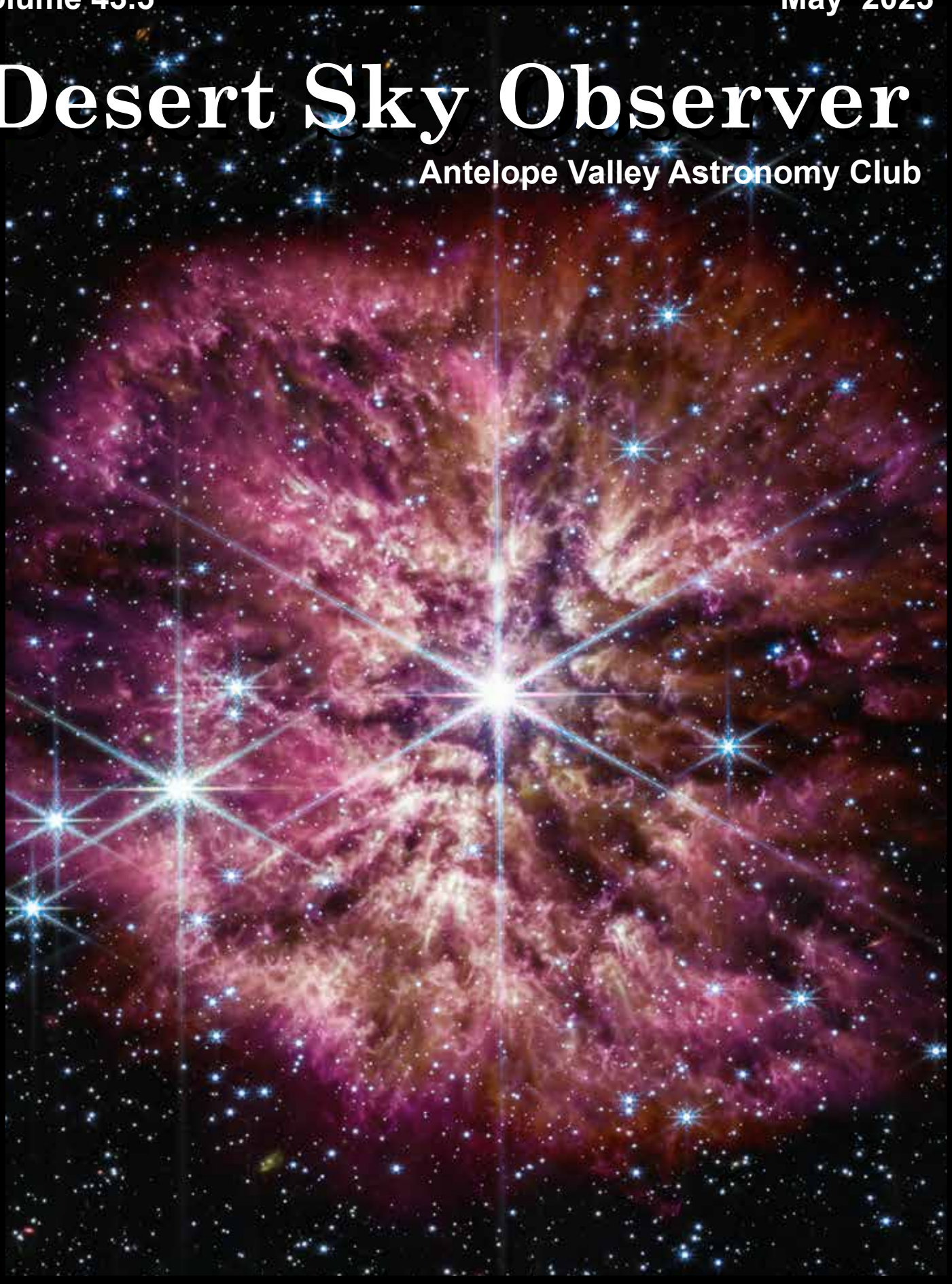
Volume 43.5 May 2023

Desert Sky Observer

Antelope Valley Astronomy Club



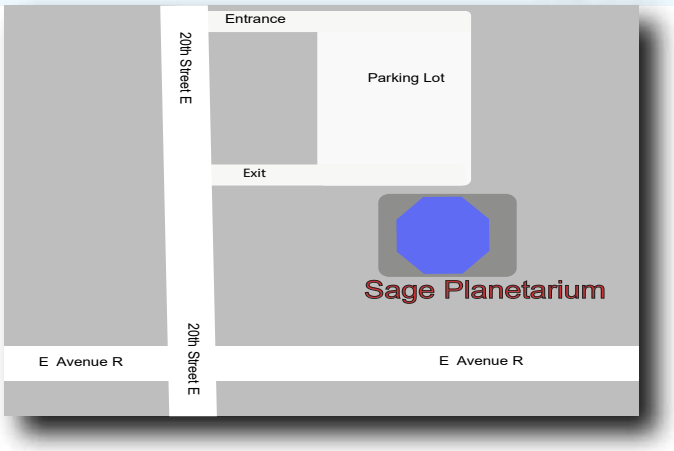
Upcoming Events

May 9: Telescope Class
May 12: Club Meeting
May 13: Moonwalk 8:00 pm @ PDW
May 20: Dark Sky Star Party @ Chuchupate
May 23: Astronomy Class

Every clear night: Personal Star Party

June 3: Moonwalk 8:30 pm @ PDW
June 9: Club Meeting
June 17: Dark Sky Star Party @ Chuchupate
June 18: Mt Wilson Trip
June 24: Lunar Club @ Matt's House

AVAC Calendar



Monthly Meetings

Monthly meetings are held at the **S.A.G.E. Planetarium** in Palmdale, the second Friday of each month except December. The meeting location is at the northeast corner of Avenue R and 20th Street East. Meetings start at 7 p.m. and are open to the public. *Please note that food and drink are not allowed in the planetarium.*

Membership

Membership in the Antelope Valley Astronomy Club is open to any individual or family.

The Club has three categories of membership.

- Family membership at $30.00 per year.
- Individual membership at $25.00 per year.
- Junior membership at $15.00 per year.

Membership entitles you to ...

- The Desert Sky Observer -- monthly newsletter
- The Reflector -- the publication of the Astronomical League.
- The AVAC Membership Manual.
- To borrow club equipment, books, videos, and other items.

AVAC
PO Box 8545
Lancaster, CA 93539-8545

Visit the Antelope Valley Astronomy Club website at www.avastronomyclub.org/.

www.avastronomyclub.org

The Antelope Valley Astronomy Club, Inc. is a §503(c)(3) Non-Profit Corporation.

The AVAC is a Sustaining Member of The Astronomical League and the International Dark-Sky Association

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www.avastronomyclub.org
ANTELOPE VALLEY
ASTRONOMY CLUB, INC.

President's Message

By Phil Wriedt

Hi There!

We have a Club Meeting on the 12th of the month. We have a speaker this month! Believe me when I say it's taken a lot to get a speaker to come to us. Our speaker is Peter Boorman, PhD at the NuStar group at Caltech. NuStar is the Nuclear Spectroscopic Telescope Array mission launched on June 13, 2012. Dr. Boorman's thesis title was: "The Obscured Accretion and Growth of Supermassive Black Holes." So, we should all come away with a better understanding of Black Holes. So please, bring your family, friends and neighbors

On April 28th, we participated in the Spring Star Party at the College of the Canyons. We did this along with "The Local Group"aka Santa Clarita Astronomy Club. They were able to field a few more telescopes than we brought. The big story was the crowd. By my estimate there had to be 300-400 people there, at least a third were kids less than high school age. A bunch of new astronomers! I hope.

