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The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

Coming Events

Monthly Meeting
December 3, 2023, 7:00PM
Baker Wetlands Discovery Center

Public Observing
December 3, 2023, 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 Heschmeyer

The recent Thanksgiving weekend snow was a good reminder that winter is around the corner. While the temperatures will be colder, the longer nights are perfect for stargazing. Get out and enjoy before it gets too cold!

Our last club meeting of the year will take place on Sunday, December 3 at 7:00 PM and Alex Polanski, KU graduate student and exo-planet researcher, will be presenting "Some Like it Hot: Exploring the Atmospheres of the Hottest Exoplanets". He recently completed an IPAC Visiting Graduate Fellowship at CalTech. Weather permitting, public telescope observing will take place following Alex's talk.

The December "Telescope Night at KU" will take place on Thursday December 14th starting at 7:00 PM in the lawn west of Malott Hall. The Geminids meteor shower, one of the best showers of the year, peaks on the morning of the 14th, so hopefully a few meteors will be observed that evening.

Our first meeting of the new year will take place on Sunday, January 28, 2024. AAL Member Jerelyn Ramirez will talk to us about her recent trip to observe the October Annular Solar Eclipse. The meeting will start at 7:00 PM, and will be followed by public telescope observing, weather permitting.

We hope to see you at one of these events, and hope everyone has a wonderful holiday season.

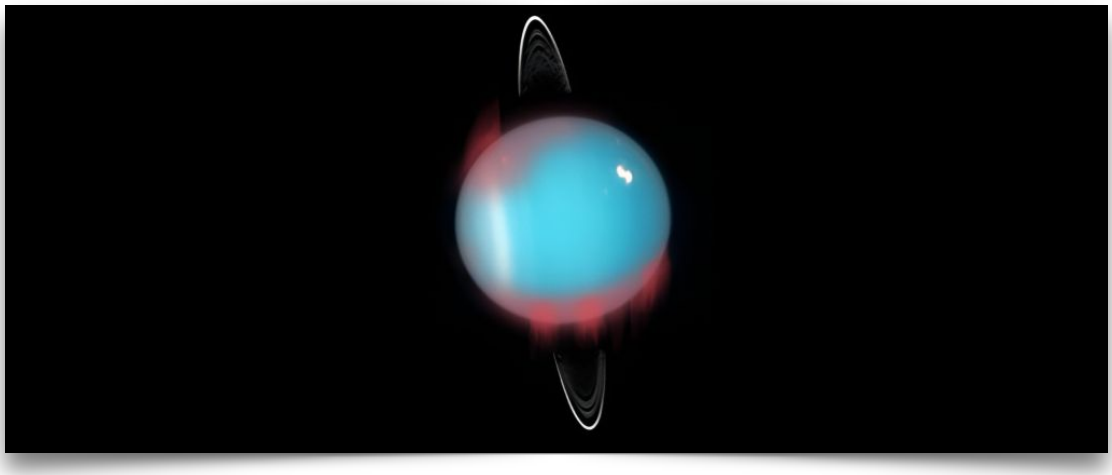
Keep looking up!

For The First Time, Infrared Aurora Has Been Confirmed on Uranus

By Michelle Starr

ScienceAlert, October 30, 2023

In data nearly 20 years old, scientists have finally confirmed the presence of infrared auroras, glowing in the northern regions of Uranus.



It's a discovery that allows astronomers to fill in some of the unknowns about the Uranian auroras, and perhaps shed some light on why the planet is so much hotter than it should be, so far from the Sun.

"The temperature of all the gas giant planets, including Uranus, are hundreds of degrees Kelvin/Celsius above what models predict if only warmed by the Sun, leaving us with the big question of how these planets are so much hotter than expected?" says astrophysicist Emma Thomas of the University of Leicester in the UK.

"One theory suggests the energetic aurora is the cause of this, which generates and pushes heat from the aurora down towards the magnetic equator."

Auroras are created when energetic particles are accelerated towards a planet, usually along magnetic field lines, and interact with particles, usually in its atmosphere, when they rain down upon it. The ionization that results from this interaction produces a glow.

They are very far from an exclusive Earth phenomenon, although they can look very different on different worlds.

Jupiter's powerful, permanent auroras blaze in ultraviolet light, as do those on Mars. Venus' are similarly green to Earth's. Mercury has no atmosphere; its auroras manifest as X-ray fluorescence from the minerals on the surface.

Since 1986, we've known about ultraviolet auroras on Uranus, and there may even be an X-ray component. Scientists have thought that it must have infrared auroras, too, like those seen at Jupiter and Saturn. However, although they've been looking since 1992, evidence of this glow has proven elusive.

