

New
Braunfels
Astronomy
Club

BECAUSE IT'S OUT THERE

Larry's Celestial Calendar & Newsletter

by Eric Erickson

308th Edition

Volume 26, Number 3

March 16th to April 20th, 2023

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Meeting Agenda

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Watch the ISS

My Celestial Pick

Cover Story

Lagniappe

Cover Story> Remembering SOFIA

NASA/DLR

- Open meeting and introduce new members (get names, email)
- Interesting observations, experiences
- Show and tell
- Current news and what's in our sky this month: *Member input, Newsletter*
- Events, Outreach, Planning
 - Messier Party at Dot's – March 18th – See Astronomy Magazine article below the calendar. It's for those who do not plan to stay up all night. M13 will be observable around midnight.
 - Make this an annual NBAC event?
 - Astronomy Night at TPML – March 25th
 - CCFNS members also participating at ACE Hardware BBQ and Heritage Museum Dinosaur Day events today
 - Land and Sky fundraiser event at Dot's – May 20th
- Business
 - Acquisition of solar scope/filters/glasses by TPML
 - Update: Bob Keyser's Lunt H-alpha diagonal's blue/green filter had a crusty internal deposit, I sent it to Lunt and the blue filter has been replaced. Lunt had to replace the nosepiece also-it was stuck due to corroded threads and had to be removed to replace the blue filter.
- Main Event

Coming up: **OUR 283rd ASTRONOMY CLUB MEETING**

April 20th, 2023, from 6 - 8 pm

TJ's on Loop 337

astronomynbt.org Email: info@astronomynbt.org



Astronomy Friends New Braunfels.....

facebook.com/groups/354953995432792/



Comal County Friends of the Night Sky.....

facebook.com/groups/166098014710276/

comaldarksky.org/ Email: info@comaldarksky.org

Astronomy Night at Tye Preston Memorial Library Canyon Lake, TX



Date	Doors Open	Note
1/21/2023	7:00 PM	
2/18/2023	7:30 PM	
3/25/2023	8:30 PM	
4/22/2023	8:30 PM	
5/20/2023	2:00 PM	<i>Sun Party - wear sunscreen and sunglasses!</i>
9/16/2023	8:00 PM	
10/14/2023	8:00 PM	
10/21/2023	7:30 PM	International Observe the Moon Night
11/18/2023	6:30 PM	Crescent Moon
12/9/2023	6:30 PM	



Tye Preston Memorial Library
New Braunfels Astronomy Club

tpml.org

astronomynbtx.org



[Astronomy Friends New Braunfels](#)

There will be surprise giveaways at some evnts so join us!!

Comal County Friends of the Night Sky supports and encourages Astronomy Night

Website: comaldarksky.org Email: info@comaldarksky.org



[Comal County Friends of the Night Sky Group](#)

MARCH/APRIL 2023

SUN MON TUE WED THU FRI SAT

Cover Story – SOFIA (Stratospheric Observatory for Infrared Astronomy) This composite image of Centaurus A (NGC 5128) is in visible, sub-millimeter, x-ray, and infrared, overlayed with SOFIA’s magnetic field imaging.

161718

NBAC Meeting
6:00
TJ’s on Loop 337

Messier Party at Dot’s on Purgatory Rd
Get there before sunset!

19202122232425

Vernal Equinox
4:24 PM CDT

Dusk, March 22 – 24
45 minutes after sunset
Sky & Telescope

Astronomy Night
8:30 pm
TPML, Canyon Lake

26272829303101 APR

Astronomy

Uranus • ARIES
• Venus • Hamal • Mirach
CETUS ANDROMEDA
PISCES Alpheratz •
Jupiter • Mercury
March 27, 30 minutes after sunset
Looking west

Dusk, March 22 – 24
45 minutes after sunset
Sky & Telescope

Looking West

0205060708

Pink Moon
11:37pm CDT
Also called the Paschal Moon – first full Moon of the spring season

09101112131415

Astronomy

Betelgeuse ORION Aldebaran PERSEUS
Rigel TAURUS Pleiades Venus
ERIDANUS Uranus ARIES Hamal
CETUS 16 17
April 10, 1 hour after sunset
Looking west

Dusk, April 11
45 minutes after sunset
Sky & Telescope

TAURUS 18 19
Aldebaran Venus Pleiades
Mercury
Looking West

20
NBAC Meeting
6:00
TJ’s on Loop 337

Astronomy

Pollux Castor GEMINI
Procyon CANIS MINOR Mars Mebsuta AURIGA Capella
Betelgeuse ORION Aldebaran TAURUS Venus Pleiades
Rigel
April 14, 10 P.M.
Looking west



