★BUFFALO ASTRONOMICAL ASSOCIATION★

THE SPECTRUM

November/December 2018

MULTIMESSENGER ASTRONOMY

ADVICE TO A BEGINNER AMATEUR ASTRONOMER

NASA RETIRES KEPLER

THE MANY REASONS TO ATTEND AN OUTDOOR ASTRONOMY CONVENTION

The Official Newsletter of the Buffalo Astronomical Association

UPCOMING EVENTS

TABLE OF CONTENTS

ABOUT THE COVER

Image of M20 and M8 by Dennis Bartkowiak - to view more visit the BAA forums at http://www.buffalo-astronomy.com/community

CALENDAR

November 9	7:30 pm	General Meeting
December 14	7:30 pm	Genearl Meeting - Xmas party
January 11	7 pm	Genearl Meeting @ Williamsville Planeterium
February 8	&;30 pm	General Meeting
March 8	Dusk	Geneal Meeting
April	8pm	Annual Dinner Meeting

SEND CALENDAR EVENTS TO
Mike Humphrey thespectrum@buffaloastronomy.com
FOR THE LATEST INFORMATION ON CLUB EVENTS,
visit http://www.buffaloastronomy.com/events

MEMBERSHIP APPLICATION

You can join (or renew) at the organization web site, http://www.buffaloastronomy.com.
Click the 'Membership' Tab. To Join by mail Send funds to address shown along with the following information: Name, Address, Phone Number, Special Interests in Astronomy, Do you own a Telescope? (If so, what kind?), and where you first heard of The BAA.

BAA DIRECTORY

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Dan Marcus
Gene Timothy

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Mike Humprey
SPECTRUM LAYOUT
Mike Humprey
WEBMASTER
Gene Timothy

CHECK THE WEBSITE

BUFFALOASTRONOMY.COM

The BAA website not only has news and information about our association, but also a variety of features to manage your membership and connect with other club members. Current members can post photos, trade gear, pay dues, manage discount magazine subscriptions, swap stories in the forum, and more. Questions about the site? Need a hand to get your account set up? Contact webmaster@buffaloastronomy.com

BAA MEETINGS

All meetings are held at the Buffalo State College classroom building. For directions to the location and more information see the last page.

GENERAL MEETING

7:30 P.M. room C122
Classroom Building

"TUESDAY" NIGHT IMAGERS MEETING

AS POSTED by Dan Marcus via the MEMBERS ONLY @ BMO

GENERAL MEMBERSHIP MEETING

The Buffalo Astronomical Association holds its regular monthly General Membership Meeting on the second Friday of each month.

BOARD OF DIRECTORS MEETING

The Board of Directors Meeting is held on dates and at locations scheduled by the board. Information provided to The Spectrum will be published. The meetings are open to all members of the Club in good standing. Attendance is encouraged.

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Online at
www.buffaloastronomy.com

NOVEMBER GENERAL MEETING

JOIN US FOR THE NOVEMBER GENERAL MEETING

Our November general meeting will be held at Buffalo State College Classroom C122 @ 7:30pm. Tech Night. We will have presentations by BAA members and break sessions on the top topics chosen through the website poll. Stop in for and a few surprises.

Meeting notes:

December 14: Annual Christmas Party; It's about food, fun, and friendship, with a little astronomy thrown in the mix. Join us and bring a plate to share, or just enjoy the company and conversations with fellow astronomers

Notice: What do Clark Kent and Peter Parker have in common? They both worked for a newspaper! It was the one place they found the same freedom and excitement they had in their alter egos without the fear of being injured by a super villain. You can have that same feeling too. We are looking for an editor for our newsletter, the Spectrum. You are reading it, why not work on it? If you are interested, please email Mike Humphrey. (jetpac@iname.com- put "Spectrum Editor" in the subject line) and we can discuss the opportunity. Note: Everyone is welcome to apply, even if you don't have a super alter ego.

