L.A.S.
Lima Astronomical Society
STAR GAZER
Night Sky Network
Astronomy clubs bringing the wonders of the universe to the public
Member of the Astronomical League and the NASA Night Sky Network
May 2022

Lima Astronomical Society • PO Box 201 • Lima, OH 45802
Schoonover Observatory • 670 N. Jefferson St. • Lima, OH 45801

SOCIETY NEWS AND EVENTS

Upcoming Events

MONTHLY MEETINGS

Board Meeting – May 6 @ 7:00pm
Members Meeting – May 6 @ 8:00pm
Held at Schoonover Observatory

Program / Observing

An astronomy-related video or presentation will be provided along with open discussion.

The primary telescope in the dome will be open for observing (weather-dependent).

ASTRONOMY DAY
MAY 7, STARTING AT 6:00PM

Lima Astro members will be at Kendrick Woods with the Johnny Appleseed Metropolitan Parks District. Telescopes will be set up for observing on the grass and astronomy programs and handouts will be available in the shelter house.

**This event is weather-dependent.*

TOTAL LUNAR ECLIPSE
MAY 15-16, STARTING AT 9:00PM

A total eclipse of the Moon will occur on the night of May 15-16. Schoonover Observatory will open at 9:00pm on May 15, and will stream the eclipse live to the 60-inch monitor from the telescope in the dome. If local skies are cloudy, a live view from a clear site elsewhere in the US will be broadcast.

- Partial eclipse begins at 9:32pm, May 15
- Full eclipse begins at 11:29pm
- Maximum eclipse at 12:11am, May 16
- Full eclipse ends at 12:54am
- Partial eclipse ends at 1:55am

Under the Dome

The library room in the observatory has seen major reorganization and additional shelving has been installed. This room currently stores a variety of materials used by the club throughout the year as well as archival materials.

The optical shop has also been reorganized. In the earlier years of the observatory, this room was dedicated to the maintenance and storage of optics. With the modern equipment currently in place, the room now serves as a maintenance and storage area for observatory upkeep.

Members and visitors will also find changes to the meeting room in the observatory. Handouts and other print materials have been organized for better access, along with some other tidying of club materials. Members and visitors should also note that the original telescope that was built by members has been reassembled and is on display. If you have never seen this, we invite you to come to the next meeting and hear the story behind the construction and the members that built it.

The dome was exhibiting some difficulty rotating during the past couple of months. As the new motors are slightly different than the previous ones, we determined that the rotation wheels may need adjustment and/or a wheel with a different material may be needed to better grip the dome track.

The rotation wheels have been replaced and shimmed to provide better rotation, and a new spring tensioning system has been installed to help wheels maintain adequate pressure against the drive rim of the dome. The drive rim has also been cleaned. This all makes for a better and more responsive dome rotation. Thanks to Michael Ritchie for performing this maintenance.

This edition of the *Star Gazer* was compiled by Joshua Crawford.
Please forward comments, suggestions, or to unsubscribe/subscribe to this newsletter to crajos@gmail.com.

U.S. SPACE FORCE RELEASES DATA ON BRIGHT FIREBALLS

Sky & Telescope

The U.S. Department of Defense has released data on some 1,000 bright fireballs. Scientists are still debating if the data confirm an interstellar meteor.

Nearly 1,000 brilliant fireballs — big meteors that (mostly) burn up in Earth's atmosphere — have hit our planet since 1988. We know this because the U.S. Department of Defense has been tracking them.

For years the Department of Defense (DoD) released only basic information about these events. Now, via a collaboration between NASA and the U.S. Space Force, the DoD is making public additional data on the brightest fireballs to aid basic research and planetary defense.

If you've watched meteor showers, you may have seen a fireball. These meteors are the brilliant ones, brighter than Venus, that occur when a bigger-than-usual space rock slams into our upper atmosphere. Bolides represent the brightest fireballs (though in practice, the terms are often used interchangeably).