SEE SPRING'S BEST Messier objects

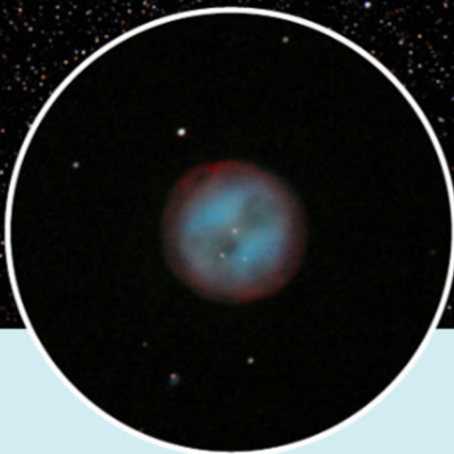
Here's a list of 25 targets to help you make the most of your evening. BY MICHAEL E. BAKICH



M5 is the brightest globular cluster in the northern sky. ADAM BLOCK/MOUNT LEMMON SKYCENTER/UNIVERSITY OF ARIZONA



The Orion Nebula, M42, is perhaps the most famous deep-sky object and the closest major star-forming region — just 1,500 light-years away. MADHUP RATHI



The Owl Nebula is one of the four planetary nebulae that Messier cataloged. JOHN CHUMACK

Charles Messier was a French comet-hunter who occasionally spied objects masquerading as comets due to their fuzzy appearance through his small scope. But they didn't move against the starry background like comets did, so he documented them to avoid confusion. Over time, his list grew to 109 deep-sky objects, encompassing what we now know to be galaxies, nebulae, and star clusters.

Messier's objects are not spread out evenly across the sky, so a window exists from mid-March to early April when observers in the Northern Hemisphere can catch them all in a single night. This feat is called a Messier marathon, an activity that's been popular with astronomy clubs since the 1980s.

Many observers have nabbed all 109 objects in one night. But what if you can't devote a whole night to the hunt? Then spring for the Messier mini-marathon, 25 great objects you can see between the fall of darkness and midnight.

Start with the first object on the list; it will be farthest west, so the following objects will set one after the another, in order, giving you more time to observe them.

This list describes the highlights, and is not exhaustive so you can add available Messier objects as you like. For example, M64 (Coma Berenices), M65/66 (Leo), M92 (Hercules) are not in the list but easily captured.

Eric Erickson

M38: The Starfish

Cluster in Auriga glows at magnitude 6.4. Through a 4-inch telescope, you'll spot 30 stars in an area 20' across. Although this region's background is rich, the cluster stands out well. Crank up the magnification and you'll identify several nice chains of stars. While you're there, be sure to look 0.5° south of M38 for another open cluster, NGC 1907.

M1: The Crab Nebula in Taurus is a supernova remnant with a high surface brightness, so even a 3-inch scope will reveal it. It shines at magnitude 8.0 and its oval shape, measuring 6' by 4', is oriented northwest to southeast. To find it, start at 4th-magnitude Zeta (ζ) Tauri and move 1° northwest of the star.

M36: The Pinwheel Cluster shines at magnitude

6.0. With a 4-inch scope, several dozen stars will be visible strewn across an area 12' wide. Insert an eyepiece that gives a magnification around 100x and see if you can spot a pinwheel-like pattern in this cluster's stars.

M42: The Orion Nebula may be the sky's No. 1 object. Any scope will reveal nebulosity here, plus a tiny cluster of stars called the Trapezium. Although you don't need a nebula filter, using one from a dark location accentuates the contrast between the light and dark regions.

M37: The Salt and Pepper Cluster in Auriga shines at magnitude 5.6 and displays an even distribution of stars not found in many other clusters. Although it sits squarely within the Milky Way, M37's borders are easy to discern. A 3-inch scope reveals 50 stars

within a 20'-wide circle. The brightest member — a magnitude 9 orange star — sits near the cluster's center.

M35 lies 2.3° northwest of magnitude 3.3 Eta (η) Geminorum. From a dark site, you'll spot the magnitude 5.1 cluster easily without optical aid. Point a telescope at it and you'll see a second open cluster, NGC 2158, at magnitude 8.6. M35 contains two dozen stars brighter than 9th magnitude. Near the cluster's center, look for a string of stars shaped like a saxophone.

M41: This is an easy target because it lies 4° south of Sirius (Alpha [α] Canis Majoris). It glows at magnitude 4.5 and measures 38' across. Through a 6-inch scope, you'll see about 50 stars. At first glance, this cluster appears roughly circular. Closer inspection reveals several chains of stars running north-south.

M50: The Heart-Shaped Cluster shines at magnitude 5.9 in Monoceros. Through a small scope at 100x, you'll spot 50 stars in an area 16' across. The brightest glows at 8th magnitude. The cluster's common name refers to how the oval-shaped central region appears to connect with two trails of stars that move outward.

M47: You'll see this open cluster easily from a dark site without optical aid. It lies in Puppis, 5° south-southwest of Alpha Monocerotis. At magnitude 4.4, M47 ranks as the sky's 14th-brightest open cluster. Most of that brightness comes from just six stars, which lie in a field of about 75 others.