Mark your Calendars! The 2019 January BAA general meeting will be our annual trip to the Williamsville Planetarium. Mark Percy will be presenting a program in the dome that is sure to please. Updates about the presentation topics will appear on the website in December. Stay tuned

Please note: For this event, the start time is 7:00 pm rather than the usual 7:30.

Treasury Update

Balances as of 10/12/2018

1729.17	Checking
29028.07	Money Market
1249.07	PayPal

Total
32006.31

BAA T-Shirts

Show your support for the BAA

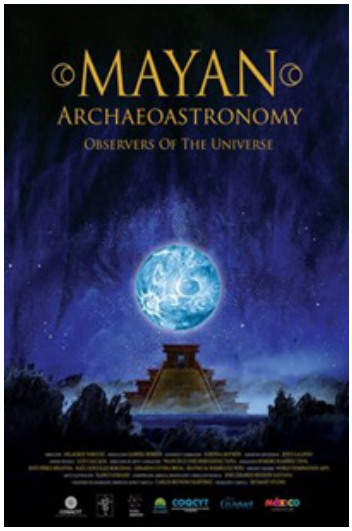
The BAA has a new logo and with it we have new T-Shirts available for Purchase. each T-Shirt is $10 and can be prepaid and ordered by seeing Gene Timothy.

January General Meeting

Meeting at the Williamsville Space Lab Planetarium
January 11, 2019 – starting at 7:00 pm

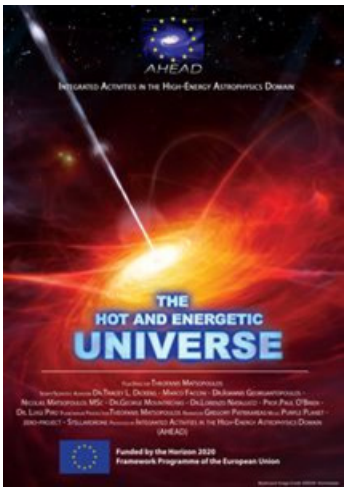
January Meeting Poll will be live soon, so go make your voice be heard for your choice of what you would like to see presented.

Choices for about an hour of immersive full dome program(s):
#1 – Ancient Astronomy - Mayan Archaeoastronomy
#2 – High Energy Astro - The Hot and Energetic Universe
#3 – Solar Science - The Sun: Our Living Star
Any two from above or one below
#4 – Exoplanets and Alien Life – Distant Worlds, Alien Life



Mayan Archaeoastronomy: Observers of the Universe

Length: 20 Minutes
Observers of the Universe is unique among planetarium shows, intertwining science and mythology to take the viewer on a poetic journey through how the Mayans have viewed and understood the Universe throughout their history. The visuals are stunning, giving the viewer the impression of being inside a beautifully stylistic painting. This artistic interpretation of the Universe makes for a journey that will not be forgotten.

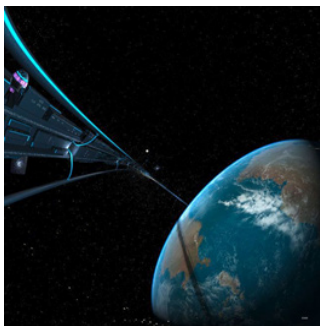


The Hot and Energetic Universe

Length: 30 Minutes
The planetarium documentary "The Hot and Energetic Universe" presents with the use of immersive visualizations and real images the achievements of the modern astronomy, the most advanced terrestrial and orbital observatories, the basic principles electromagnetic radiation and the natural phenomena related to the High Energy Astrophysics. High Energy Astrophysics plays a key role in understanding the universe. These radiations reveal the processes in the hot and violent universe. High Energy Astrophysics probes hot gas in clusters of galaxies, which are the most massive objects in the universe. It also probes hot gas accreting around supermassive black holes in the centers of galaxies. Finally, high energy radiation provides important information about our own galaxy, neutron stars, supernova remnants and stars like our Sun which emit copious amounts of high energy radiation.