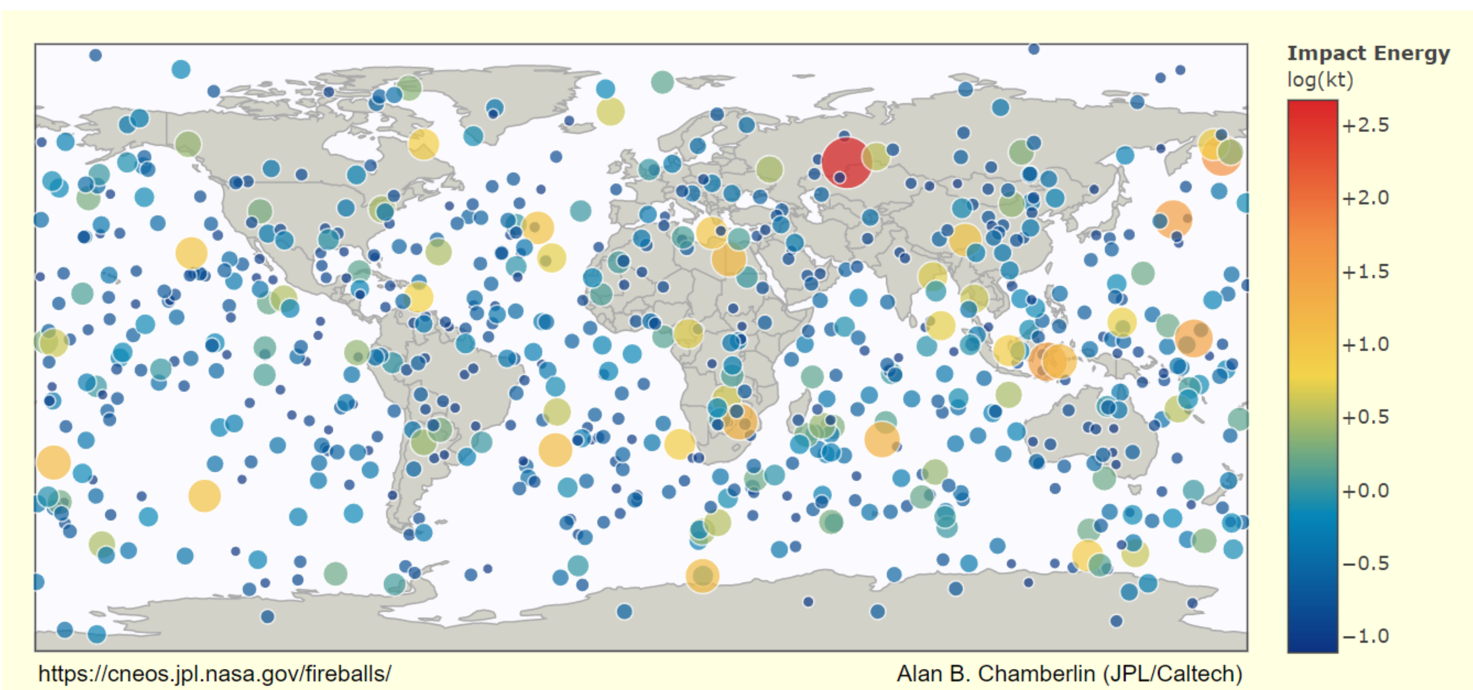
Here's what actually happens when you see that brilliant, seconds-long flash: As a meteoroid pushes into the atmosphere, air's friction sluices away its surface. The extreme pressure on the front end often breaks apart the body, which can exceed a meter in size. Those pieces then make more surface contact with the atmosphere until all of the meteor has vaporized in the upper atmosphere, typically in the mesosphere, some 50 to 85 km (31 to 53 miles) above Earth's surface. The whole event takes just a few seconds.

Until now, researchers had to rely on the data publicly available: typically, the impact time, location and altitude, and estimated speed as well as occasional estimates of the fireball's total energy. Now, for the first time, scientists will have access to a crucial piece of information: how these explosions vary in brightness over the few seconds it takes them to break apart.

The energy released by a typical atmospheric impact is on the order of a couple hundred tons of TNT. A few have released a couple thousand tons, though, and the Chelyabinsk meteor that exploded above Russia in 2013 released the energy of 440,000 tons of TNT — only slightly less than the Tunguska explosion of 1908.