We have a Moonwalk on the 13th at Prime Desert Woodland. Sunset is at 7:47pm, so the Moonwalk will start after 8:00 pm; so get there by about 6:30 pm to setup in daylight. Come, bring your telescope, binoculars, star chart, and, of course, enthusiasm. Meet the public and help answer questions. See You There!

Our next Deep Sky Star Party is on May 20th at the Chuchupate parking lot. Who knows what the weather will bring, but hopefully we can rule out snow. It will probably still be chilly overnight, so come prepared. Come out enjoy a dark sky, let's put the party back in "Star Party"!

Sunday, June 18 is the Mt Wilson trip. All of the 25 slots for the trip are currently taken. But if anyone drops out, we will take the next one on the waiting list. So if you want to be put on the waiting list, please contact Rose.

On June 24th, we have the return of the Lunar Club. We will be meeting at Matt's house just north of Willow Springs Race Track in Rosamond. This is a club to study Earth's closest neighbor. More information will be available as the time gets closer.

Keep Looking Up, Phil

On The Cover

Please note: North is 40.6° right of vertical RA: 19h 11' 31.02" DEC: 16° 51' 37.29" (Sagitta)

The luminous, hot star Wolf-Rayet 124 (WR 124) is prominent at the centre of the NASA/ESA/CSA James Webb Space Telescope's composite image combining near-infrared and mid-infrared wavelengths of light. The star displays the characteristic diffraction spikes of Webb's Near-infrared Camera (NIRCam), caused by the physical structure of the telescope itself. NIRCam effectively balances the brightness of the star with the fainter gas and dust surrounding it, while Webb's Mid-Infrared Instrument (MIRI) reveals the nebula's structure.

Background stars and galaxies populate the field of view and peek through the nebula of gas and dust that has been ejected from the ageing massive star to span 10 light-years across space. A history of the star's past episodes of mass loss can be read in the nebula's structure. Rather than smooth shells, the nebula is formed from random,

From the Secretary

By Rose Moore

Members:

Jeremy is continuing his classes in the month of May. His Telescope Class is on Tuesday May 9th at 6:30pm; and his Astronomy Class is on Tuesday May 23rd at 6:30pm. Come on out to the classes, you can learn something new, and ask questions! These are free and open to the public.

Friday May 12th we have a club meeting with a speaker. Our speaker will be Peter Boorman who is a Post Doc at CalTech in Pasadena. His talk will be on his research on Black Holes. Our meeting starts at 7pm. Please come out and enjoy this presentation and help support your club! Speaker donations are welcomed.

We have a Prime Desert Woodland Moon Walk with Jeremy, on Saturday May 13th starting at 8pm. Weather permitting. Members are needed with telescopes. We only had 2 members (our 2 reliable members who always show up) at our last PDW, and 153 public. Please consider coming out to help for the 2 hours or so!

We have our Dark Sky Star Party scheduled for Saturday May 20th at Chuchupate. Weather permitting. More info to follow in a few weeks.

To start out the month of June, we have a Prime Desert Moon Walk on Saturday June 3rd from 8:30pm to 10:30pm. More info to follow.

Also in June we have our trip to Mt. Wilson. Information, directions and maps will be sent out soon.

Clear skies, Rose

On The Cover ... continued

asymmetric ejections. Bright clumps of gas and dust appear like tadpoles swimming toward the star, their tails streaming out behind them, blown back by the stellar wind.

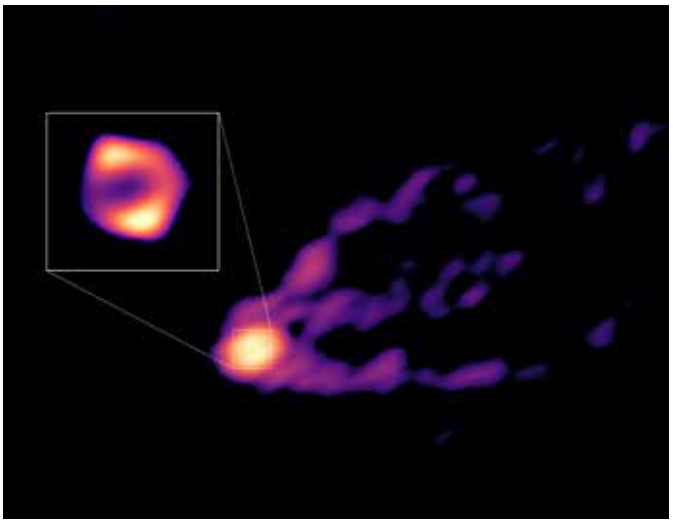
This image combines various filters from both Webb imaging instruments, with the colour red assigned to wavelengths of 4.44, 4.7, 12.8, and 18 microns (F444W, F470N, F1280W, F1800W), green to 2.1, 3.35, and 11.3 microns (F210M, F335M, F1130W), and blue to 0.9, 1.5, and 7.7 microns (F090W, F150W, F770W).

Credit:
NASA, ESA, CSA, STScI, Webb ERO Production Team

First Direct Image Of A Black Hole Expelling A Powerful Jet

eso2305 — Science Release The European Southern Observatory (ESO)

https://www.eso.org/public/news/eso2305/?lang



For the first time, astronomers have observed, in the same image, the shadow of the black hole at the centre of the galaxy Messier 87 (M87) and the powerful jet expelled from it. The observations were done in 2018 with telescopes from the Global Millimetre VLBI Array (GMVA), the Atacama Large Millimeter/submillimeter Array (ALMA), of which ESO is a partner, and the Greenland Telescope (GLT). Thanks to this new image, astronomers can better understand how black holes can launch such energetic jets.

Most galaxies harbour a supermassive black hole at their centre. While black holes are known for engulfing matter in their immediate vicinity, they can also launch powerful jets of matter that extend beyond the galaxies that they live in. Understanding how black holes create such enormous jets has been a long standing problem in astronomy. “We know that jets are ejected from the region surrounding black holes,” says Ru-Sen Lu from the Shanghai Astronomical Observatory in China, “but we still do not fully understand how this actually happens. To study this directly we need to observe the origin of the jet as close as possible to the black hole.”