Although Uranus probes have, sadly, been few and far between, Thomas and her team thought that we might have detected infrared auroral emissions without realizing.

In 2006, the NIRSPEC instrument (Near InfraRed SPECtrograph) at the Keck Observatory was used to collect 6 hours of observations of Uranus. It was here that the researchers decided to look.

They made a careful study of 224 images, looking for signs of a specific particle – ionized triatomic hydrogen (H_3^+). The strength of this particle's glow changes with temperature, which means it can be used to measure how hot or cold something is.

But when the researchers found signs of H_3^+ in their data, they found that it increased in density, without altering the temperature of the planet's atmosphere.

This is consistent with the increase in upper atmosphere ionization the astronomers expect to see with an infrared aurora. Therefore, they say the signature finally represents the discovery of infrared auroras in the atmosphere of Uranus.

Since auroras are connected to both the atmosphere and the magnetic field of Uranus, the discovery adds some information that may help us better understand some of the planet's weirder mysteries. For example, its magnetic field is sort of a hot mess – not only tipped sideways, but asymmetrical to boot.

And it could help us better understand the abundance of Neptune- and Uranus-like worlds out there in the wider galaxy, and assess their suitability for life, Thomas says. That's because we can study the way these alien worlds glow to draw inferences about their own atmospheres and magnetospheres, based on our observations of Uranus.

"This paper is the culmination of 30 years of auroral study at Uranus, which has finally revealed the infrared aurora and begun a new age of aurora investigations at the planet," she says.

"Our results will go on to broaden our knowledge of ice giant auroras and strengthen our understanding of planetary magnetic fields in our Solar System, at exoplanets and even our own planet." ☀

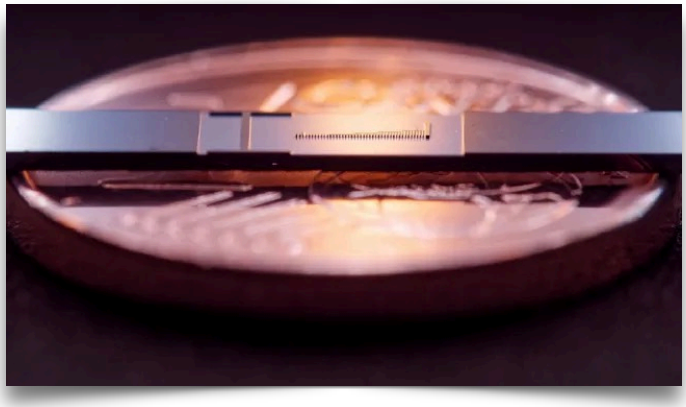
World's smallest particle accelerator is 54 million times smaller than the Large Hadron Collider — and it works

By Harry Baker

SPACE.COM, OCTOBER 29, 2023

The device is small enough to fit on a coin.

Scientists recently fired up the world's smallest particle accelerator for the first time. The tiny technological triumph, which is around the size of a



small coin, could open the door to a wide range of applications, including using the teensy particle accelerators inside human patients.

The new machine, known as a nanophotonic electron accelerator (NEA), consists of a small microchip that houses an even smaller vacuum tube made up of thousands of individual "pillars." Researchers can accelerate electrons by firing mini laser beams at these pillars.

The main acceleration tube is approximately 0.02 inches (0.5 millimeter) long, which is 54 million times shorter than the 16.8-mile-long (27 kilometers) ring that makes up CERN's Large Hadron Collider (LHC) in Switzerland — the world's largest and most powerful particle accelerator, which has discovered a range of new particles including the Higgs boson (or God particle), ghostly neutrinos, the charm meson and the mysterious X particle.

The inside of the tiny tunnel is only around 225 nanometers wide. For context, human hairs are 80,000 to 100,000 nanometers thick, according to the National Nanotechnology Institute.

In a new study, published Oct. 18 in the journal Nature, researchers from the Friedrich-Alexander University of Erlangen–Nuremberg (FAU) in Germany used the tiny contraption to accelerate electrons from an energy value of 28.4kiloelectron volts to 40.7keV, which is an increase of around 43%.

It is the first time that a nanophotonic electron accelerator, which was first proposed in 2015, has been successfully fired, the researchers wrote in a statement. (Researchers from Stanford University have already repeated the feat with their mini accelerator, but their results are still under review).

"For the first time, we really can speak about a particle accelerator on a [micro]chip," study co-author Roy Shiloh, a physicist at FAU, said in the statement.

The LHC uses more than 9,000 magnets to create a magnetic field that accelerates particles to around 99.9% of the speed of light. The NEA also creates a magnetic field, but it works by firing light beams at the pillars in the vacuum tube; this amplifies the energy in just the right way, but the resulting energy field is much weaker.