Much of these fireworks happen at infrared wavelengths, but the U.S. government sensors record visible light. As a result, the light curves can only be constructed for the brightest fireballs. Check out the database here: Fireball Light Curve Database

By watching the light emitted as a meteor breaks apart, scientists can learn about the meteors themselves. "[Meteors'] response to increasing pressure from the atmosphere, represented by the light curves, is an indirect probe of their strength and structure," says Peter Brown



Fireballs reported by U.S. government sensors between April 15, 1988, and April 4, 2022. The individual events are color-coded by the energy they released.

NASA / JPL-Caltech and U.S. Space Force

(University of Western Ontario, Canada), a planetary scientist who has used publicly available fireball data in his own research. "By studying the light curves, we can indirectly infer the global strength of meter- to decameter-sized near-Earth objects."

Such data can, for example, shed light on whether an incoming meteor is a fragment from an asteroid or a comet. Understanding meteor structures is essential to defending the planet against future impacts.

AN INTERSTELLAR OBJECT BEFORE 'OUMUAMUA?

One unexpected result to come from analysis of fireball data is the identification of a possible interstellar bolide — that is, an impactor that originated from outside the solar system. It's worth noting up front, though, that not everyone's convinced of the claim.

In 2019 Amir Siraj and Abraham Loeb (both at Harvard University) reported that a half-meter meteor detected on January 8, 2014, was hurtling toward Earth on a hyperbolic orbit, one unbound to the Sun. They based the object's trajectory on the high impact speed recorded in the Center for Near-Earth Object Studies (CNEOS): 44.8 kilometers per second (100,000 mph).

If this pans out, it would precede the discovery of 'Oumuamua, thought to be the first interstellar object, by three years. Joel Mozer, the chief scientist of the U.S. Space Operations Command, considers the velocity data sufficiently accurate to indicate the meteor's origin from outside the solar system. However, others don't think the evidence merits such an extraordinary claim.

"The data being referred to is just for a very brief period as the bolide is detected passing through Earth's atmosphere," explains NASA planetary defense officer Lindley Johnson. "The data span is less than 5 seconds and there is no other known source of independent detection."

"While further analysis by our US Space Force source does confirm a relatively high velocity for this bolide," he adds, "it is very hard to be conclusive about the origin of an object based on that sparse and short of data span."

This is one artist's portrayal of 'Oumuamua (1I/2017 U1), thought to be the first interstellar object but now vying with other contenders for that prize.

ESO / M. Kornmesser

WEBB TELESCOPE'S COLDEST INSTRUMENT REACHES OPERATING TEMPERATURE

NASA

NASA's James Webb Space Telescope will see the first galaxies to form after the big bang, but to do that its instruments first need to get cold – really cold. On April 7, Webb's Mid-Infrared Instrument (MIRI) – a joint development by NASA and ESA (European Space Agency) – reached its final operating temperature below 7 kelvins (minus 447 degrees Fahrenheit, or minus 266 degrees Celsius).

Along with Webb's three other instruments, MIRI initially cooled off in the shade of Webb's tennis-court-size sunshield, dropping to about 90 kelvins (minus 298 F, or minus 183 C). But dropping to less than 7 kelvins required an electrically powered cryocooler. Last week, the team passed a particularly challenging milestone called the "pinch point," when the instrument goes from 15 kelvins (minus 433 F, or minus 258 C) to 6.4 kelvins (minus 448 F, or minus 267 C).

"The MIRI cooler team has poured a lot of hard work into developing the procedure for the pinch point," said Analyn Schneider, project manager for MIRI at NASA's Jet Propulsion Laboratory in Southern California. "The team was both excited and nervous going into the critical activity. In the end it was a textbook execution of the procedure, and the cooler performance is even better than expected."

The low temperature is necessary because all four of Webb's instruments detect infrared light – wavelengths slightly longer than those that human eyes can see. Distant galaxies, stars hidden in cocoons of dust, and planets outside our solar system all emit infrared light. But so do other warm objects, including Webb's own electronics and optics hardware. Cooling down the four instruments' detectors and the surrounding hardware suppresses those infrared emissions. MIRI detects longer infrared wavelengths than the other three instruments, which means it needs to be even colder.

Another reason Webb's detectors need to be cold is to suppress something called dark current, or electric current created by the vibration of atoms in the detectors themselves. Dark current mimics a true signal in the detectors, giving the false impression that they have been hit by light from an external source. Those false signals can drown out the real signals astronomers want to find. Since temperature is a measurement of how fast the atoms in the detector are vibrating, reducing the temperature means less vibration, which in turn means less dark current.