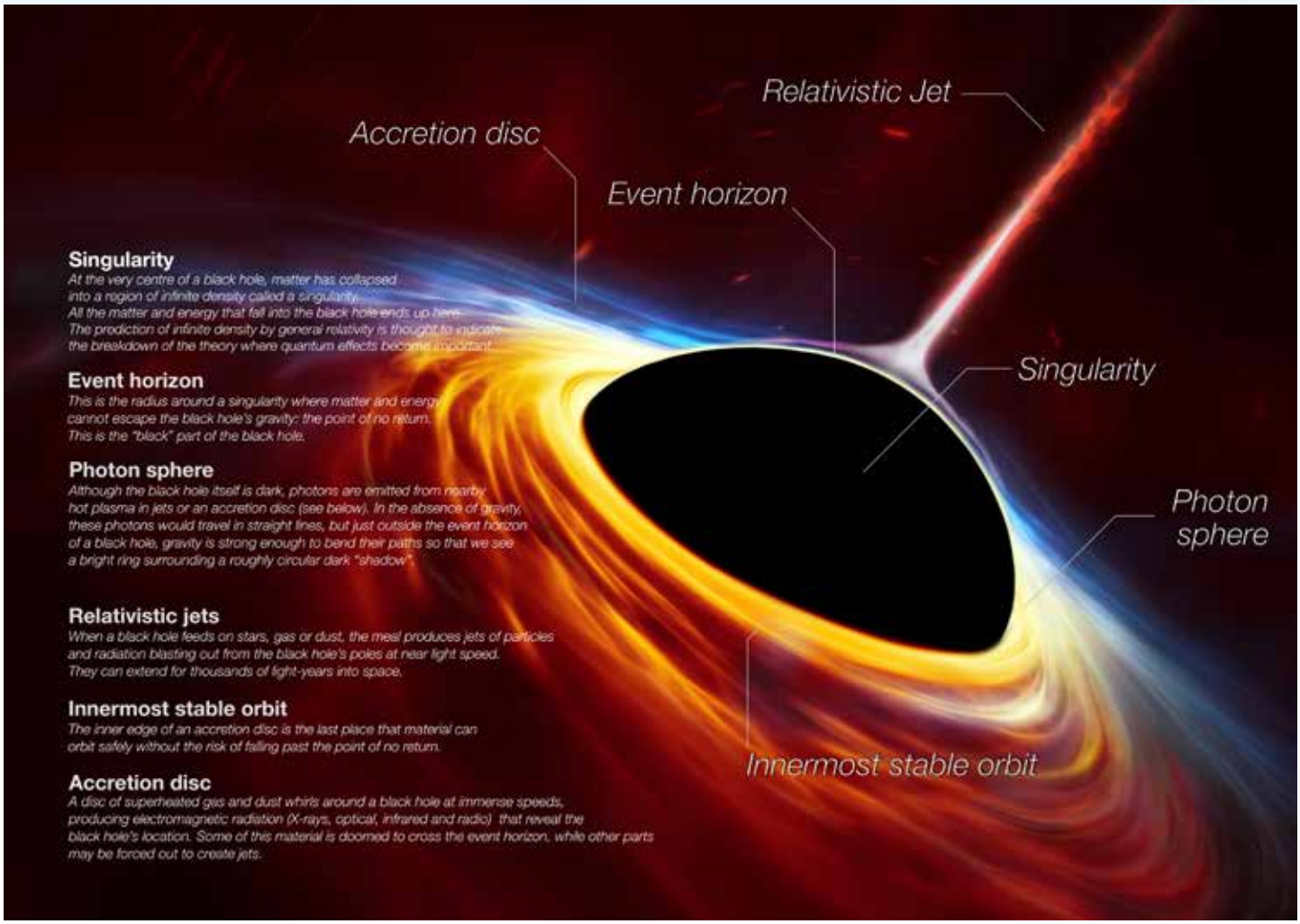
The new image published today shows precisely this for the first time: how the base of a jet connects with the matter swirling around a supermassive black hole. The target is the galaxy M87, located 55 million light-years away in our cosmic neighbourhood, and home to a black hole 6.5 billion times more massive than the Sun. Previous observations had managed to separately image the region close to the black hole and the jet, but this is the first time both features have been observed together. “This new image completes the picture by showing the region around the black hole and the jet at the same time,” adds Jae-Young Kim from the Kyungpook National University in South Korea and the Max Planck Institute for Radio Astronomy in Germany.

The image was obtained with the GMVA, ALMA and the GLT, forming a network of radio-telescopes around the globe working together as a virtual Earth-sized telescope. Such a large network can discern very small details in the region around M87’s black hole.

The new image shows the jet emerging near the black hole, as well as what scientists call the shadow of the black hole. As matter orbits the black hole, it heats up and emits light. The black hole bends and captures some of this light, creating a ring-like structure around the black hole as seen from Earth. The darkness at the centre of the ring is the black hole shadow, which was first imaged by the Event Horizon Telescope (EHT) in 2017. Both this new image and the EHT one combine data taken with several radio-telescopes worldwide, but the image released today shows radio light emitted at a longer wavelength than the EHT one: 3.5 mm instead of 1.3 mm. “At this wavelength, we can see how the jet emerges from the ring of emission around the central supermassive black hole,” says Thomas Krichbaum of the Max Planck Institute for Radio Astronomy.

The size of the ring observed by the GMVA network is roughly 50% larger in comparison to the Event Horizon Telescope image. “To understand the physical origin of the bigger and thicker ring, we had to use computer simulations to test different scenarios,” explains Keiichi Asada from the Academia Sinica in Taiwan. The results suggest the new image reveals more of the material that is falling towards the black hole than what could be observed with the EHT.

These new observations of M87’s black hole were conducted in 2018 with the GMVA, which consists of 14 radio-telescopes in Europe and North America [1]. In addition, two other facilities were linked to the GMVA: the Greenland Telescope and ALMA, of which ESO is a partner. ALMA consists of 66 antennas in the Chilean Atacama desert, and it played a key role



in these observations. The data collected by all these telescopes worldwide are combined using a technique called interferometry, which synchronises the signals taken by each individual facility. But to properly capture the actual shape of an astronomical object it's important that the telescopes are spread all over the Earth. The GMVA telescopes are mostly aligned East-to-West, so the addition of ALMA in the Southern hemisphere proved essential to capture this image of the jet and shadow of M87's black hole. "Thanks to ALMA's location and sensitivity, we could reveal the black hole shadow and see deeper into the emission of the jet at the same time," explains Lu.

Future observations with this network of telescopes will continue to unravel how supermassive black holes can launch powerful jets. "We plan to observe the region around the black hole at the centre of M87 at different radio wavelengths to further study the emission of the jet," says Eduardo Ros from the Max Planck Institute for Radio Astronomy. Such simultaneous observations would allow the team to disentangle the complicated processes that happen near the supermassive black hole. "The coming years will be exciting, as we will be able to learn more about what happens near one of the most mysterious regions in the Universe," concludes Ros.

Notes

[1] The Korean VLBI Network is now also part of the GMVA, but did not participate in the observations reported here.

Messier 87 Captured by ESO's Very Large Telescope

Space News

News from around the Net

New Exoplanet Discovered

An international research team led by UTSA Associate Professor of Astrophysics Thayne Currie has made a breakthrough in accelerating the search for new planets. In a paper slated for publication April 14 in Science, Currie reports the first exoplanet jointly discovered through direct imaging and precision astrometry, a new indirect method that identifies a planet by measuring the position of the star it orbits. Data from the Subaru Telescope in Hawai`i and space telescopes from the European Space Agency (ESA) were integral to the team's discovery. . . . (continued at https://www.sciencedaily.com/releases/2023/04/230413154452.htm)

A Sharper Look At The M87 Black Hole

The iconic image of the supermassive black hole at the center of M87 -- sometimes referred to as the "fuzzy, orange donut" -- has gotten its first official makeover with the help of machine learning. The new image further exposes a central region that is larger and darker, surrounded by the bright accreting gas shaped like a "skinny donut." The team used the data obtained by the Event Horizon Telescope (EHT) collaboration in 2017 and achieved, for the first time, the full resolution of the array. In 2017, the EHT collaboration used a network of seven pre-existing telescopes around the world to gather data on M87, . . .(continued at https://www.sciencedaily.com/releases/2023/04/230413154351.htm)