M46: This magnitude 6.1 open cluster in Puppis contains several hundred stars, 100 of which are visible through an 8-inch scope. They appear evenly distributed throughout a circle slightly less than half a degree across. Within the boundaries of M46 resides planetary nebula NGC 2438. It sits 7' north of the cluster's center and measures about 1' across.

Distance measurements place NGC 2438 several thousand light-years closer than M46.

M48: This open cluster in Hydra shines at magnitude 5.8, measures nearly 1° across, and lies 3° south-southeast of Zeta Monocerotis. A 6-inch scope reveals about 75 stars. Look for a zigzag chain of 9th- and 10th-magnitude stars running south-southwest to north-northeast through the cluster's center.

M44: The Beehive Cluster in Cancer glows at magnitude 3.1 and spans 1.5°. M44 looks best through binoculars with magnifications between 10x and 16x. The Beehive's brightest star is magnitude 6.3 Epsilon (ϵ) Cancri. Some 80 of the cluster's stars are brighter than 10th magnitude.

M67: The other open cluster in Cancer is M67, magnitude 6.9. It spans 0.5° and lies 1.7° due west of Alpha Cancri.

Through a 4-inch scope, you'll spot roughly two dozen stars. Note the yellow star on its north-eastern edge; it shines at magnitude 7.8 but is not a member of the cluster.

M81: At magnitude 6.9, Bode's Galaxy is one of the sky's brightest galaxies. It's also big — 24' by 13'. You'll find it 2° east-southeast of 24 Ursae Majoris. Through an 8-inch scope, a large, bright central region surrounds the much brighter core, and a 12-inch scope will show you how the spiral arms wind around it.

M82: The Cigar Galaxy glows at magnitude 8.4, measures 12' by 5.6', and lies 0.5° due south of M81. M82 appears four times as long as it is wide, oriented east-southeast to west-northwest. The galaxy's brightest part lies east of center and a dark lane cuts diagonally across its minor axis.

M97: One of the best springtime planetary nebulae is the Owl Nebula, which shines at magnitude 9.9 and spans 3.3'. Look for its "eyes," two dark, circular regions in its disk. An Oxygen-III filter and a magnification of 100x work best. M97 lies 2.3° southeast of Merak (Beta [β] Ursae Majoris).

M104: The Sombrero Galaxy in Virgo looks like a bright lens split by a dark dust lane. Through a 4-inch scope, the lane shows up only near the center. The core is bright, with a large halo surrounding it. M104 glows at magnitude 8.0 and measures 7.1' by 4.4'. Find it 5.5° north-northeast of Delta (δ) Corvi.

M94: This magnitude 8.2 spiral galaxy lies 3.2° east of Beta Canum Venaticorum. It spans 13' by 11' and looks

like an elliptical galaxy through small scopes. Through an 8-inch scope, you'll see the tiny nucleus surrounded by a bright disk with a much fainter oval halo around it.

M53: To find this magnitude 7.7 globular cluster, look a little less than 1° northeast of Alpha Comae Berenices. Through a 4-inch scope under a dark sky, you'll see several dozen faint stars in a 12.6'-wide circle, many of which concentrate in the bloated core.

M63: The Sunflower Galaxy, 5° northeast of Alpha Canum Venaticorum, shines at magnitude 8.6 and measures 13.5' by 8.3'. Through small scopes, the nucleus appears stellar, and a 3' long oval halo surrounds it. Through a 10-inch scope, the halo shows clumps made of star-forming regions in M63's spiral arms.

M51: The Whirlpool Galaxy in Canes Venatici lies 3.6° southwest of Eta Ursae

Majoris, glows at magnitude 8.4, and measures 8.2' by 6.9'. It also has a smaller companion, NGC 5195. You'll see M51's spiral arms through an 8-inch scope. Look for the thin, dark dust lanes that follow the arms' inner edges. Also try to spot the apparent connecting arm between M51 and NGC 5195.

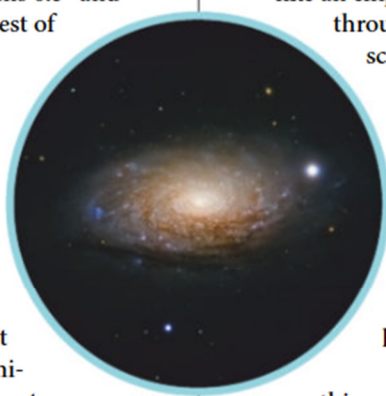
M83: The Southern Whirlpool Galaxy lies 7.2° west-southwest of Pi (π) Hydrae. It appears nearly face-on, so you'll see its spiral structure through scopes with apertures as small as 6 inches. The core is compact and round, and both spiral arms are easy to see, but the one that wraps southward from the bar's northeastern end shows up better. M83 shines at magnitude 7.5 and measures 15.5' by 13'.