MIRI's ability to detect longer infrared wavelengths also makes it more sensitive to dark current, so it needs to be colder than the other instruments to fully remove that effect. For every degree the instrument temperature goes up, the dark current goes up by a factor of about 10.

Once MIRI reached a frigid 6.4 kelvins, scientists began a series of checks to make sure the detectors were operating as expected. Like a doctor searching for any sign of illness, the MIRI team looks at data describing the instrument's health, then gives the instrument a series of commands to see if it can execute tasks correctly. This milestone is the culmination of work by scientists and engineers at multiple institutions in addition to JPL, including Northrop Grumman, which built the cryocooler, and NASA's Goddard Space Flight Center, which oversaw the integration of MIRI and the cooler to the rest of the observatory.

"We spent years practicing for that moment, running through the commands and the checks that we did on MIRI," said Mike Ressler, project scientist for MIRI at JPL. "It was kind of like a movie script: Everything we were supposed to do was written down and rehearsed. When the test data rolled in, I was ecstatic to see it looked exactly as expected and that we have a healthy instrument."

There are still more challenges that the team will have to face before MIRI can start its scientific mission. Now that the instrument is at operating temperature, team members will take test images of stars and other known objects that can be used for calibration and to check the instrument's operations and functionality. The team will conduct these preparations alongside calibration of the other three instruments, delivering Webb's first science images this summer.

"I am immensely proud to be part of this group of highly motivated, enthusiastic scientists and engineers drawn from across Europe and the U.S.," said Alistair Glasse, MIRI instrument scientist at the UK Astronomy Technology Centre (ATC) in Edinburgh, Scotland. "This period is our 'trial by fire' but it is already clear to me that the personal bonds and mutual respect that we have built up over the past years is what will get us through the next few months to deliver a fantastic instrument to the worldwide astronomy community."

NIGHT LIGHTS: AURORA, NOCTILUCENT CLOUDS, AND THE ZODIACAL LIGHT

DAVID PROSPER - NIGHT SKY NETWORK

Have you spotted any "night lights"? These phenomena brighten dark skies with celestial light ranging from mild to dazzling: the subtle light pyramid of the zodiacal light, the eerie twilight glow of noctilucent clouds, and most famous of all, the wildly unpredictable and mesmerizing aurora.

Aurora, often referred to as the northern lights (aurora borealis) or southern lights (aurora australis), can indeed be a wonderful sight, but the beautiful photos and videos shared online are often misleading. For most observers not near polar latitudes, auroral displays are relatively rare and faint, and without much structure, more gray than colorful, and show up much better in photos. However, geomagnetic storms can create auroras that dance and shift rapidly across the skies with several distinct colors and appear to observers much further away from the poles - on very rare occasions even down to the mid-latitudes of North America! Geomagnetic storms are caused when a magnetic storm on our Sun creates a massive explosion that flings a mass of particles away from its surface, known as a Coronal Mass Ejection (CME). If Earth is in the path of this CME, its particles interact with our planet's magnetic field and result in auroral displays high up in our ionosphere. As we enter our Sun's active period of its 11-year solar cycle, CMEs become more common and increase the chance for dazzling displays! If you have seen any aurora, you can report your sighting to the Aurorasaurus citizen science program at aurorasaurus.org

The zodiacal light extends into the Pleiades, as seen in the evening of March 1, 2021 above Skull Valley. Utah. The Pleiades star cluster (M45) is visible near the top.