Humans Need Earth-Like Ecosystem For Deep-Space Living

Can humans endure long-term living in deep space? The answer is a lukewarm maybe, according to a new theory describing the complexity of maintaining gravity and oxygen, obtaining water, developing agriculture and handling waste far from Earth. Dubbed the Pancosmorio theory -- a word coined to mean "all world limit" -- it was described in a paper published in Frontiers in Astronomy and Space Sciences.. . . (continued at https://www.sciencedaily.com/releases/2023/04/230412131102.htm)

Astronomers Solve Mystery About Quasars - And The Likely Future Of The Milky Way

Astronomers have solved the mystery of how quasars - the brightest and most powerful objects in the universe - are ignited. These celestial objects of very high luminosity are found in the centres of some galaxies and can be a trillion times brighter than the sun, according to NASA. Although first discovered 60 years ago, quasars have remained a mystery because it was unclear how such powerful activity could be generated. . . . (continued at https://news.sky.com/story/astronomers-solve-mystery-about-quasars-and-the-likely-future-of-the-milky-way-12866482)

Japanese Mission Attempts Moon Landing, Falls Silent (Update)

The lunar lander dubbed Hakuto R, built by the Tokyo-based company iSpace, fell silent at around 12:40 p.m. EDT (16:40 UT) — right around the time it was heading for Atlas Crater on the Moon. Mission controllers are investigating, but there is only a small chance that the lander could power up its high gain antenna and contact Earth. iSpace developed its Hakuto R lander as part of the Google Lunar XPrize competition to land on the Moon. . . . (continued at https://skyandtelescope.org/astronomy-news/japanese-mission-attempts-moon-landing-falls-silent/)

SpaceX Starship Effectively Grounded by FAA After in-Flight Explosion

It was an exciting time when, two weeks ago, SpaceX got the clearance it needed to conduct its first orbital flight test with the Starship and Super Heavy launch system. After years of waiting, SN flight tests, static fire tests, and stacking and unstacking, the long-awaited test of the SN24 Starship and BN7 Booster prototype was on! . . . Unfortunately, things began to go awry a few minutes into the flight as the Starship prototype failed to separate from the booster, sending the rocket into a spin . . .(continued at https://www.universetoday.com/161124/spacex-effectively-grounded-by-faa-after-in-flight-explosion/)

Space News

News from around the Net

Aurorae Throughout Our Solar System And Beyond

Both inside and outside the solar system, aurorae light up the skies of planets, moons, and a variety of other celestial objects. With their emissions ranging from X-ray to radio wavelengths, aurorae are a signpost for the myriad interactions that can produce them — interactions that would otherwise be difficult to imagine. What causes aurorae on Earth? For example, the Sun's solar wind, which is packed with charged particles, . . .(continued at https://astronomy.com/news/2023/04/aurorae-throughout-our-solar-system-and-beyond)

Hubble Telescope Eyes Galactic Site Of Distant Star Explosion

The famed Hubble snagged the clearest picture yet of a faraway galaxy while hunting for evidence of a supernova. The area, imaged by the Hubble Space Telescope, came into the limelight three years ago after astronomers witnessed the violent death of one of its massive stars just days after it ran out of fuel and exploded into a supernova. The fresh, face-on image showcases the distant UGC 678 galaxy, which lies 260 million light-years from Earth in the constellation Pisces. . . . . (continued at https://www.space.com/hubble-space-telescope-galaxy-supernova-star-explosion)

Gravitational Waves From Pulsars Could Be Used To Probe The Interior Of The Sun

Gravitational wave astronomy is still in its early stages. So far it has focused on the most energetic and distinct sources of gravitational waves, such as the cataclysmic mergers of black holes and neutron stars. But that will change as our gravitational telescopes improve, and it will allow astronomers to explore the universe in ways previously impossible. Although gravitational waves have many similarities to light waves, one distinct difference is that most objects are transparent to gravitational waves. Light can be absorbed, scattered, and blocked by matter, . . . (continued at https://phys.org/news/2023-04-gravitational-pulsars-probe-interior-sun.html)

Key Radar Antenna Stuck On Europe's Jupiter-Bound Spacecraft

A critical antenna is jammed on a Jupiter-bound spacecraft launched two weeks ago, the European Space Agency reported Friday. The 52-foot (16-meter) radar antenna on Juice unfolded only one-third of the way following liftoff, according to the space agency. Engineers suspect a tiny pin may be protruding. Flight controllers in Germany plan to fire the spacecraft's engine in hopes of shaking the pin loose. If that doesn't work, they said they have plenty of time to solve the problem. . . . (continued at https://phys.org/news/2023-04-key-radar-antenna-stuck-europe.html)

Astronomers Catch A Rare Glimpse Of Two Quasars In The Process Of Colliding

Astronomers using the Hubble Space Telescope, the Chandra X-ray Observatory, the European Space Agency's Gaia and ground-based optical and radio telescopes have found a pair of galaxies, each one hosting a brilliant quasar, in the process of colliding 10 billion years ago. Quasars are extremely active supermassive black holes emitting torrents of energy as they consume surrounding gas and dust. Finding a double quasar just 3 billion years . . (continued at https://astronomynow.com/2023/04/06/astronomers-catch-a-rare-glimpse-of-two-quasars-in-the-process-of-colliding/)

'Einstein Rings' Around Distant Galaxies Inch Us Closer To Solving Dark Matter Debate

Physicists believe most of the matter in the universe is made up of an invisible substance that we only know about by its indirect effects on the stars and galaxies we can see. We're not crazy! Without this "dark matter," the universe as we see it would make no sense. But the nature of dark matter is a longstanding puzzle. However, a new study by Alfred Amruth at the University of Hong Kong and colleagues, published in Nature Astronomy, uses the gravitational bending of light to bring us a step closer to understanding. . . .(continued at https://astronomy.com/news/2023/04/einstein-rings-inch-us-closer-to-solving-dark-matter-debate)

Dark Sky Observing Sites

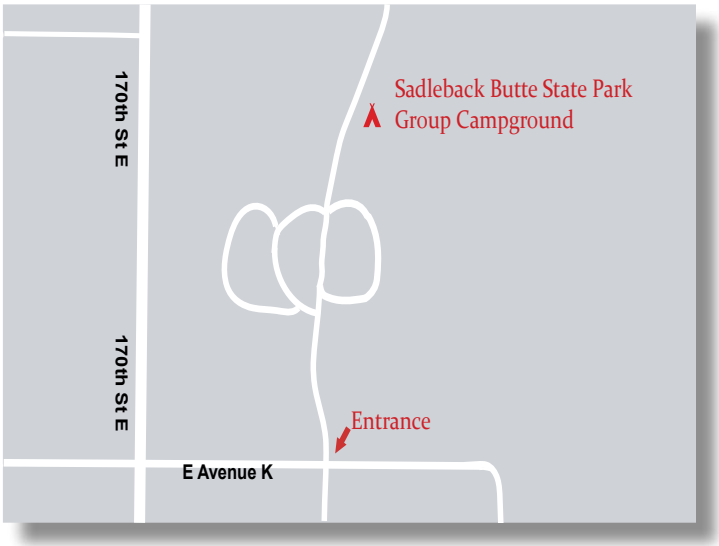
The Chuchupate parking lot is a half a mile beyond the Mt Pinos ranger station (on some maps The Chuchupate Ranger Sta., the parking lot is also called Frazier Mountain trailhead).