The electrons accelerated by the NEA only have around a millionth of the energy that particles accelerated by the LHC have. However, the researchers believe they can improve the NEA's design by using alternative materials or stacking multiple tubes next to one another, which could further

accelerate the particles. Still, they will never reach anywhere near the same energy levels as the big colliders.

That may be no bad thing, given the main goal of creating these accelerators is to utilize the energy given off by the accelerated electrons in targeted medical treatments that can replace more damaging forms of radiotherapy, which is used to kill cancer cells.

"The dream application would be to place a particle accelerator on an endoscope in order to be able to administer radiotherapy directly at the affected area within the body," study lead author Tomáš Chlouba, a physicist at FAU, wrote in the statement. But this is still a long way off, he added. ☀

NASA's Webb, Hubble Combine to Create Most Colorful View of Universe

HUBBLESITE, NOVEMBER 9, 2023

The result: A vivid landscape of galaxies along with more than a dozen newfound, time-varying objects.

When two flagship observatories unite, they reveal a wealth of new details only possible through their combined power. Webb and Hubble have joined forces to study the galaxy cluster MACS0416, located about 4.3 billion light-years from Earth. Their combined data yields a prismatic panorama of blues and reds – colors that give clues to the distances of the galaxies. While the image itself is stunning, researchers are already using these observations to fuel new scientific discoveries, including the identification of gravitationally magnified supernovae and otherwise-invisible, ordinary stars.

NASA's James Webb Space Telescope and Hubble Space Telescope have united to study an expansive galaxy cluster known as MACS0416. The resulting panchromatic image combines visible and infrared light to assemble one of the most comprehensive views of the universe ever taken. Located about 4.3 billion light-years from Earth, MACS0416 is a pair of colliding galaxy clusters that will eventually combine to form an even bigger cluster.

The image reveals a wealth of details that are only possible by combining the power of both space telescopes. It includes a bounty of galaxies outside the cluster and a sprinkling of sources that vary over time, likely due to gravitational lensing – the distortion and amplification of light from distant background sources.

This cluster was the first of a set of unprecedented, super-deep views of the universe from an ambitious, collaborative Hubble program called the Frontier Fields, inaugurated in 2014. Hubble pioneered the search for some of the intrinsically faintest and youngest galaxies ever detected. Webb's infrared view significantly bolsters this deep look by going even farther into the early universe with its infrared vision.

"We are building on Hubble's legacy by pushing to greater distances and fainter objects," said Rogier Windhorst of Arizona State University, principal investigator of the PEARLS program (Prime Extragalactic Areas for Reionization and Lensing Science), which took the Webb observations.

What the Colors Mean

To make the image, in general the shortest wavelengths of light were color-coded blue, the longest wavelengths red, and intermediate wavelengths green. The broad range of wavelengths, from 0.4 to 5 microns, yields a particularly vivid landscape of galaxies.

Those colors give clues to galaxy distances: The bluest galaxies are relatively nearby and often show intense star formation, as best detected by Hubble, while the redder galaxies tend to be more distant as detected by Webb. Some galaxies also appear very red because they contain copious amounts of cosmic dust that tends to absorb bluer colors of starlight.

“The whole picture doesn’t become clear until you combine Webb data with Hubble data,” said Windhorst.

Christmas Tree Galaxy Cluster

While the new Webb observations contribute to this aesthetic view, they were taken for a specific scientific purpose. The research team combined their three epochs of observations, each taken weeks apart, with a fourth epoch from the CANUCS (CAnadian NIRISS Unbiased Cluster Survey) research team. The goal was to search for objects varying in observed brightness over time, known as transients.

They identified 14 such transients across the field of view. Twelve of those transients were located in three galaxies that are highly magnified by gravitational lensing, and are likely to be individual stars or multiple-star systems that are briefly very highly magnified. The remaining two transients are within more moderately magnified background galaxies and are likely to be supernovae.

“We’re calling MACS0416 the Christmas Tree Galaxy Cluster, both because it’s so colorful and because of these flickering lights we find within it. We can see transients everywhere,” said Haojing Yan of the University of Missouri in Columbia, lead author of one paper describing the scientific results.

Finding so many transients with observations spanning a relatively short time frame suggests that astronomers could find many additional transients in this cluster and others like it through regular monitoring with Webb.

A Kaiju Star

Among the transients the team identified, one stood out in particular. Located in a galaxy that existed about 3 billion years after the big bang, it is magnified by a factor of at least 4,000. The team nicknamed the star system “Mothra” in a nod to its “monster nature,” being both extremely bright and extremely magnified. It joins another lensed star the researchers previously identified that they nicknamed “Godzilla.” (Both Godzilla and Mothra are giant monsters known as kaiju in Japanese cinema.)