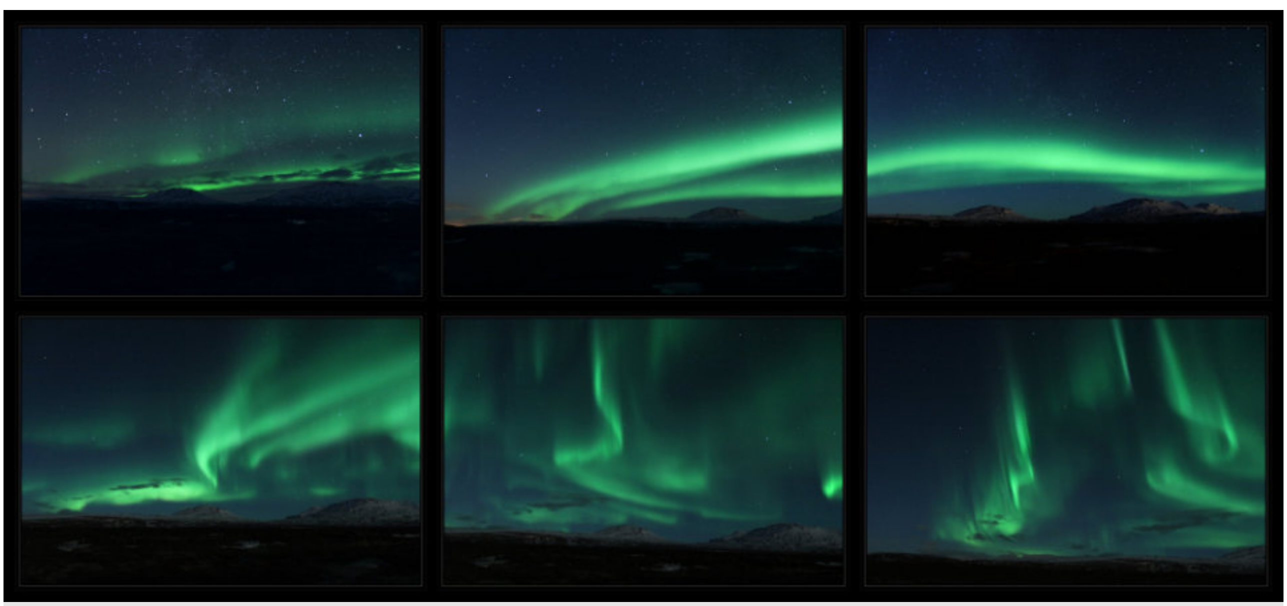
Credit and source:: NASA/Bill Dunford .https://www.flickr.com/photos/gsfc/51030289967

Have you ever seen wispy clouds glowing an eclectic blue after sunset, possibly towards your west or northwest? That wasn't your imagination; those luminescent clouds are noctilucent clouds (also called Polar Mesospheric Clouds (PMC)). They are thought to form when water vapor condenses around 'seeds' of dust from vaporized meteorites - along with other sources that include rocket launches and volcanic eruptions - around 50 miles high in the mesosphere. Their glow is caused by the Sun, whose light still shines at that altitude after sunset from the perspective of ground-based observers. Noctilucent clouds are increasing both in frequency and in how far south they are observed, a development that may be related to climate change. Keeping in mind that observers closer in latitude to the poles have a better chance of spotting them, your best opportunity to spot noctilucent clouds occurs from about half an hour to two hours after sunset during the summer months. NASA's AIM mission studies these clouds from its orbit high above the North Pole: go.nasa.gov/3uV3Yj1

You may have seen the zodiacal light without even realizing it; there is a reason it's nicknamed the "false dawn"! Viewers under dark skies have their best chance of spotting this pyramid of ghostly light a couple of hours after sunset around the spring equinox, or a couple of hours before dawn around the autumnal equinox. Unlike our previous two examples of night lights, observers closer to the equator are best positioned to view the zodiacal light! Long known to be reflected sunlight from interplanetary dust orbiting in the plane of our solar system, these fine particles were thought to originate from comets and asteroids. However, scientists from NASA's Juno mission recently published a fascinating study indicating a possible alternative origin: dust from Mars! Read more about their serendipitous discovery at: go.nasa.gov/3Onf3kN

Curious about the latest research into these night lights? Find news of NASA's latest discoveries at nasa.gov

Comet NEOWISE flies high above a batch of noctilucent clouds in this photo from Wikimedia contributor Brwynog.