M3: This magnitude 6.3 globular cluster lies midway between Arcturus and Cor Caroli in Canes Venatici. Through a 4-inch scope, the cluster has a wide, bright center that accounts for about half of its 16.2' width. Surrounding the center are dozens of stars whose density gradually decreases with distance.

M5: This globular cluster in Serpens lies 11.5° due north of Beta Librae. It glows at magnitude 5.7 and spans 17.4'. Through a 4-inch scope at 150x or more, you'll see a grainy structure and several dozen stars around the core. An 11-inch scope reveals more than a hundred stars.

M13: The Hercules Cluster is the fuzzy "star" two-thirds of the way from Zeta to Eta Herculis. Through 8-inch and larger scopes, you'll see hundreds of stars in a 16'-wide circle. Crank your magnification to 200x or more and try to see the propeller, a small Y-shaped region of three dark lanes near M13's center. ☼

Michael E. Bakich is a contributing editor of *Astronomy* who has run *Messier marathons* since the mid-1970s.



Solar System Happenings

✚ **Mercury** becomes an evening planet in late March, improving daily until greatest eastern elongation on April 11th. It joins Venus, the Pleiades, and Aldebaran on April 10th for a nice post-sunset view in the west.

✚ **Venus** is an evening planet. Bright in the southwestern sky.

✚ **Earth** still spins, and we are still here to marvel at it all.

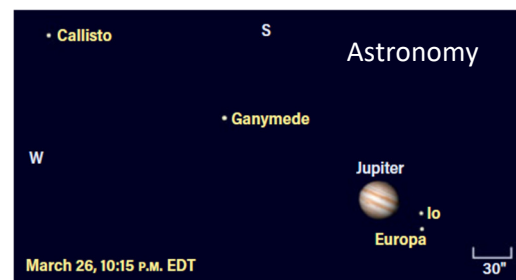
Best ISS viewing for Canyon Lake/New Braunfels - From [Heavens Above](#)

Date	Start Time	Start Loc	Max Alt °	End Loc	Note
03/16	20:16	SW	53	NE	Travels east of Venus
03/17	21:07	W	11	NNE	Low along the horizon
03/18	20:15:08	WSW	17	NNE	Skims just west of Jupiter shortly after rising
04/04	20:50	NW	90	SE	Enters Earth's shadow at 20:56:35
04/05	21:36:06	WNW	12	SW	Passes west of Venus shortly after rising. Enters Earth's shadow at 21:41:36
04/06	20:45:04	WNW	24	SSE	Passes between Mercury and Venus shortly after rising.
04/17	06:27	S	14	ENE	Passes east of Saturn, then west of the crescent Moon
04/19	06:20	SSW	43	NE	Passes through Scorpius, Sagittarius, Pegasus, Andromeda

✚ **The Moon** dances with planets and stars.

✚ **Mars** is brilliant and big but past opposition and shrinking as we part ways. It joins up with Venus, Aldebaran, the Pleiades, Betelgeuse and other notables on April 14th in the western night sky. In late March and early April Mars is within 2° of open cluster M35 in Gemini – a nice binocular target.

✚ **Jupiter** is in the southwest by sunset and still a nice target but getting closer to sunset glare. On March 27th it is in conjunction with Mercury, visible low on the western horizon about 30 minutes after sunset. Jupiter enters conjunction with the Sun on April 11.



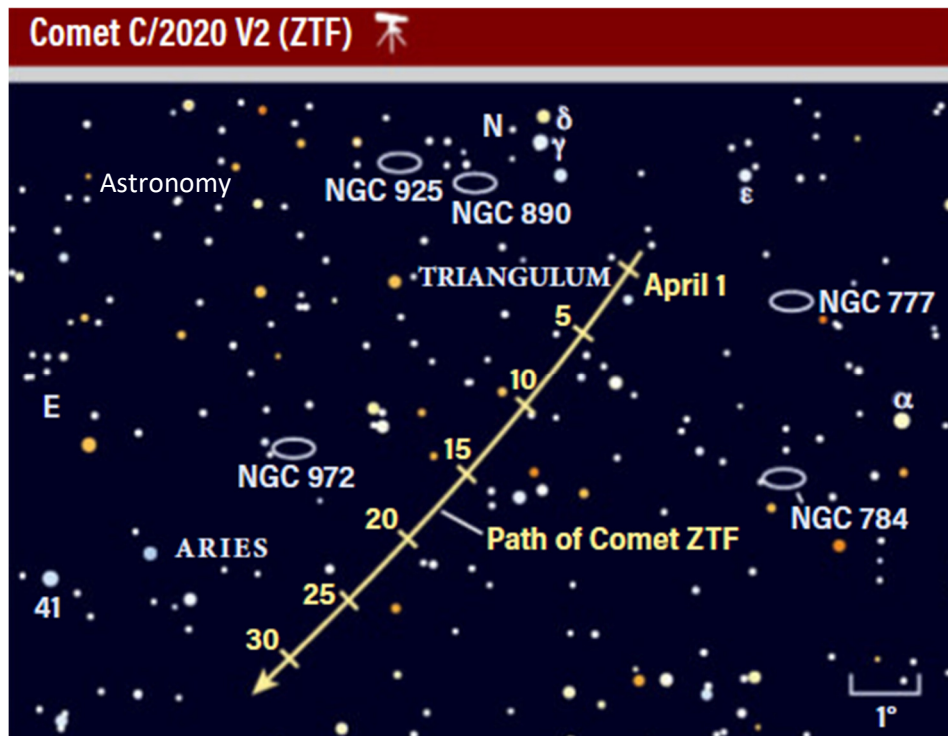
✚ **Saturn** is in the Sun's glare, becoming a morning planet later in March, rising about an hour before the Sun by March 31st.