The Sun: Our Living Star

Length: 25 Minutes
The Sun has shone on our world for four and a half billion years. The light that warms our skin today has been felt by every person who has ever lived. It is our nearest star and our planet's powerhouse, the source of the energy that drives our winds, our weather and all life. The passage of the Sun's fiery disc across the sky — day by day, month by month — was the only way to keep track of time for countless past civilizations. Don't be fooled by the terminology; although it is a typical dwarf star, the Sun consumes 600 million tons of hydrogen each second and is 500 times as massive as all the planets combined. Discover the secrets of our star in this planetarium show and experience never-before-seen images of the Sun's violent surface in immersive fulldome format.



Distant Worlds, Alien Life

Length: 53 minutes
The night sky is a view of infinity. Does alien life exist out there? Nothing we can ask about the universe is so important for our understanding of the world. In the show we examine the conditions for a habitable zone starting the journey in our own solar system. Then we imagine a tour to some of the recently discovered exoplanets orbiting other stars in the Milky Way. What might be essential for life on distant moons or planets and how could we detect it? We get an impression of the importance of telescopes, Mars rovers like "Curiosity" and space probes for these challenging studies.

OBSERVATORY REPORT

The latest Observatory news

All computers seem to be running properly AGAIN at the Observatory. (Until windows 10 does something stupid AGAIN). Since we had a long cloudy stretch the Tues Nigh Group has started inventorying the Observatory and digging up all the old equipment and testing it. Found the mount for the fiberglass tube 6" refractor under the floor – it is awaiting someone to test it out on a clear night. The 8"LX200 GPS scope's hand paddle had died, we have purchased a new one and it is back in working order. The large screen TV in the new warming room died Rick G had previously repaired the bad capacitors in it last time and it has been replace with a new 43" TV.

Tuesday Night at the Observatory:

WARNING: Want to find out when "Tues Night at the Obs" (TNatO) will occur? I have now completely switched over to the clubs forum as a means of communicating when Tue Night will be :-) . If you need help joining and using the Clubs Forum, please contact me at DMa3141551@msn.com.

We actually had a clear Moonless night (on a Tues no less)in October with the temperature hovering around 68 degrees and NO dew to speak of. Seems we had to reload the Ascom and the ATIK drivers and after remembering to turn on the camera cooler, life got better. Mike P wanted to try his ASI1600 with a 2x barlow on the NP101 for more image scale. We used APT for image acquisition, and PHD2 for autoguiding. We could use a second USB3 so we can automatically dither using 2 cameras. Currently there is only one USB3 cable going to the mount, and that only connects to the right hand computer. If we replace the flakey USB2 cable going to the left hand computer with a new USB3cable we can run both cameras on the same computer as we control the Telescope with. That will allow us to dither and use both cameras to automatically image so we can do do something else- like fix stuff.

Here are the two images of IC1396, C-14 and clubs camera, and NP101 with Mikes camera. If someone wants the raw images to process themselves to see if they can get a better image (bet most of you can!) come out on a Tues night or bring memory stick to a meeting.

Loaner Scopes:

The Observatory has several loaner scopes you can check out for 4 weeks at a time. We have a Celestron 8" on a tracking German Equatorial Mount and a 6" Dobson. If you wish to borrow one of these scopes, see Gene Timothy on a "Tues" night.

Astronomy Adventures: Do you want to chase and Asteroid occultation, Grazing Lunar Occultation, Clear dark skies to image? I'm always up for an adventure, so give me a call. I will also be posting to the Tues group as well as on our web site any ISS transits of the Sun or Moon.

