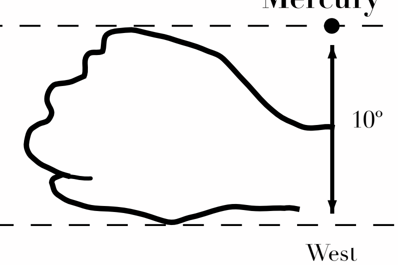
Binocular Highlights

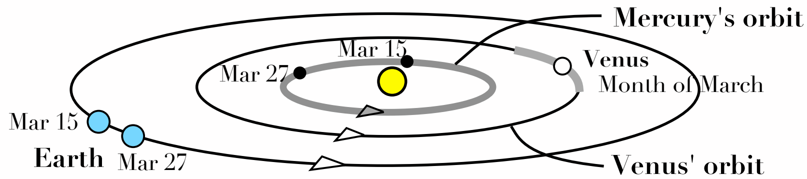
A: Between the "W" of Cassiopeia and Perseus lies the Double Cluster. **B:** Examine the stars of the Pleiades and Hyades, two naked eye star clusters. **C:** M42 in Orion is a star forming nebula. **D:** Look south of Sirius for the star cluster M41. **E:** M44, a star cluster barely visible to the naked eye, lies to the southeast of Pollux. **F:** Look high in the east for the loose star cluster of Coma Berenices.



Mercury in the Evening!

Mercury appears about "1 fist width on a fully extended arm" above the true horizon forty minutes after sunset.





Mercury's best evening apparition of 2024!

From 40 to 60 minutes after sunset after March 15th, look to the west for a point of light shining low above the horizon.

• Outstretch your arm and make a fist. Place one side at the true horizon. At it its other side should be Mercury.

• Over the next week, the little planet rises slightly higher each evening into the darker twilight while brightening, making it easier to spot.

• On the 24th, Mercury appears as far from the set sun as it will be. This point in its orbit is called Greatest Eastern Elongation. Just three nights later as it descends in the twilight, it will become much more difficult to spot.

About Astronomy Associates

The club is open to all people interested in sharing their love for astronomy. Monthly meetings are typically on the last Sunday of each month and often feature guest speakers, presentations by club members, and a chance to exchange amateur astronomy tips. These meetings and the public observing sessions that follow are scheduled at the Baker Wetlands Discovery Center, south of Lawrence. All events and meetings are free and open to the public. Periodic star parties are scheduled as well.

Because of the flexibility of the schedule due to holidays and alternate events, it is always best to check the Web site for the exact Sundays when events are scheduled.

Copies of the Celestial Mechanic can also be found on the web at newsletter.
Annual Dues for the club are: $12 for regular members; $6 for students Membership forms can be accessed at the club website form.