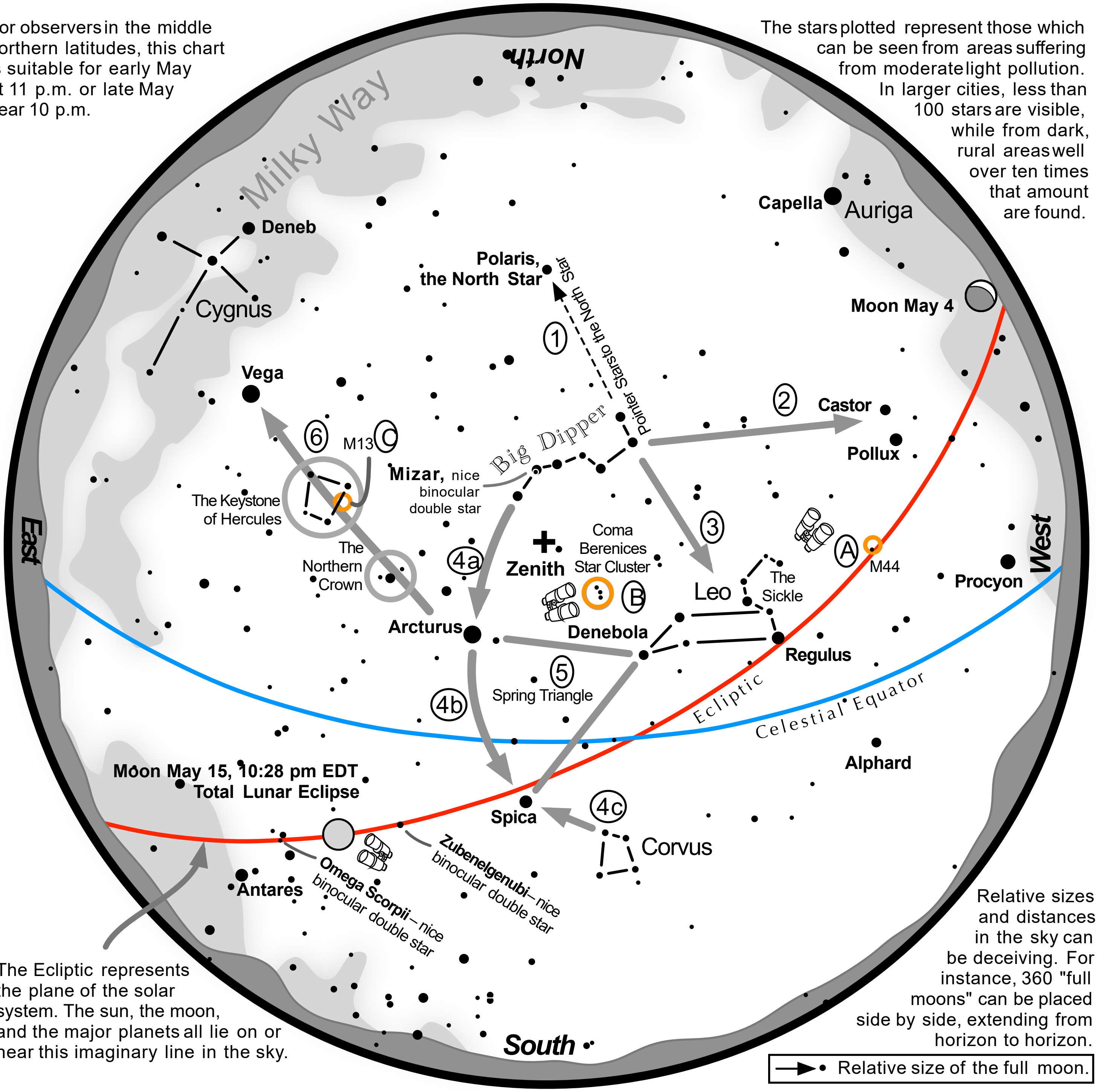


A sampling of some of the various patterns created by aurora, as seen from Iceland in 2014. The top row photos were barely visible to the unaided eye and were exposed for 20-30 seconds; in contrast, the bottom row photos were exposed for just 4 seconds- and were clearly visible to the photographer, Wikimedia contributor Shnuffel2022.

Navigating the May Night Sky

For observers in the middle northern latitudes, this chart is suitable for early May at 11 p.m. or late May near 10 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.

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

1 Extend a line northward from the two stars at the tip of the Big Dipper's bowl. It passes by Polaris, the North Star.

2 Through the two diagonal stars of the Dipper's bowl, draw a line pointing to the twin stars of Castor and Pollux in Gemini.