✚ **Uranus** is in Aries, use binoculars or telescope and catch this gray-green dot. It is in conjunction with Venus on March 27th. Look in the west 30 minutes after sunset.

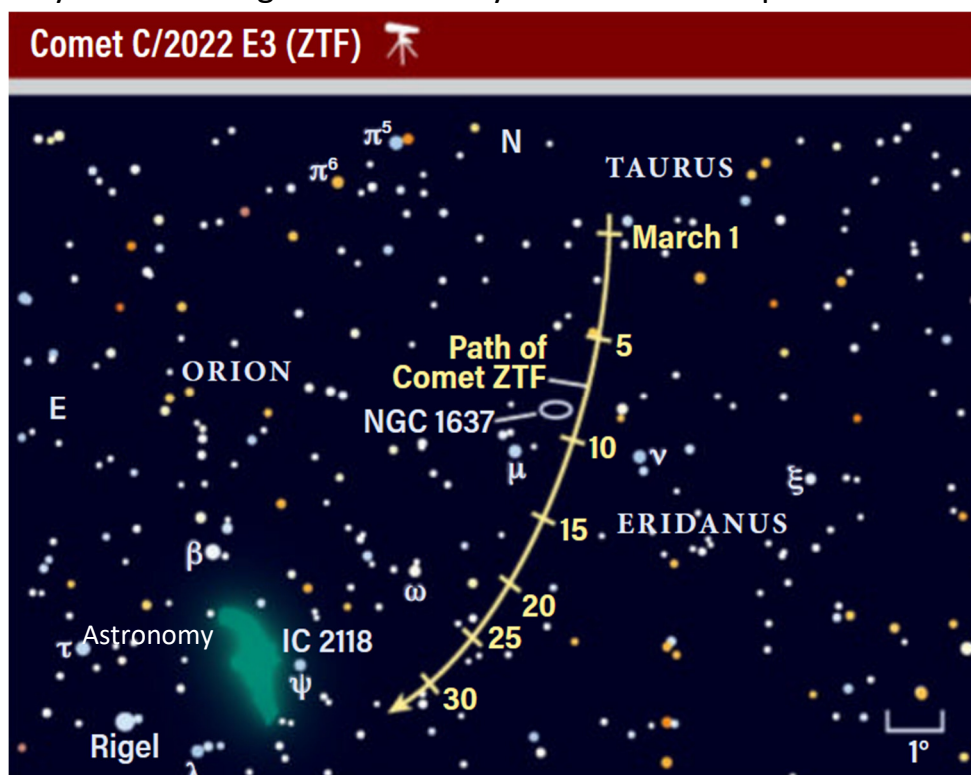
✚ **Neptune** is in eastern Aquarius and in the Sun's glare.

Comets:

- Comet C/2020 V2 (ZTF) discovered in November 2020 by the Zwicky Transient Facility. At magnitude 10...it's very dim.



- Comet C/2022 E3 (ZTF) was discovered in March 2022 by the Zwicky Transient Facility. It's dimming more each day and difficult to spot in small instruments.