Astronomy Adventures:

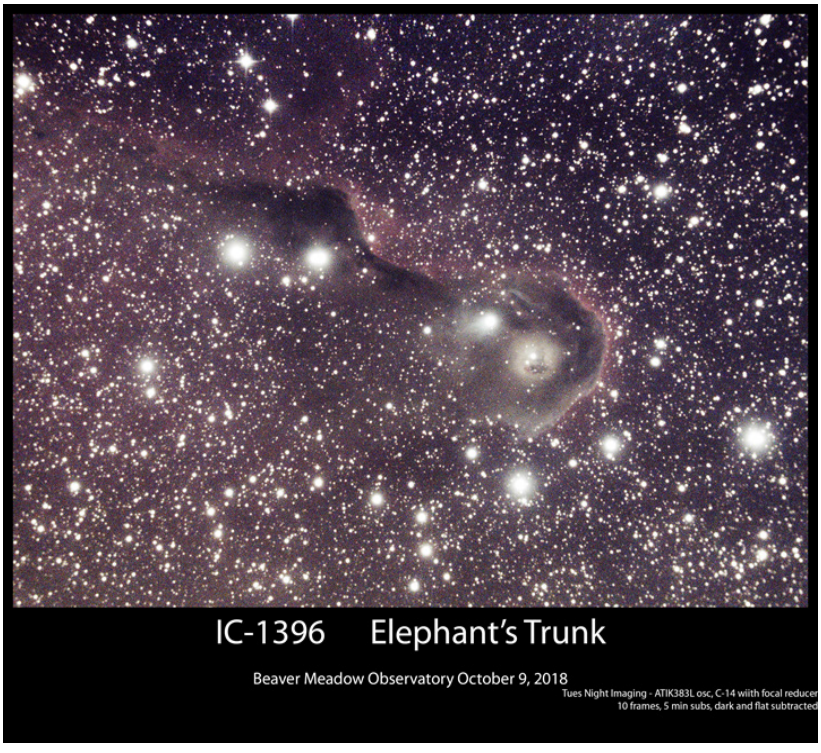
Well I have penciled in an Annular Eclipse trip October 14, 2023 – Looks like Arizona will be the pimary target location. Not as much fun as a total, but good practice for the April 8, 2024 total. Still looking for a good asteroid occultation, Grazing Lunar Occultation event, so stay tuned.

If you are planning an astronomy adventure and want company, I'm always up for an adventure, so give me a call. I will also be posting to the Tues group as well as on our web site any ISS transits of the Sun or Moon.

The usual schedule for BAA events: always subject to change, we may be changing BAA meeting times and locations so stay tuned for email meeting updates!

Nov 9 BAA Meeting at Buffalo State 7:30pm
Dec 14 BAA Meeting at Buffalo State 7:30pm- Holiday Party

See you at the Observatory!
Daniel Marcus
Gene Timothy



BAA Outreach Update November 2018

Even though the Public Astronomy Night Season came to a close in October, we've still been busy with Outreach activities. We always have a lot of fun and it's a rewarding experience for members that participate. Unfortunately, this time around we didn't take any photographs, but the following is offered as a summary of our activities.

Immaculate Conception School:

On October 9th, Tom Heyer and Phil Newman visited a 6th Grade Science class at Immaculate Conception School in East Aurora. The focus of the trip was the Solar System. Materials and activities were presented in the classroom and two telescopes (one H-alpha and one with a white light filter) were set up outside for viewing the Sun, as the weather actually cooperated for a change. Tom and Phil provided the class of 28 students views of the Sun, although devoid of sunspots, did exhibit a nice prominence. The program was very well received and the teacher was complementary. The following is an excerpt of an email received after the event:

"Everything went wonderfully!! The students loved it and Tom and Phil were great with the students. They are so knowledgeable and it was interesting listening to them. I couldn't of asked for a more perfect morning. "

Many thanks to Tom & Phil for taking the time out of their busy schedules to participate in this event. Additional thanks to Mike Humphrey and Dan Marcus for their efforts in planning the event and providing materials.