To get there, take the Frazier Mountain Park RD east about 7 miles from I-5, to Lake Of The Woods, Turn left on Lockwood Valley Rd. (If you see Mike's Pizza on your left you missed the turn) In less than a mile there is a road to the left, go past the ranger station, the parking lot is on the right. The Club gathers in the upper end of the lot. The Elevation is 5430 feet. There is a vault toilet.

The Red Cliffs Natural Area is part of **Red Rock Canyon State Park** is a day use area and is not for use by the public after dark. The Club gets a special permit for a star party and pays a fee.

To get there: Take the CA-14 north 25 miles past Mojave. You will see giant red cliffs on the right side and a small sign that says "Red Cliffs Natural Area" and a dirt road. (If you see the large sign for the Ricardo campground, you drove a mile too far). Follow the road to the large parking lot (that hasn't been graded in a long time). Elevation is 2410 feet. There is a vault toilet.

Saddleback Butte State Park is east of 170th Street East between Avenue I and Avenue K. Elevation 3651 feet. Temperatures in summer average 95° with a high of 115,° winter average lows are 33° with occasional snow. There are 37 individual campsites and one group campsite. When the club has a star party there the group campsite is used. Individual campsites cost $20 per night. Enter off Avenue K.



Solar System Summary

The **Sun** moves from the middle of Aries to the middle of Taurus

The Planets

Mercury begins the month in inferior conjunction. Returning to the morning sky about mid-month just as it reaches aphelion, at about mag 2.0. On the 29th reaches max western elongation at mag 0.6.

Venus spends the evenings moving east from mid Taurus to mid Gemini at mag -4.28. On the evening of the 22nd the 3½ day old Moon passes by 5° to the northwest.

Mars spends the May moving east through Gemini and into Cancer, fading from mag 1.3 to 1.6 at months end. On June 2, Mars will be within 10 arc-minutes of M44.

Jupiter is now a "morning star"starting the month in Pisces, pulling away from the Sun, and crossing into Aries at months end. At Moonrise on the 17th (04:35) the 5% wanning Moon will eclipse Jupiter, finishing about 05:09. (Sunrise 05:49)

Saturn rises well before the Sum slowly moving east in western Aquarius at mag 0.99. The 39% waning Moon passes 4° south on the morning of the 13th.

Uranus just too close to the Sun to be seen. Solar conjunction on the 9th..

Neptune in the morning twilight moving east in southern Pisces at 7.9.

Dwarf Planets

134340 Pluto spends the month on the eastern edge of Capricorn in retrograde at mag 14.4 just southeast of M75.

1 Ceres spends the month in loop moving from Coma Berenices (mag 7.6), before passing into Leo, and then into Virgo at 8.2.

2 Pallas (mag 8.6) moves from near of Procyon, northewast into southern Cancer at 8.9.

3 Juno (mag 9.6) moves east central Taurus crossing into northern Orion, setting a few minutes after the Sun at month's end.

4 Vesta (mag 8.2) starts the month rising before the Sun in northern Cetus. By mid-month passes into southern Aries, by now two hours ahead of the Sun

Moon Phases

First Qtr May 27 | Full May 5 | Third Qtr May 12 | New May 19

Sun and Moon Rise and Set*

Date	Moonrise	Moonset	Sunrise	Sunset
5/1/2023	15:53	04:05	06:02	19:37
5/5/2023	20:04	05:51	05:58	19:40
5/10/2023	00:30	10:09	05:54	19:44
5/15/2023	03:37	15:57	05:49	19:48
5/20/2023	06:17	21:24	05:46	19:52
5/25/2023	10:47	00:39	05:43	19:55
5/30/2023	15:37	02:55	05:41	19:59

Planet Data*

May 1

	Rise	Transit	Set	Mag	Phase%
Mercury	06:03	12:50	19:36	6.0	0.02
Venus	08:25	15:47	23:08	-4.13	65.9
Mars	10:26	17:40	00:53	1.35	91.4
Jupiter	05:28	11:55	18:23	-2.06	99.9
Saturn	03:15	08:47	14:18	0.99	99.8

May 15

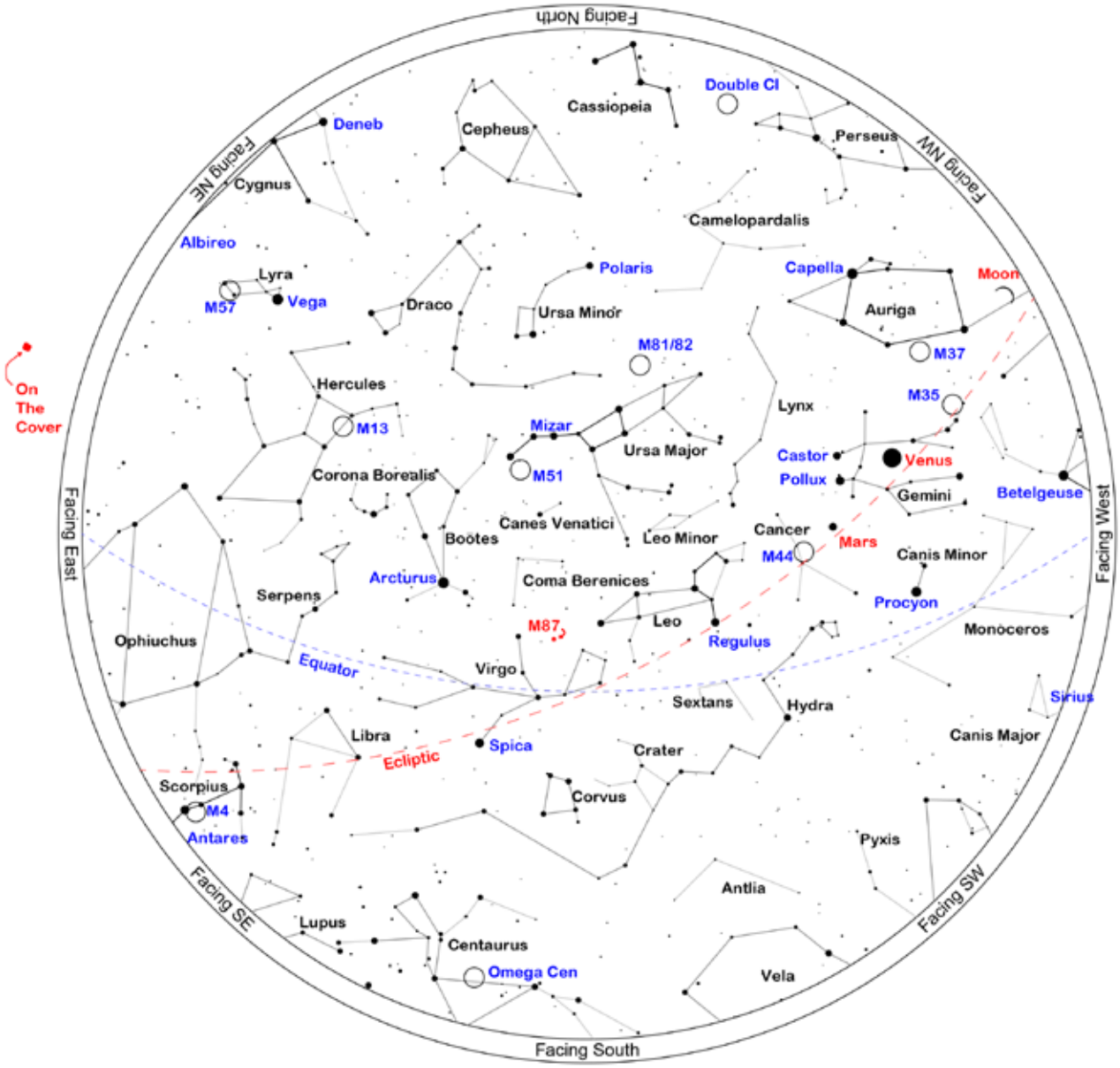
	Rise	Transit	Set	Mag	Phase%
Mercury	05:05	11:38	18:10	1.91	15.4
Venus	08:37	15:59	23:21	-4.20	59.7
Mars	10:09	17:19	00:26	1.47	92.2
Jupiter	04:42	11:13	17:44	-2.09	99.8
Saturn	02:23	07:55	13:27	0.97	99.7