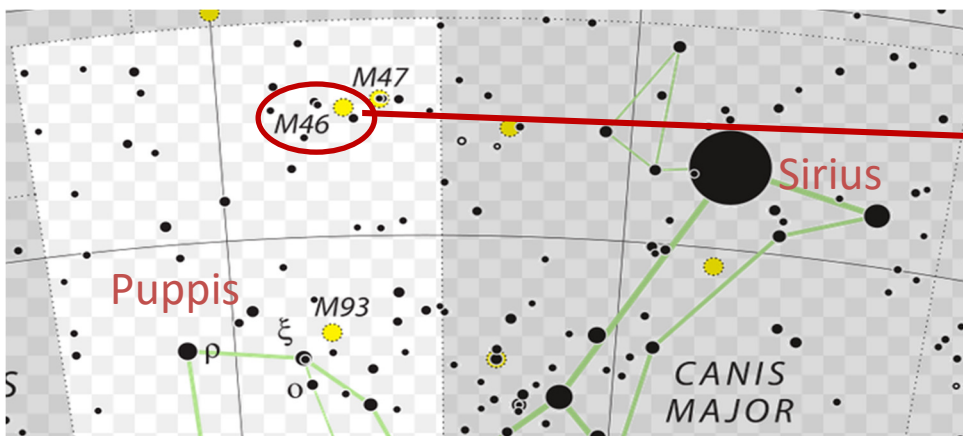
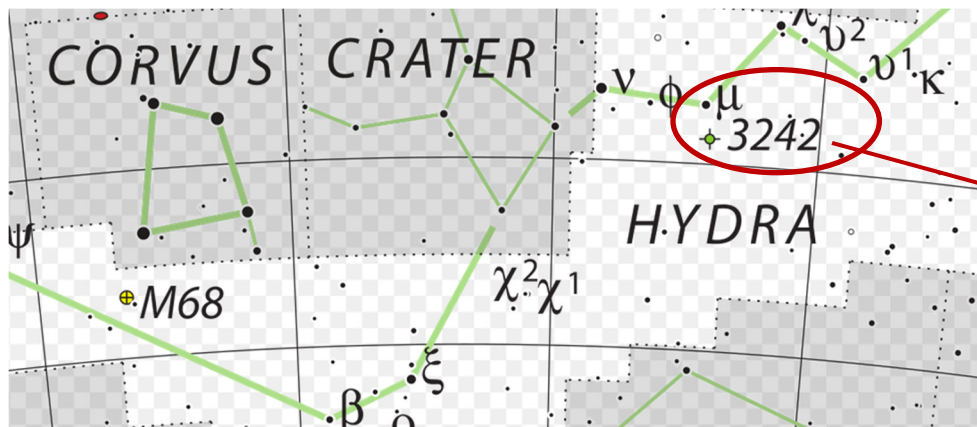
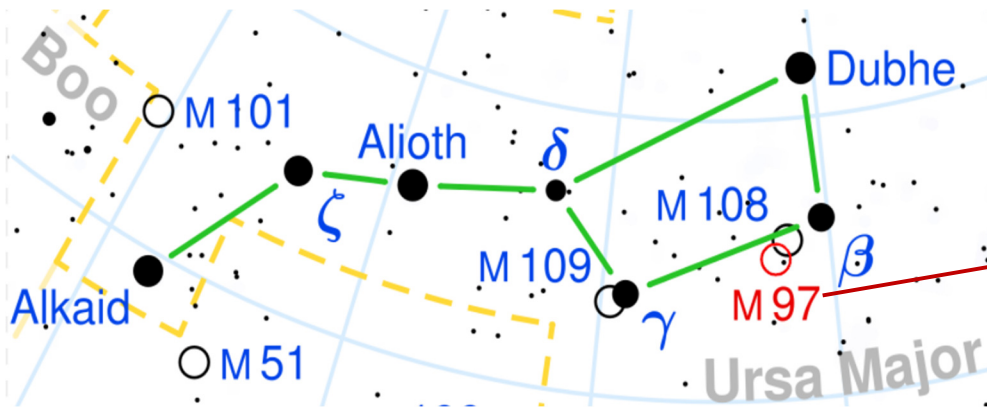


My Celestial Pick: Planetary Nebulae

Stick around for another 5 billion years or so and watch our Sun go through periods of convulsive fusion as its hydrogen fuel wanes. Transitioning to helium fusion is a start-stop situation and our Sun's core contracts-expands as fusion slows then starts up again. Meanwhile, some hydrogen fusion is going on at the outer reaches of the core and plasma puffs outward as helium fusion kicks a blast of its own plasma - and the core slowly expands. Eventually helium fusion stabilizes and our Sun becomes a Red Giant, all show but little substance. Hey, it's still hot enough to fry Mercury, Venus, Earth, the Moon, and threaten Mars. Alas, helium – carbon – oxygen fusion eventually sputters and spasms of core contraction – expansion start again (oscillations over millions of years), sending plasma and other matter outward in concentric shells. Another billion years and fusion stops without enough gravitational pressure to continue carbon fusion. A final core collapse crushes the remaining carbon, oxygen, helium, and hydrogen into a matrix of densely packed atoms, only kept apart by electron degeneracy. The Pauli exclusion principle of quantum mechanics disallows two fermions to simultaneously occupy the same quantum state. For a Sun size core there is not enough gravitational pressure to overcome this, so the mass of atoms settles into a super-hot white dwarf. A white dwarf's surface temperature can range from 4,000°K to 150,000°K and the interior well into the millions of degrees Kelvin. Its surface is composed of degenerate oxygen and carbon atoms, and the interior thought to be totally ionized plasma. With not enough heat or pressure to start fusion, the white dwarf slowly cools, crystalizes, becomes the theoretical black dwarf. This process could take a trillion years, so don't wait up. Meanwhile, the plasma, gas, and dust that puffed off the still fusing core has formed shells around the white dwarf and intense radiation from the white dwarf causes the shells to fluoresce in several colors. It's a Planetary Nebula. That's the future for our Sun. You can see versions of this by observing/imaging planetary nebulae. Our eyes are not sensitive enough to see their colors, but long exposure images bring the colors out and they are brilliant!