3 Directly below the Dipper's bowl reclines the constellation Leo with its primary star, Regulus.

4 Follow the arc of the Dipper's handle. It first intersects Arcturus, then continues to Spica. Confirm Spica by noting that two moderately bright stars just to its southwest form a straight line with it.

5 Arcturus, Spica, and Denebola form the Spring Triangle, a large equilateral triangle.

6 Draw a line from Arcturus to Vega. One-third of the way sits "The Northern Crown." Two-thirds of the way hides the "Keystone of Hercules." A dark sky is needed to see these two dim stellar configurations.

Binocular Highlights

A: M44, a star cluster barely visible to the naked eye, lies to the southeast of Pollux. **B:** Look near the zenith for the loose star cluster of Coma Berenices. **C:** M13, a round glow from a cluster of over 500,000 stars.

Astronomical League *www.astroleague.org/outreach; duplication is allowed and encouraged for all free distribution.*

OBSERVING LISTS

Top ten deep-sky objects for May	
M3	M87
M51	M104
M63	M106
M64	NGC 4449
M83	NGC 4565

Top ten binocular objects for May	
M3	M86
M51	M87
M63	M104
M64	M106
M84	Mel 111

Challenge deep-sky object for May
3C 273 (quasar in Virgo)
3C 273 is the optically brightest quasar in the sky from Earth. It is also one of the most luminous quasars known. If it were as close to Earth as the star Pollux, it would appear nearly as bright in the sky as the Sun. Apparent Magnitude: 12.9

THIS MONTH IN ASTRONOMY

- The first recorded perihelion passage of Comet Halley (1P/Halley) occurred on May 25, 240 BC.
- Thales of Miletus accurately predicted a solar eclipse on May 28, 585 BC.
- The German astronomers Gottfried and Maria Magarethe Kirch discovered the bright globular cluster M5 on May 5, 1702.
- On May 1, 1759, the English amateur astronomers John Bevis and Nicholas Munckley observed Comet Halley on its first predicted return.
- The French astronomer Charles Messier discovered the globular cluster M3 on May 3, 1764 and the globular cluster M10 on May 29, 1764.
- The Italian astronomer Annibale de Gasparis discovered asteroid 11 Parthenope on May 11, 1850.
- Asteroid 14 Irene was discovered on May 19, 1851 by the English astronomer John Russell Hind.
- The German astronomer Robert Luther discovered asteroid 26 Proserpina on May 6, 1853.
- The Australian astronomer John Tebbutt discovered the Great Comet of 1861 on May 13.
- The English astronomer Norman Pogson discovered asteroid 80 Sappho on May 2, 1864.
- Norman Pogson discovered asteroid 87 Sylvia on May 16, 1866.
- The 40-inch Clark refractor at the Yerkes Observatory saw first light on May 21, 1897.
- The Griffith Observatory opened to the public on May 14, 1935.
- Nereid, Neptune's third-largest satellite, was discovered on May 1, 1949 by the Dutch-American astronomer Gerard Kuiper.

MESSIER 51

THE WHIRLPOOL GALAXY

May 2022 Astronomy Events Calendar

Sun	Mon	Tues	Wed	Thurs	Fri	Sat
1	2 **Mercury 1.8° N of Moon**	3 Algol at minimum	4	5 Uranus in conjunction with the Sun Moon at apogee	6 **LAS Meeting @ 8pm** Algol at minimum Eta-Aquariid meteors peak	7 **Astronomy Day @ Kendrick Woods Begins at 6pm.**
8	9 **First quarter Moon** Algol at minimum	10 Mercury stationary	11	12 Algol at minimum	13	14 Algol at minimum
15 **Sch. Observatory opens @ 9pm for Total Lunar Eclipse** Venus at aphelion	16 **Full Moon** **Maximum lunar eclipse @ 12:11am**	17 Mercury at descending node Moon at perigee Algol at minimum **Mars 0.6° S of Neptune**	18	19	20 Algol at minimum	21 Mercury in inferior conjunction
22 Saturn 4° N of Moon **Last quarter Moon**	23 Algol at minimum	24 Mars 3° N of Moon	25 Jupiter 3° N of Moon	26 Mars at greatest heliocentric lat. S Algol at minimum	27 Mercury at aphelion	28
29 **Mars 0.6° S of Jupiter** Algol at minimum	30 **New Moon**	31				