Allendale Elementary School:

On October 24th Allendale Elementary School held a Harry Potter Reading Celebration Event. The school contacted us, as there is a strong connection to the stars and constellation in the popular series of books. Dan Marcus, Phil Newman, Mike Humphrey, Dennis Bartkowiak and I participated in this fun event for the school's 3rd to 5th grade students. As is typical of this time of the year, the weather was not cooperative forcing us to set-up inside in the Gymnasium. Several pictures of the planets were taped to the Gymnasium wall and students and parents could view them through Phil's Questar and my Dob. Phil had a nice setup with his laptop and two monitors. He displayed an eclipse video, ISS Sun transit video and several pictures. Dan had a camera setup on his Astroscan. Dennis brought his meteorite collection, which is always a big hit! Mike brought some Star Charts and Night Sky Network materials and activities. The school was very pleased and would like us back, hopefully on a clear evening. Many thanks to Dan, Phil, Dennis, and Mike for sharing their time, expertise and passion for astronomy!

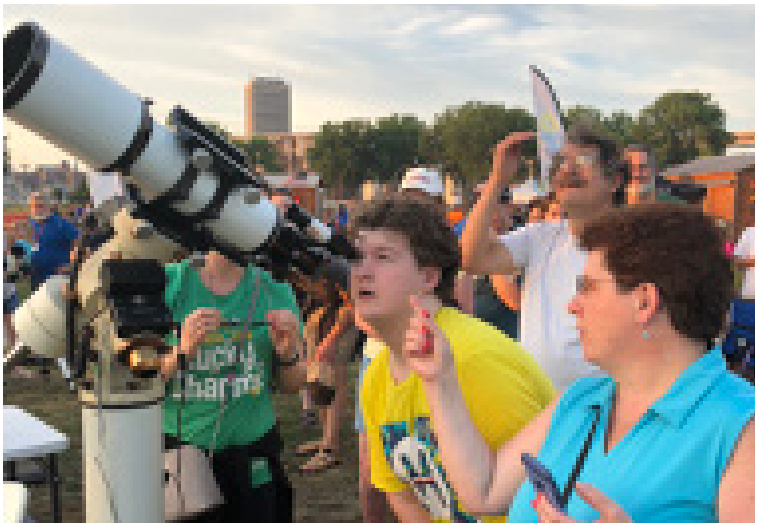
Upcoming Events:

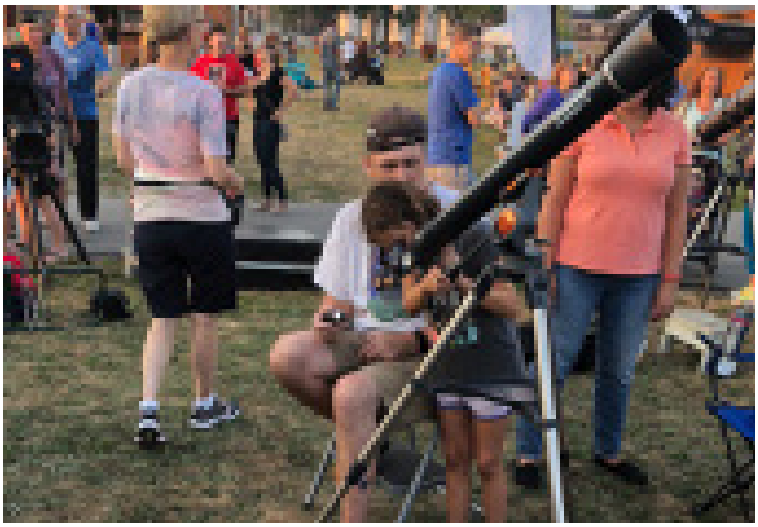
Mike Humphrey will be holding an event at a retirement home in Getzville on Wednesday November 7th. This hour-long program for the residents of the Weinberg Campus, will be during the day and will primarily focus on the Sun.