Interestingly, Mothra is also visible in the Hubble observations that were taken nine years previously. This is unusual, because a very specific alignment between the foreground galaxy cluster and the background star is needed to magnify a star so greatly. The mutual motions of the star and the cluster should have eventually eliminated that alignment.

The most likely explanation is that there is an additional object within the foreground cluster that is adding more magnification. The team was able to constrain its mass to be between 10,000 and 1 million times the mass of our Sun. The exact nature of this so-called “milli-lens,” however, remains unknown.

“The most likely explanation is a globular star cluster that’s too faint for Webb to see directly,” stated Jose Diego of the Instituto de Física de Cantabria in Spain, lead author of the paper detailing the finding. “But we don’t know the true nature of this additional lens yet.”

How giant mirrors are made for what will be the world’s largest telescope

The Giant Magellan Telescope could reveal signs of life on faraway planets

By Nikk Ogasa

Sciencenews, October 30, 2023

TUCSON — Hot and dry air, perfused with a scent reminiscent of a warmed hair straightener, stuffed a hangar-sized room beneath the football stadium at the University of Arizona. The space, part of the Richard F. Caris Mirror Lab, was dominated by a

gyrating, carousel-sized furnace, fire truck red and shaped like a flying saucer. The swirling cocoon of a colossal light collector.

"It's making 4.9 revolutions per minute," says astronomer Buell Januzzi of the University of Arizona, raising his voice over the lab's droning ventilation system. About half past noon on October 7, after about a week of gradual warming, the temperature inside the rotating machine had finally peaked at 1165° Celsius.

In the heart of that inferno, nearly 17,500 kilograms of borosilicate glass — roughly four semitruck loads — had melted into a crystal clear fluid. If all goes to plan, the molten material will anneal to form the body of an enormous mirror — one as tall as a two-story house, if stood on edge. The mirror is the last of seven needed to capture light for what will be the world's most powerful optical instrument, the Giant Magellan Telescope.

Slated to start operating in the late 2020s, the telescope, developed by an international consortium of research institutions, will repose on a mountaintop in Chile's Atacama Desert, beneath some of the clearest night skies on Earth. There, within a yet-to-be-built, 22-story enclosure, the seven primary mirrors will be united in a flowerlike formation, Januzzi explains. "We've got six petals, and one in the middle."

Together, the mirrors will function as a single unit, about as wide as an adult blue whale is long, that reflects light into the telescope's secondary mirrors and, ultimately, its scientific instruments. This shiny expanse will provide the new telescope with an image resolution at least four times that of today's most advanced space telescopes.

And unlike the James Webb Space Telescope, best suited for measuring infrared light emitted by hot celestial bodies, the Giant Magellan Telescope will excel at capturing optical and near-infrared wavelengths of light emitted by cooler, Earthlike worlds (*SN: 8/20/23; SN: 3/27/23*). That's light that could potentially carry signatures of alien life.

"It's going to give us the opportunity to find potentially habitable planets," says astrobiologist Antígona Segura of the National Autonomous University of Mexico in Mexico City.

Current instruments may be able to measure a particular exoplanet's mass, says Segura, who isn't involved with the telescope's construction. And sometimes, researchers may even be able to detect certain molecules in a large exoplanet's atmosphere when it passes in front of its star. This new telescope, however, will be able to directly measure a smaller planet's atmosphere, without relying on a starlight backdrop, and detect much more of what floats within.

The telescope's name originates with Ferdinand Magellan, leader of the first expedition to circumnavigate the globe. Some astronomers have called for renaming the galaxies known as the Magellanic Clouds, due partly to the explorer's brutal actions toward Indigenous people (*SN: 9/26/23*). But according to a spokesperson from the consortium constructing the telescope, no decisions have yet been made to change the telescope's name.

In the meantime, the marathon that is the casting of the mirrors continues. It took about eight years to fabricate JWST's segmented, 6.5-meter-wide mirror. Casting the Giant Magellan Telescope's primary mirrors — each nearly 8.5 meters wide — has been ongoing for roughly 18 years.

Starting with a glass-loaded furnace, it takes about a week to bring the enclosed material to peak temperature, causing it to melt and flow into a mold comprised of hexagonal columns. After three more months of cooling and annealing, the glass mirror resembles two pancakes sandwiching a honeycomb. The 80-percent-hollow structure is light enough to float on oil, but stiff enough to resist bending in the wind.

The mirror then undergoes two years of polishing, yielding a surface so smooth that if it were expanded to the size of North America, the tallest imperfection would be half as tall as a golf tee.