May 30

	Rise	Transit	Set	Mag	Phase%
Mercury	04:34	11:13	17:53	0.42	42.3
Venus	08:53	16:08	23:22	-4.28	52.1
Mars	09:53	16:55	23:56	1.58	93.1
Jupiter	03:52	10:26	17:01	-2.13	99.6
Saturn	01:22	06:54	12:31	0.93	99.7

*All time mentioned are local and approximate.
*Sun, Moon and Planetary date based on Quartz Hill, CA

Sky Chart



Location: Set from geolocation service
Latitude: 34° 39' N, longitude: 118° 10' W
Time: 2023 May 20, 21:00 (UTC -07:00)

Powered by: Heavens-Above.com

Suggested Observing List

The list below contains objects that will be visible on the night of the AVAC Deep Sky Star Party or the Saturday nearest the New Moon, in this case May 20, 2023. The list is sorted by the transit time of the object.

ID	Common Name	Type	Const	RA	Dec	Mag	Rise	Transit	Set
M50	Heart-shaped Cluster	Open	Mon	07h 02m 42s	-08° 23.0'	7.0	09:25	15:04	20:44
M47	NGC2422	Open	Pup	07h 36m 35s	-14° 29.0'	4.5	10:17	15:38	21:00
M46	NGC2437	Open	Pup	07h 41m 46s	-14° 48.6'	6.5	10:23	15:43	21:04
M93	NGC2447	Open	Pup	07h 44m 30s	-23° 51.4'	6.5	10:54	15:46	20:38
M48	NGC2548	Open	Hya	08h 13m 43s	-05° 45.0'	5.5	10:29	16:15	22:02
M44	Beehive Cluster	Open	Cnc	08h 40m 24s	+19° 40.0'	4.0	09:42	16:42	23:42
M67	King Cobra	Open	Cnc	08h 51m 18s	+11° 48.0'	7.5	10:17	16:53	23:29
M81	Bode's Galaxy	Galaxy	UMa	09h 55m 33s	+69° 03.9'	7.8	Circ	17:57	Circ
M82	Cigar Galaxy	Galaxy	UMa	09h 55m 53s	+69° 40.8'	9.2	Circ	17:58	Circ
M95	NGC3351	Galaxy	Leo	10h 43m 58s	+11° 42.2'	10.6	12:10	18:46	01:21
M96	NGC3368	Galaxy	Leo	10h 46m 46s	+11° 49.2'	10.1	12:12	18:48	01:25
M105	NGC3379	Galaxy	Leo	10h 47m 50s	+12° 34.9'	10.5	12:11	18:50	01:28
M108	NGC3556	Galaxy	UMa	11h 11m 31s	+55° 40.4'	10.6	Circ	19:13	Circ
M97	Owl Nebula	P Neb	UMa	11h 14m 48s	+55° 01.1'	12.0	Circ	19:16	Circ
M65	Leo Triplet	Galaxy	Leo	11h 18m 56s	+13° 05.5'	10.1	12:41	19:21	02:01
M66	Leo Triplet	Galaxy	Leo	11h 20m 15s	+12° 59.4'	9.7	12:42	19:22	02:02
M109	NGC3992	Galaxy	UMa	11h 57m 36s	+53° 22.4'	10.6	09:12	19:59	06:47
M98	NGC4192	Galaxy	Com	12h 13m 48s	+14° 54.0'	10.9	13:30	20:15	03:01
M99	Coma Pinwheel Galxy	Galaxy	Com	12h 18m 50s	+14° 25.0'	10.4	13:37	20:21	03:04
M106	NGC4258	Galaxy	CVn	12h 18m 58s	+47° 18.2'	9.1	11:00	20:21	05:41
M61	Swelling Spiral	Galaxy	Vir	12h 21m 55s	+04° 28.3'	10.1	14:08	20:24	02:39
M40	Winnecke 4	Dbl+Asterism	UMa	12h 22m 12s	+58° 05.0'	8.7	Circ	20:24	Circ
M100	Mirror of M99	Galaxy	Com	12h 22m 55s	+15° 49.3'	10.1	13:36	20:25	03:13
M84	NGC4374	Galaxy	Vir	12h 25m 04s	+12° 53.2'	10.2	13:47	20:27	03:06
M85	NGC4382	Galaxy	Com	12h 25m 24s	+18° 11.4'	10.0	13:32	20:27	03:23
M86	NGC4406	Galaxy	Vir	12h 26m 12s	+12° 56.7'	9.9	13:48	20:28	03:07
M49	NGC4472	Galaxy	Vir	12h 29m 47s	+08° 00.0'	9.3	14:06	20:31	02:57
M87	Smoking Gun,	Galaxy	Vir	12h 30m 49s	+12° 23.4'	9.6	13:55	20:33	03:10
M88	NGC4501	Galaxy	Com	12h 31m 59s	+14° 25.2'	10.2	13:50	20:34	03:18
M91	Missing Messier Object	Galaxy	Com	12h 35m 27s	+14° 29.7'	10.9	13:53	20:37	03:21
M89	NGC4552	Galaxy	Vir	12h 35m 40s	+12° 33.3'	10.9	13:59	20:37	03:16
M90	NGC4569	Galaxy	Vir	12h 36m 50s	+13° 09.7'	10.2	13:58	20:39	03:19
M58	NGC4579	Galaxy	Vir	12h 37m 44s	+11° 49.1'	10.4	14:03	20:39	03:16
M68	NGC4590	Globular	Hya	12h 39m 28s	-26° 44.5'	9.0	15:59	20:41	01:23
M104	Sombrero Galaxy	Galaxy	Vir	12h 39m 59s	-11° 37.3'	9.2	15:12	20:42	02:12
M59	NGC4621	Galaxy	Vir	12h 42m 02s	+11° 38.7'	10.7	14:08	20:44	03:19