We receive new requests all the time. If you know anyone that would be interested, direct them to our Website at https://buffaloastronomy.com/outreach-program. Participating in Outreach events is important and vital part of what our organization does. It is also a lot of fun and very rewarding. Consider volunteering. You don't have to have a telescope or be very experienced. We can provide materials and training.

Ernie Jacobs








Wileson Pointe Astronomy on the pointe - August 3rd, 2018

THE MANY REASONS FOR ATTENDING AN OUTDOOR ASTRONOMY CONVENTION

by Carl Milazzo

Until Riverside came about in 1968, the only one for 40 years was Stellafane. Today there are about 50 amateur astronomy conventions, all over the U.S. and Canada, all formed and operated by astronomy clubs. They are be¬coming very popular,and almost all are growing in attendance. About half dozen have attendances of over 1,000 people each year, and growing.The following are some of the reasons, why people go back just about every year.

1. To escape light pollution and trees blocking the southern horizons,and those nasty bugs.
2. to talk to hundreds of amateurs from all over the state, country and the world,to compare views and equiptment. To watch experts in action under the stars, to ask them questions, or some help. This also gives an experianced amateur a chance to help out a beginner. It's fun wondering over a field, both day and night, checking out hundreds of different types of home-made and commercial scopes, and assessories. And it is fun showing some of your equipment and some of your favorite objects up in the night sky.
3. Catching some of the formal talks, going on all morning and afternoon,given by top quality experts, from all over the world,both amateur and professional. If you have questions,they have answers,and even an autograph
4. Have you ever looked through a giant telescope,from a dark location,maybe a 25, 30, 36, 41 incher at 700 power, come to a convension. Ever use a voice activated scope and image intensifier eyepiece, or a portable observatory,come to a convension.Or try out an equatorial platform, dob-driver,a visual spectrascope, come to a convention.
5. To come and look over the latest that the commercial dealers have with them. Like scopes, eyepieces, books, charts filters etc.
6. Looking for some Bargains or some hard to find parts for a home-made project- try the swap table, or sell some of your astronomy belongings to upgrade to something better or different
7. Every now and then, there are workshops on observing or making scopes and other apperatus or imaging. Or you can offer to put on a workshop.
8. Over the years, some of your astronomy friends will move out of your local area or drop out of the club. Often you may run into them at an astronomy convention.
9. Conventions are a great place to make new friends or to finally meet an amateur you know from the internet, who lives far away.
10. At a convention you can give an informal short talk, during amateur hour of a serious note or something funny like a personal experience.
11. On a cloudy night, you can sit on a lawn chair and have a long discussion as a small group. You can exchange information, brainstorm, tell stories dream up wild ideas, discuss your local area, talk about how you got, started etc.
12. You can observe as a large group, so that you will out-number the wild creatures with the glowing eyes that make spooky noises. As an extra bonus you can hear the oohs and aaghs, from the hundreds of amateurs as a fireball flashes overhead.

Vice-President and Membership Message

Hi everyone. I wanted stop and take a moment to thank you for your continued support of the Buffalo Astronomical Association. With your participation, I firmly believe that the BAA experience will be even greater. As we continue to move forward and have more exciting opportunities to share all of the various aspects of amateur astronomy, I would love to hear from you. What would you like to see, what type of events would you like to have, what can we do to make our group better?

I especially would like to note that Gene Timothy has worked hard to continue the updates and refinement of the website. He has provided you with a customized expansion and increased ability to interact as a group. There are currently plans to make The Spectrum a members only benefit as has been done with The Member Forums. If you haven't had the opportunity to check out the updated website (http://buffaloastronomy.com) I hope that you might be able to find a little time to do so. This online connection provides a wonderful infrastructure for us to serve and easily communicate together.

Our process of joining and active renewal is straightforward, as many of the current 103 active members have found. We have moved to a rolling year membership. Joining and Active Renewal is just a simple click away. You have access to your personal profile,account, members only directory, members only forums along with opportunities to volunteer at events and activities.