Finally, a 100-nanometer-thick coat of aluminum — excellent for reflecting visible light — is applied to the clear glass surface. It's this last step that will enable the telescope to possibly capture glimpses of alien worlds, in wavelengths of light that our puny, human eyes can recognize. ☀

White House lays out possible rules for private space stations and more

By Mike Wall

SPACE.COM, NOVEMBER 15, 2023

The duties would be split between two departments: Transportation and Commerce.

The White House has laid out a possible regulatory framework for humanity's spaceflight future.

On Wednesday (Nov. 15), the National Space Council (NSC) released a draft bill that assigns oversight responsibility for novel space activities and infrastructure, including private space stations, off-Earth manufacturing and space junk removal.

That responsibility would be split between the Department of Transportation (DOT) and the Department of Commerce (DOC).

"U.S. industry leads the world in bringing the benefits of space to Earth," Deputy Secretary of Commerce Don Graves said in an emailed statement from the White House. "This legislation ensures that our government will build a regulatory environment that supports commercial expansion to benefit all Americans."

Under the United States' existing framework, the DOC regulates private, remote-sensing satellite systems while the DOT handles commercial launches and reentries, including the safety of humans on such flights (via the Federal Aviation Administration). The Federal Communications Commission, meanwhile, manages satellites' use of the electromagnetic spectrum.

But there's no clear "mission authorization" for many upcoming commercial activities in the final frontier. The proposed bill from the NSC — a policy-shaping body chaired by U.S. Vice President Kamala Harris — seeks to fill in the gaps.

For example, the new rules would extend the DOT's safety charge to people in Earth orbit as well as those on (or around) the moon and other celestial bodies. The DOT would also be responsible for licensing in-space transportation efforts, such as missions that deliver goods to the lunar surface.

The DOC would have authority over "all novel space activities that are not human-rated or assigned to DOT," according to the emailed statement. "Examples include in-space assembly and manufacturing missions, and satellites responsible for removing space debris."

The DOC would also have the authority to coordinate space traffic and provide warnings that help prevent off-Earth collisions.

The NSC's proposal isn't the only possible regulatory outline for future space activities. The U.S. House of Representatives' Science, Space and Technology Committee is working on its own legislation, known as the Commercial Space Act, noted Marcia Smith of Space Policy Online.

"Among other things, it puts the Department of Commerce (DOC) in charge of regulating new types of space activities not already regulated by other agencies, referred to as mission authorization," Smith wrote on Wednesday. ☀

Volume 49 Number 12 **December 2023**

The Backyard Observer, December 2023

By Rick Heschmeyer

PERSEUS

North of the easily recognized Pleiades star cluster, and high overhead this time of year, is the constellation of Perseus, the King. Located in a beautiful portion of the Milky Way, the constellation contains several spectacular star fields for sweeping with binoculars or small telescopes.

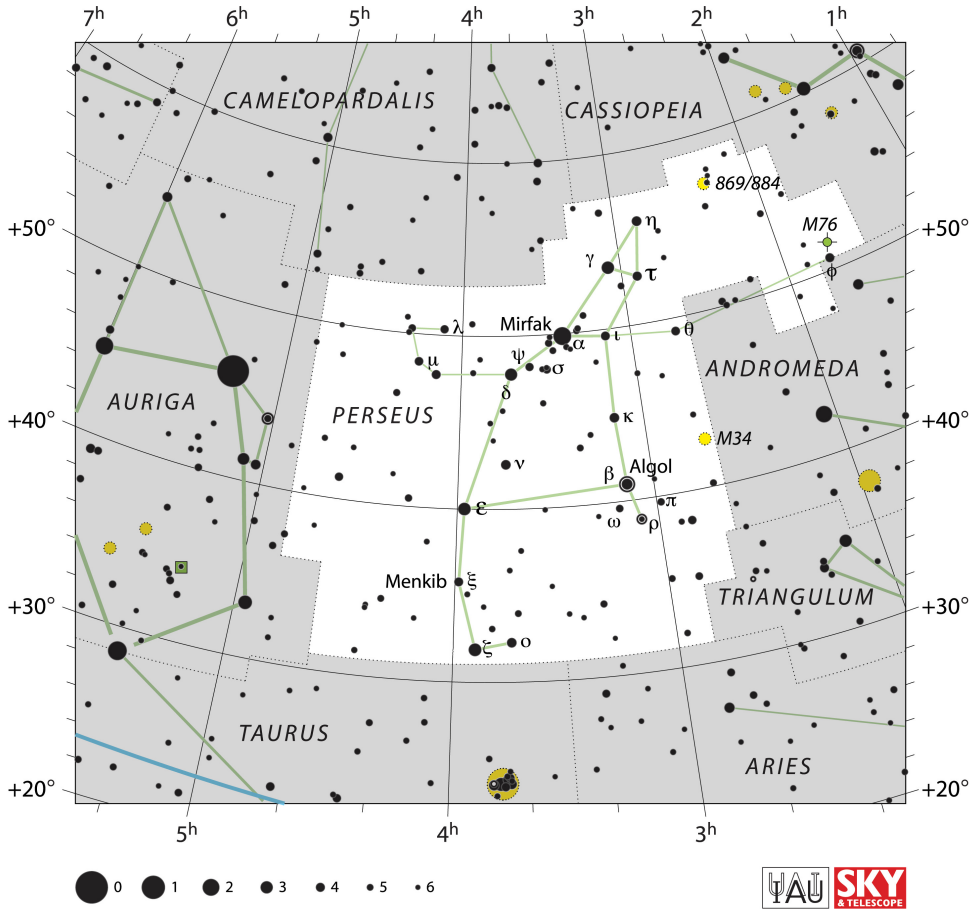
One interesting star in the constellation is Algol, or Beta Persei. Its more common moniker is “The Demon Star,” as it represents the severed head of Medusa in the Andromeda/Perseus/Cassiopeia mythic lore of the surrounding constellations. Algol is a well-known eclipsing variable star, varying in brightness over a period of just over 2.8 days. The change in brightness is due to a companion star orbiting Algol, that passes in front of Algol, from Earth's perspective, blocking some of Algol’s light.