ID	Common Name	Type	Const	RA	Dec	Mag	Rise	Transit	Set
M60	NGC4649	Galaxy	Vir	12h 43m 40s	+11° 33.1'	9.8	14:10	20:45	03:21
M94	Croc's Eye Galaxy	Galaxy	CVn	12h 50m 53s	+41° 07.1'	8.9	12:19	20:53	05:26
M64	Black Eye Galaxy,	Galaxy	Com	12h 56m 44s	+21° 41.0'	9.3	13:51	20:58	04:05
M53	NGC5024	Globular	Com	13h 12m 55s	+18° 10.1'	8.5	14:19	21:15	04:10
M63	Sunflower Galaxy	Galaxy	CVn	13h 15m 49s	+42° 01.7'	9.3	12:38	21:18	05:57
NGC5139	Omega Centauri	Globular	Cen	13h 26m 48s	-47° 29.0'	3.6	18:38	21:28	00:19
NGC5169		Galaxy	CVn	13h 28m 10s	+46° 40.3'	14.0	12:15	21:30	06:44
NGC5204		Galaxy	UMa	13h 29m 36s	+58° 25.1'	11.3	Circ	21:31	Circ
M51	Whirlpool Galaxy,	Galaxy	CVn	13h 29m 52s	+47° 11.7'	8.9	12:12	21:32	06:51
Arp85	M51B	Galaxy	CVn	13h 29m 58s	+47° 16.0'	9.6	12:12	21:32	06:52
NGC5182		Galaxy	Hya	13h 30m 41s	-28° 09.0'	13.0	16:56	21:32	02:09
NGC5214		Galaxy	CVn	13h 32m 49s	+41° 52.3'	14.0	12:56	21:34	06:12
M83	Southern Pinwheel Galaxy	Galaxy	Hya	13h 37m 00s	-29° 51.8'	8.0	17:09	21:39	02:09
HR5144	SAO82942	Triple	Boo	13h 40m 40s	+19° 57.3'	5.8	14:41	21:42	04:44
NGC5283		Galaxy	Dra	13h 41m 06s	+67° 40.3'	14.0	Circ	21:43	Circ
M3	NGC5272	Globular	CVn	13h 42m 11s	+28° 22.5'	7.0	14:13	21:44	05:15
NGC5286	C84	Globular	Cen	13h 46m 24s	-51° 22.0'	7.6	19:39	21:48	23:57
NGC5292		Galaxy	Cen	13h 47m 40s	-30° 56.4'	14.0	17:24	21:49	02:15
NGC5356		Galaxy	Vir	13h 54m 59s	+05° 20.0'	14.0	15:39	21:57	04:14
NGC5363		Galaxy	Vir	13h 56m 07s	+05° 15.2'	10.2	15:40	21:58	04:15
NGC5447	III-787	Neb	UMa	14h 02m 29s	+54° 16.3'		10:48	22:04	09:21
M101	Pinwheel Galaxy	Galaxy	UMa	14h 03m 13s	+54° 20.9'	8.2	10:45	22:05	09:25
NGC5461	III-788	Neb	UMa	14h 03m 42s	+54° 19.0'		10:47	22:05	09:24
NGC5485		Galaxy	UMa	14h 07m 11s	+55° 00.0'	11.5	Circ	22:09	Circ
NGC5460		Open	Cen	14h 07m 27s	-48° 20.6'	5.6	19:27	22:09	00:52
NGC5500		Galaxy	Boo	14h 10m 15s	+48° 32.7'	14.0	12:39	22:12	07:45
IC991		Galaxy	Vir	14h 17m 48s	-13° 52.3'	13.0	16:56	22:19	03:43
HR5362	SAO224838	Dbl	Lup	14h 20m 10s	-43° 03.5'	5.6	18:58	22:22	01:46
IC4406	Retina Nebula	P Neb	Lup	14h 22m 26s	-44° 09.0'	11.0	19:08	22:24	01:41
HR5409	SAO139951	Triple	Vir	14h 28m 12s	-02° 13.6'	4.8	16:33	22:30	04:26
NGC5669		Galaxy	Boo	14h 32m 44s	+09° 53.4'	12.0	16:04	22:34	05:05
NGC5689		Galaxy	Boo	14h 35m 30s	+48° 44.5'	11.9	13:02	22:37	08:12
M102	Spindle Galaxy (duplicate of M101?)	Galaxy	Dra	15h 06m 30s	+55° 45.7'	10.8	Circ	23:08	Circ
NGC5875		Galaxy	Boo	15h 09m 13s	+52° 31.6'	13.0	12:42	23:11	09:40
NGC5907	Splinter Galaxy	Galaxy	Dra	15h 15m 54s	+56° 19.7'	11.4	Circ	23:18	Circ
NGC5882		P Neb	Lup	15h 16m 50s	-45° 38.9'	11.0	20:13	23:19	02:24
NGC5897		Globular	Lib	15h 17m 24s	-21° 00.6'	8.6	18:18	23:19	04:21
M5	NGC5904	Globular	Ser	15h 18m 33s	+02° 04.9'	7.0	17:12	23:20	05:29

ID	Common Name	Type	Const	RA	Dec	Mag	Rise	Transit	Set
IC4593	White Eyed Pea	P Neb	Her	16h 11m 44s	+12° 04.3'	11.0	17:37	00:13	06:50
IC4592	Jabbah	Neb	Sco	16h 11m 59s	-19° 27.4'		19:07	00:14	05:20
M80	NGC6093	Globular	Sco	16h 17m 03s	-22° 58.5'	8.5	19:24	00:19	05:14
IC4601		Neb	Sco	16h 20m 18s	-20° 04.9'		19:18	00:22	05:26
Abell38		P Neb	Sco	16h 23m 17s	-31° 44.9'	11.7	20:03	00:25	04:47
M4	Cat's Eye	Globular	Sco	16h 23m 35s	-26° 31.5'	7.5	19:43	00:25	05:08
IC4603	Rho Ophiuchi Complex [1]	Neb	Oph	16h 25m 24s	-24° 28.0'		19:37	00:27	05:17
IC4604	Rho Ophiuchi Complex [2]	Neb	Oph	16h 25m 33s	-23° 26.5'		19:34	00:27	05:21
NGC6124	C75	Open	Sco	16h 25m 36s	-40° 40.0'	5.8	20:49	00:27	04:06
Abell39		P Neb	Her	16h 27m 33s	+27° 54.5'	12.9	17:00	00:29	07:59
IC4605		Neb	Sco	16h 30m 12s	-25° 06.8'		19:44	00:32	05:19
NGC6153		P Neb	Sco	16h 31m 31s	-40° 15.2'	12.0	20:52	00:33	04:14
NGC6181		Galaxy	Her	16h 32m 21s	+19° 49.5'	11.9	17:33	00:34	07:35
NGC6171		Globular	Oph	16h 32m 32s	-13° 03.1'	8.1	19:08	00:34	06:00
NGC6178		Open	Sco	16h 35m 47s	-45° 38.6'	7.2	21:32	00:37	03:43
NGC6193	C82	Open	Ara	16h 41m 18s	-48° 46.0'	5.2	22:05	00:43	03:21
M13	Great Hercules Cluster	Globular	Her	16h 41m 41s	+36° 27.5'	7.0	16:36	00:43	08:50
NGC6210	Turtle Planetary Nebula	P Neb	Her	16h 44m 30s	+23° 48.0'	9.0	17:32	00:46	08:00
Barnard44a		DkNeb	Sco	16h 44m 45s	-40° 20.0'		21:06	00:46	04:27
NGC6204		Open	Ara	16h 46m 09s	-47° 01.0'	8.2	21:54	00:48	03:42
M12	Gumball Globular	Globular	Oph	16h 47m 14s	-01° 56.8'	8.0	18:52	00:49	06:46
NGC6231	Table of Scorpius	Open	Sco	16h 54m 00s	-41° 48.0'	2.6	21:24	00:56	04:28
IC4628	Prawn Nebula	Neb	Sco	16h 56m 58s	-40° 27.3'		21:19	00:59	04:39
NGC6254		Globular	Oph	16h 57m 09s	-04° 05.9'	6.6	19:07	00:59	06:50
Barnard47		DkNeb	Oph	16h 59m 42s	-22° 38.0'		20:05	01:01	05:57
M62	Flickering Globular	Globular	Oph	17h 01m 13s	-30° 06.7'	8.0	20:34	01:03	05:32
M19	NGC6273	Globular	Oph	17h 02m 38s	-26° 16.0'	8.5	20:21	01:04	05:48
M92	NGC6341	Globular	Her	17h 17m 07s	+43° 08.1'	7.5	16:32	01:19	10:05
M9	NGC6333	Globular	Oph	17h 19m 12s	-18° 31.0'	9.0	20:11	01:21	06:30
NGC6326		P Neb	Ara	17h 20m 46s	-51° 45.2'	12.0	23:19	01:22	03:26
NGC6357	Lobster Nebula	Neb	Sco	17h 24m 43s	-34° 12.1'		21:15	01:26	05:38
IC4651		Open	Ara	17h 24m 52s	-49° 56.5'	6.9	23:01	01:27	03:53
NGC6388		Globular	Sco	17h 36m 17s	-44° 44.1'	6.9	22:26	01:38	04:50
M14	NGC6402	Globular	Oph	17h 37m 36s	-03° 14.7'	9.5	19:46	01:39	07:33
M6	Butterfly Cluster	Open	Sco	17h 40m 20s	-32° 15.2'	4.5	21:22	01:42	06:02
NGC6397	C86	Globular	Ara	17h 40m 42s	-53° 40.0'	5.6	00:10	01:42	03:15
NGC6426		Globular	Oph	17h 44m 55s	+03° 10.1'	11.2	19:35	01:47	07:58
IC4665		Open	Oph	17h 46m 30s	+05° 39.0'	4.2	19:30	01:48	08:07