If you have any questions or issues with the website please contact me so that I can personally resolve the situation. Has your active membership lapsed? Just let me know and I can resolve any issues you experience. Please feel free to email, text or call me.

As we focus on practical astronomy and sharing here's to clear skies and looking forward to all the exciting opportunities we have ahead.

Dennis Bartkowiak
BAA Vice-President and membership Chair
membership@buffaloastronomy.com
716-207-2316

HUBBLE REVEALS A GIANT COSMIC 'BAT SHADOW'

Shadows on Earth can be mysterious and foreboding, but when they occur in space, they can convey information we otherwise could not know. In a stellar nursery called the Serpens Nebula, nearly 1,300 light-years away, a young star's game of shadow play is revealing secrets of its unseen planet-forming disk. The near-infrared vision of NASA's Hubble Space Telescope captured the shadow cast by the fledgling star's brilliant light being blocked by this disk.

Named HBC 672, this Sun-like star is surrounded by a debris ring of dust, rock and ice — a disk that is too small and too distant to be seen, even by Hubble. But like a little fly that wanders into the beam of a flashlight shining on a wall, its shadow is projected large upon the cloud in which it was born.

In this Hubble image, the feature — nicknamed the "Bat Shadow" — spans approximately 200 times the length of our solar system. It is visible in the upper right portion of the picture.

"This is an analog of what the solar system looked like when it was only 1 or 2 million years old," explained Klaus Pontoppidan, an astronomer at the Space Telescope Science Institute (STScI) in Baltimore, Maryland. "For all we know, the solar system once created a shadow like this."

The presence of a shadow means that the disk is being viewed nearly edge-on. This is something that could not otherwise be known because of the disk's great distance from us, which makes it too small to be seen by Hubble.

The disk's shadow is similar to what is produced by a cylindrical lamp shade. Light escapes from the top and bottom of the shade, but along its circumference, dark cones of shadow form. Although the disk that gives rise to the shadow is a common object around young stars, the combination of an edge-on viewing angle and the surrounding nebula is rare.

Scientists can use the shadow to figure out the shape of the disk. For example, they now know that the disk is puffy, which implies that it is full of gas. While most of the shadow is completely opaque, scientists can look for color differences along its edges, where some light gets through. They can use the shape and color of the shadow to determine the size and composition of dust grains suspended in the disk.

"These shadows are not easily seen in visible light, but the stellar disks and the shadows they project onto the surrounding nebula can be easily detected in infrared light," said Max Mutchler, a research and instrument scientist at STScI. "This infrared Bat Shadow reveals properties of both the small, dusty disk and the much larger nebula."

The shadow is an example of what the future James Webb Space Telescope will be capable of studying in even greater depth. "Webb's power lies in its ability to see into the dust and gas of these disks to understand the material that comprises these environments that form planets," explained scientist Alexandra Lockwood of STScI.

A similar-looking shadow phenomenon emanates from another young star, at the upper left of the Hubble image. At the lower right, what appears to be a void is likely a part of a foreground cloud. Light from the red, double star inside the void is partially blocked by this cloud.

The image will be used with NASA's Universe of Learning to illustrate how shadows can convey information about phenomena invisible to us. This program creates materials and experiences to enable learners to explore the universe for themselves. NASA's Universe of Learning materials are based upon work supported by NASA under award number NNX16AC65A.

The Hubble Space Telescope is a project of international cooperation between NASA and ESA (European Space Agency). NASA's Goddard Space Flight Center in Greenbelt, Maryland, manages the telescope. The Space Telescope Science Institute (STScI) in Baltimore, Maryland, conducts Hubble science operations. STScI is operated for NASA by the Association of Universities for Research in Astronomy, in Washington, D.C.