The Alpha (brightest) star in Perseus is Mirfak. It is a good reference star for comparing the changing brightness of Algol. From a dark location you may be able to make out several dimmer stars around Mirfak. This is the Alpha Persei Moving Group, of which its namesake star Mirfak is a part, and are all travelling together in the same direction through space.

Messier 34 is a large, bright open cluster. It lies about 1500 light years from Earth, making it one of the nearest Messier objects to Earth. M34 contains about 80 stars, a couple dozen of which are visible in small telescopes.

Messier 76, also known as the Little Dumbbell Nebula, is a planetary nebula. It is sometimes referred to as the Barbell Nebula, because of its smaller apparent size than the much larger Dumbbell Nebula, M27. It is one of the more difficult Messier objects to see. Through small telescopes and binoculars, the nebula looks like a small, out-of-focus star, but in telescopes of 8-inches or more the double-lobed structure and even some of the diffuse halo can be seen. It lies about 2500 light years distant and measured a little over 1 light year across.

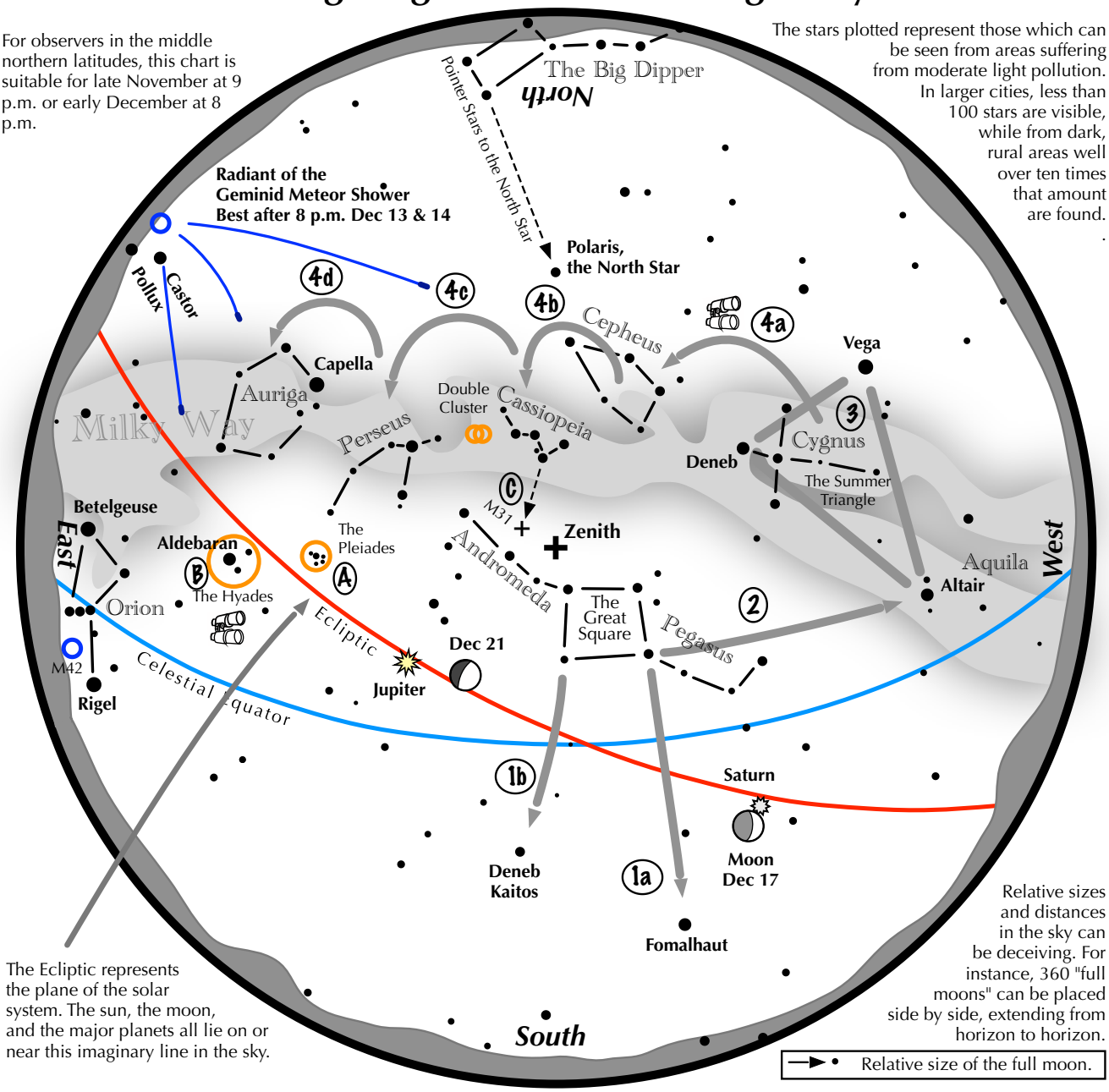
NGC 869 & NGC 884, better know as the Double Cluster in Perseus, are two beautiful open clusters that can be viewed in the same low power field of small telescopes. Larger telescopes will have to employ wide-field eyepieces to fit both clusters into the same field of view. These clusters are some of the finest objects in the night sky that were not catalogued by Charles Messier. Both clusters contain mostly blue-white stars, but there are several red stars that are visible. How many can you see? The clusters are located a couple of hundred light years from each other and lie about 7500 light years away from Earth.