Spring is not the ideal time for planetary nebulae but there are a few notables to catch.

M97 (Owl), NGC 3242 (Ghost of Jupiter), NGC 2438 (in front of M46)



Imagining Imaging: Imaging Articles Needed!

Cover Story> SOFIA and Airborne Astronomy

Airborne astronomy has been around about as long as humans were able to send cameras into the sky. Mountain tops, balloons, bi-planes, little jet planes, and big jet planes – all are used to get cameras away from image (especially infrared) ruining atmospheric water vapor.

Ever watch shows about air disasters? It seems you shouldn't open hatches while the plane is at 45,000 feet! Video from events like that are similar...everything in the cabin, including people, swirling around. Things, including people, getting sucked out of the opening. That's a recipe for disaster.

And, apparently, a recipe for an observatory. That's right, an airplane with a gaping hole in its side and a telescope looking out. On the face of it, this sounds unlikely. Yet, with design and engineering advances, it became a reality way back in 1965! How embarrassing, there have been aircraft observatories for over 50 years, and I was mostly ignorant of it.

OK, I got to the party late – while SOFIA was doing astronomy, and had been unaware of SOFIA's predecessors: Galileo, Learjet, and Kuiper. So, a little airborne observatory history is due.

The concept of high-altitude astronomy is solid – get above 99% of the atmosphere for a much clearer view, especially with infrared light – which is absorbed by atmospheric water vapor. Starting in 1957 Helium balloons took instruments up to the edge of space but were not maneuverable and had little in the way of corrective measures if problems with instruments arose. An observatory within a jet aircraft was something NASA contemplated in the early 1960's. Planes can go pretty much anywhere, up to 50,000 feet altitude, with scientists and engineers on board. Once solutions to mitigate challenges such as airstream turbulence, vibration, air pressure differentials, and temperature variations were developed NASA just needed a plane.

Meanwhile, the United States and Soviet Union were racing to see who would be first to land a human on the Moon! Maybe that's why little media attention was given to NASA's first airborne astronomical observatory...*Galileo*.

The Galileo Airborne Observatory was produced from a General Dynamics Convair-990 aircraft – similar to and in competition with Boeing's then current 707. It was fitted with 13 ports on its upper left fuselage, with 12" telescopes used primarily for viewing/recording total solar eclipses. The first version, Galileo I was destroyed on April 13, 1973, ending on top of a Navy P-3 Orion aircraft as both approached landing on the same runway. Only one person survived, from the Naval craft. Its replacement, Galileo II was destroyed in 1985 after metal from a wheel failure pierced the wing fuel tank, causing a fire during takeoff. Fortunately, all survived.



The next observatory was a Learjet 23 fitted with a 12" infrared telescope, commissioned in 1968 and used into the 1970s.



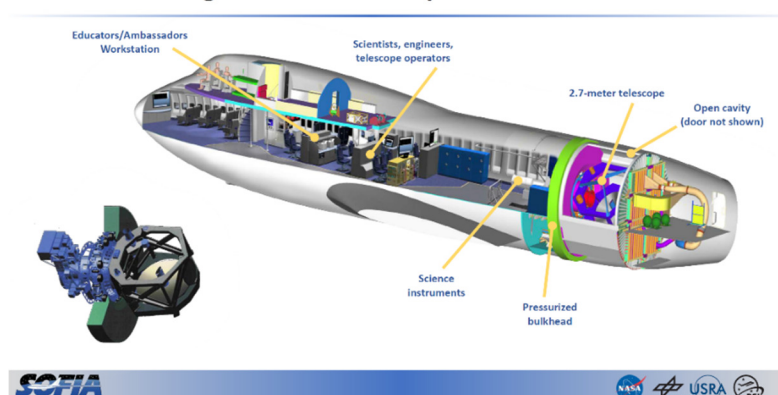
Then came *Kuiper* – a converted C-141, fitted with a 36" Cassegrain telescope. It provided a platform for research from 1975 to 1995, discovering rings around Uranus, Pluto's tenuous atmosphere, a ring of star formation around the Milky Way's center, complex organic molecules in space, water in comets and in Jupiter's atmosphere.