ID	Common Name	Type	Const	RA	Dec	Mag	Rise	Transit	Set
NGC6445	Crescent Nebula	P Neb	Sgr	17h 49m 15s	-20° 00.6'	13.0	20:46	01:51	06:56
NGC6503		Galaxy	Dra	17h 49m 27s	+70° 08.6'	10.2	Circ	01:51	Circ
M7	Scorpion's Tail	Open	Sco	17h 53m 51s	-34° 47.6'	3.5	21:47	01:56	06:04
IC4670		Neb	Sgr	17h 55m 07s	-21° 44.6'		20:58	01:57	06:56
NGC6501		Galaxy	Her	17h 56m 04s	+18° 22.3'	12.3	19:02	01:58	08:54
M23	NGC6494	Open	Sgr	17h 57m 04s	-18° 59.1'	6.0	20:51	01:59	07:07
NGC6543	Cat Eye Nebula	P Neb	Dra	17h 58m 36s	+66° 38.0'	8.1	Circ	02:00	Circ
NGC6496		Globular	Sco	17h 59m 04s	-44° 16.0'	9.2	22:45	02:01	05:16
M20	Trifid Nebula	Open+D Neb	Sgr	18h 02m 42s	-22° 58.2'	5.0	21:09	02:04	06:59
M8	Lagoon Nebula	Open+D Neb	Sgr	18h 03m 41s	-24° 22.7'	5.0	21:15	02:05	06:55
M21	NGC6531	Open	Sgr	18h 04m 13s	-22° 29.3'	7.0	21:09	02:06	07:02
NGC6530		Open	Sgr	18h 04m 31s	-24° 21.5'	4.6	21:16	02:06	06:56
NGC6528		Globular	Sgr	18h 04m 50s	-30° 03.3'	9.5	21:37	02:07	06:36
IC4684		Neb	Sgr	18h 09m 08s	-23° 26.1'		21:17	02:11	07:04
IC4685		Neb	Sgr	18h 09m 18s	-23° 59.2'		21:20	02:11	07:02
NGC6572		P Neb	Oph	18h 12m 06s	+06° 51.2'	9.0	19:52	02:14	08:36
NGC6567		P Neb	Sgr	18h 13m 45s	-19° 04.5'	12.0	21:08	02:15	07:23
M24	Small Sagittarius Star Cloud	Open	Sgr	18h 18m 26s	-18° 24.3'	4.5	21:10	02:20	07:30
M16	Eagle Nebula	Open+D Neb	Ser	18h 18m 48s	-13° 48.3'	6.5	20:57	02:20	07:44
M18	Black Swan	Open	Sgr	18h 19m 58s	-17° 06.1'	8.0	21:08	02:22	07:35
M17	Omega Nebula,	Open+D Neb	Sgr	18h 20m 47s	-16° 10.3'	7.0	21:06	02:22	07:39
M28	NGC6626	Globular	Sgr	18h 24m 33s	-24° 52.1'	8.5	21:38	02:26	07:15
NGC6637		Globular	Sgr	18h 31m 23s	-32° 20.8'	7.7	22:13	02:33	06:53
IC1287		Neb	Sct	18h 31m 26s	-10° 47.7'		21:01	02:33	08:06
M25	M25	Open	Sgr	18h 31m 42s	-19° 07.0'	6.5	21:26	02:33	07:41
M57	Ring Nebula	P Neb	Lyr	18h 53m 35s	+33° 01.7'	9.5	19:05	02:55	10:46
NGC6723		Globular	Sgr	18h 59m 33s	-36° 37.9'	7.3	23:01	03:01	07:01
NGC6729	C68	BrNeb	CrA	19h 01m 54s	-36° 57.0'		23:05	03:04	07:02

And - Andromeda
Ant - Antlia
Aps - Apus
Aql - Aquila
Aqr - Aquarius
Ara - Ara
Ari - Aries
Aur - Auriga
Boo - Bootes
Cae - Caelum
Cam - Camelopardis
Cap - Capricornus
Car - Carina
Cas - Cassiopeia
Cen - Centaurus
Cep - Cepheus
Cet - Cetus
Cha - Chamaeleon
Cir - Circinus
CMa - Canis Major
CMi - Canis Minor
Cnc - Cancer
Col - Columba
Com - Coma Berenices
CrA - Corona Australis
CrB - Corona Borealis
Crt - Crater
Cru - Crux
Crv - Corvus
CVn - Canes Venatici
Cyg - Cygnus
Del - Delphinus
Dor - Dorado
Dra - Draco
Equ - Equuleus
Eri - Eridanus
For - Fornax
Gem - Gemini
Gru - Grus
Her - Hercules
Hor - Horologium
Hya - Hydra
Hyi - Hydrus
Ind - Indus
Lac - Lacerta
Leo - Leo
Lep - Lepus
Lib - Libra
LMi - Leo Minor
Lup - Lupus
Lyn - Lynx
Lyr - Lyra
Men - Mensa
Mic - Microscopium
Mon - Monoceros
Mus - Musca
Nor - Norma
Oct - Octans
Oph - Ophiuchus
Ori - Orion
Pav - Pavo
Peg - Pegasus
Per - Perseus
Phe - Phoenix
Pic - Pictor
PsA - Pisces Austrinus
Psc - Pisces
Pup - Puppis
Pyx - Pyxis
Ret - Reticulum
Scl - Sculptor
Sco - Scorpius
Sct - Scutum
Ser - Serpens
Sex - Sextans
Sge - Sagitta
Sgr - Sagittarius
Tau - Taurus
Tel - Telescopium
TrA - Triangulum Australe
Tri - Triangulum
Tuc - Tucana
UMa - Ursa Major
UMi - Ursa Minor
Vel - Vela
Vir - Virgo
Vol - Volans
Vul - Vulpecula

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