Navigating the December Night Sky

For observers in the middle northern latitudes, this chart is suitable for late November at 9 p.m. or early December at 8 p.m.

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.

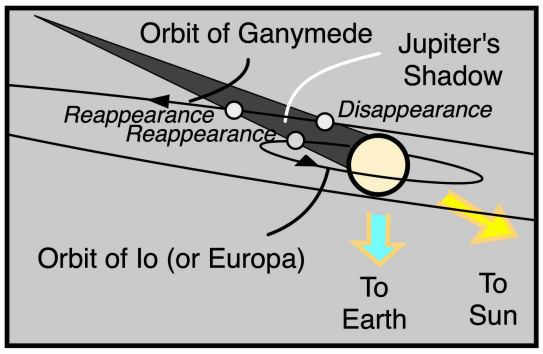
Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

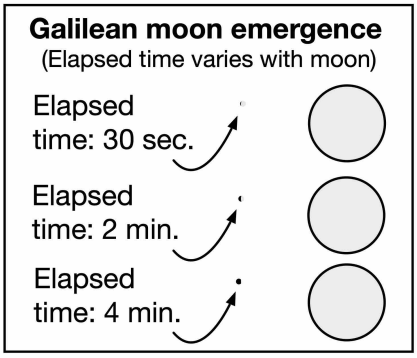
Relative size of the full moon.

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

1. Face south. Almost overhead is the "Great Square" with four stars about the same brightness as those of the Big Dipper. Extend an imaginary line southward following the Square's two westernmost stars. The line strikes Fomalhaut, the brightest star in the southwest. A line extending southward from the two easternmost stars, passes Deneb Kaitos, the second bright star in the south.
2. Draw another line, this time westward following the southern edge of the Square. It strikes Altair, part of the "Summer Triangle."
3. Locate Vega and Deneb, the other two stars of the "Summer Triangle. Vega is its brightest member while Deneb sits in the middle of the Milky Way.
4. Jump along the Milky Way from Deneb to Cepheus, which resembles the outline of a house. Continue jumping to the "W" of Cassiopeia, to Perseus, and finally to Auriga with its bright star Capella.

Binocular Highlights
A and B: Examine the stars of the Pleiades and Hyades, two naked eye star clusters.
C: The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval.
D: Sweep along the Milky Way from Altair, past Deneb, through Cepheus, Cassiopeia and Perseus, then to Auriga for many intriguing star clusters and nebulous areas.