The latest and probably last airborne observatory, SOFIA (Stratospheric Observatory For Infrared Astronomy) was the best of the bunch. Conceived of in 1984, NASA first proposed they and German Space Agency DLR (Deutsches Zentrum für Luft- und Raumfahrt) team up (80% NASA, 20% DLR) to create SOFIA – from a highly modified Boeing 747 SP aircraft. Due to the reunification of Germany and budget changes at NASA the project did not begin until 1996. It was to have the largest airborne telescope, with a 2.5 - meter (100") diameter mirror, made in Germany. The mirror was a lightweight honeycomb design using Schott Glass's new Zerodur glass/ceramic substrate with nearly zero expansion, so it was not affected by dynamic ambient temperatures.



SOFIA Boeing 747-SP Platform Layout



The telescope is configured as a Cassegrain reflector with a f1.3 parabolic primary and remotely adjustable hyperbolic secondary, giving a final focal ratio of f19.7. A flat dichroic coated tertiary mirror sends infrared light to the Nasmyth focus for evaluation.

SOFIA's instrument capabilities included mid-to-far infrared imaging, spectrographic, visible light imaging, and a new instrument – the HAWC+ (High-resolution Airborne Wide-band Camera Plus) to produce data for spectacular images of large scale magnetic fields.

Guess what? More delays. In 2001 three subcontractors went out of business and United Airlines pulled out of the project as the plane's operator – it entered bankruptcy litigation. SOFIA did finally get finished and test flights commenced in 2007.

SOFIA's primary missions included examining our solar system planet's atmospheres and surface structures, cometary structure and composition, analyze interstellar medium, and observe stellar and planetary system formation. Some of SOFIA's accomplishments include examining Pluto's exceedingly thin atmosphere, molecular oxygen in Mars' atmosphere, detecting water on the sunlit portion of the Moon, and observing the occultation of a star by Kuiper Belt object 486958 Arrokoth – helping preparations for New Horizons to visit it. Its HAWC+ camera system has produced mesmerizing images of how magnetic fields around galaxies are warped by interactions with other galaxies.

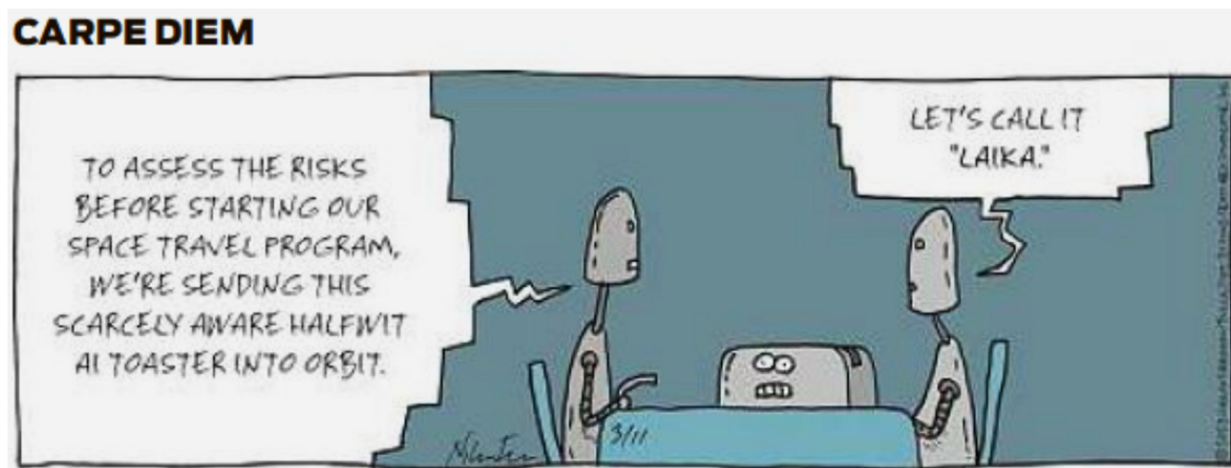
SOFIA was also part of NASA's public outreach with its Airborne Astronomy Ambassadors Program, partnering with educators from K-12, science museum and planetarium educators.

During SOFIA's earlier lifetime it had a controversial reputation for excessive costs to run it, around \$85 million per year while not producing the amount of data expected. In later years new management of SOFIA's projects doubled its output but that did not sway decision makers as they cut funding and cancelled SOFIA.

SOFIA saw first light on May 26, 2010 and last light on September 29, 2022. It currently resides at the Pima Air & Space Museum in Tucson, AZ.

Eric Erickson

Lagniappe





THE BRILLIANT MIND OF EDISON LEE



LUANN

BY GREG EVANS



CARPE DIEM



CRANKSHAFT



BLISS



"I wonder if Buzz Aldrin ever stood outside at 3 a.m. waiting for a puppy to finish."

SPEED BUMP



NON SEQUITUR



WUMO