An "Oh! Wow!" moment through your telescope

Imagine seeing a world emerge in the darkness, taking several minutes to fully appear. Such a body is Io, Europa, or Ganymede on multiple occasions this December.

Aim a telescope at Jupiter shining in the south a few minutes before the event is predicted to take place. Look away from the planet's bright disk, about one planet diameter from its eastern edge. At the designated time, a faint speck can be discerned. As the seconds pass, that speck grows brighter and brighter.

This is one of the large Galilean moons, slowly leaving Jupiter's shadow while orbiting the giant planet. December is a good month this year to witness an event like this in the evening sky, because Jupiter's shadow angles to the east of the planet, putting the emerging moon relatively far from the planet's glare. Each moon takes a different time to fully emerge, because of its diameter and of its orbital velocity around the planet.

Note: December 12 and 19 have Ganymede disappearing into the shadow and reappearing.
December 21 and 28 have Io and Europa both disappearing near the same time.

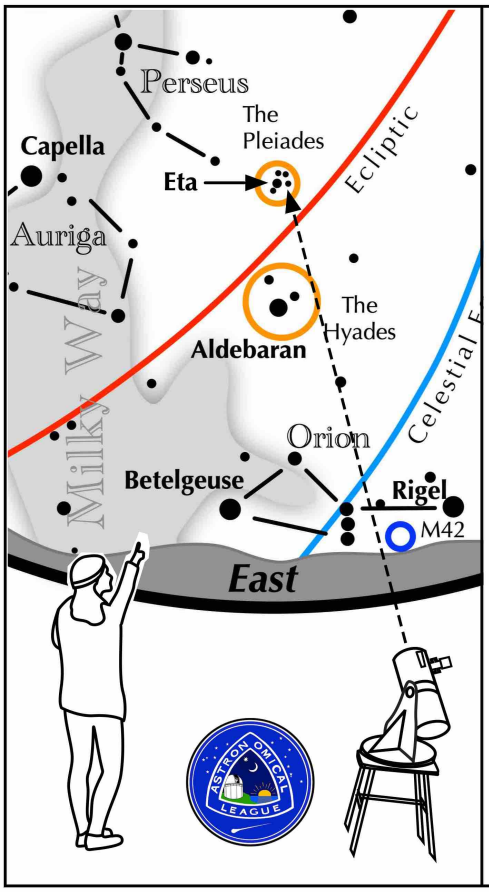
Make sure that Jupiter is sufficiently above the horizon at your location
and that the evening twilight has sufficiently darkened.
Begin viewing a few minutes before the listed times.

Event commencement: (all times CST)

Io	Dec 5, 11:34 pm
Io	Dec 7, 6:04 pm
Ganymede	Dec 12, disappearance 5:41 pm, reappearance 7:48 pm
Io	Dec 13, 1:30 am
Europa	Dec 14, 6:24 pm
Io	Dec 14, 7:58 pm
Ganymede	Dec 19, disappearance 9:45 pm, reappearance 11:49 pm
Europa	Dec 21, 9:03 pm
Io	Dec 21, 9:53 pm
Europa	Dec 28, 11:42 pm
Io	Dec 28, 11:48 pm
Io	Dec 30, 6:18 pm

Use a "high" magnification!

ASTRONOMICAL LEAGUE Double Star Activity



Other Suns: Eta Tauri (Alcyone)

How to find Eta Tauri on a December evening

Face east. Look for the Pleiades star cluster. Eta Tauri is the cluster's brightest member. It is a quadruple star.

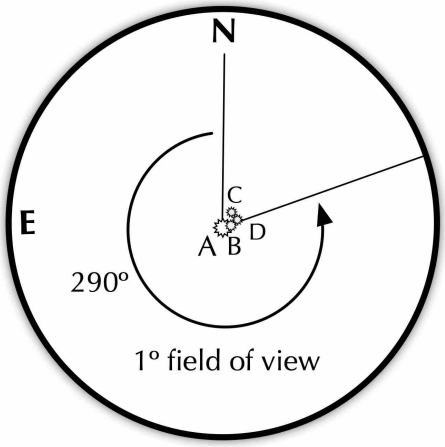
Eta Tauri

A-B separation: 118 sec
A magnitude: 2.8
B magnitude: 6.3
Position Angle: 290º

A-C separation: 182 sec
C magnitude: 8.2
Position Angle: 313º

A-D separation: 192 sec
D magnitude: 8.7
Position Angle: 296º

Suggested magnification: >20x
Suggested aperture: >3 inches



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.