For more information about NASA's Universe of Learning, see: https://www.universe-of-learning.org

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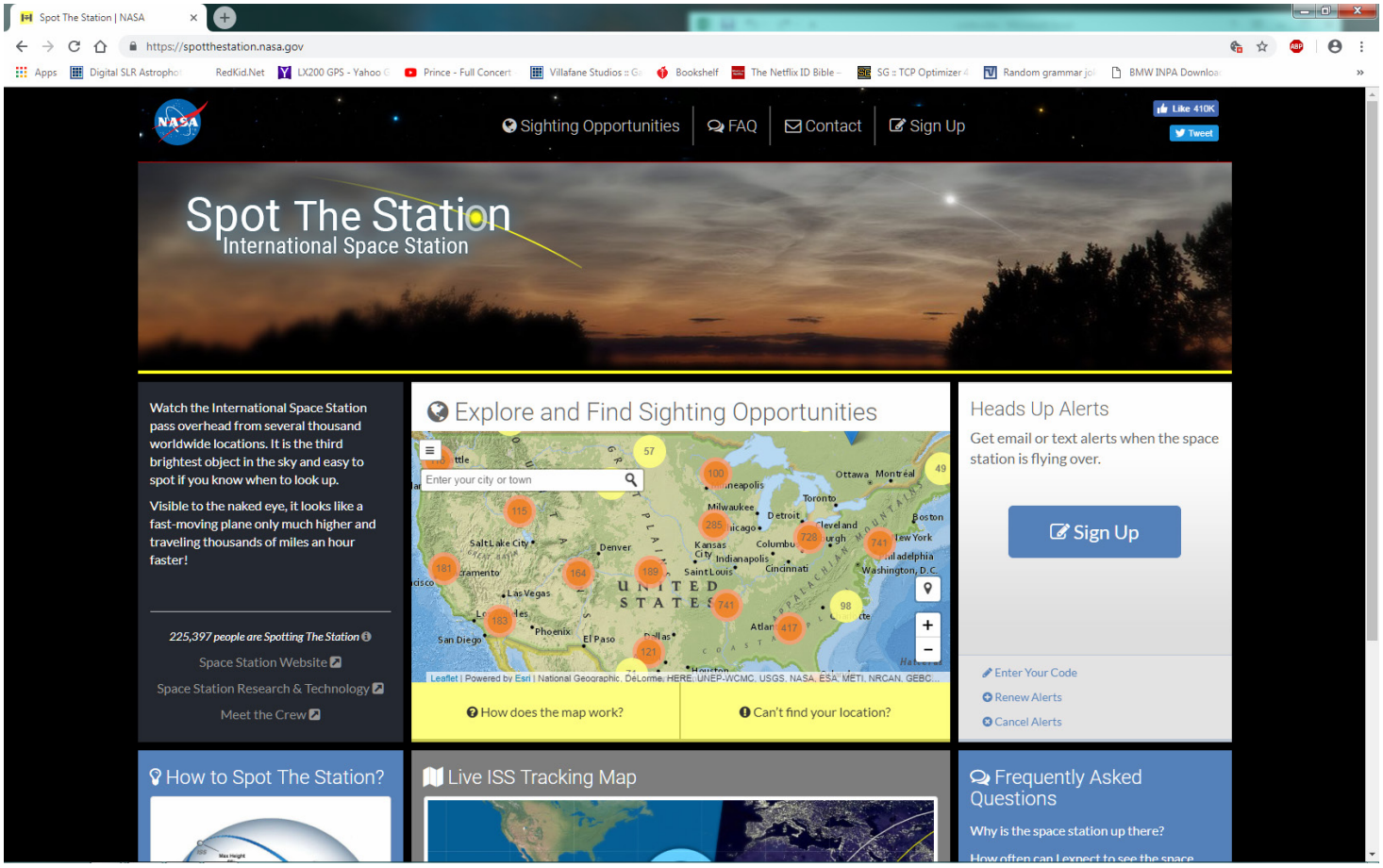
Credits: NASA, ESA and STScI
Last Updated: Oct. 31, 2018
Editor: Karl Hille

SPOT THE INTERNATIONAL SPACE STATION

https://spotthestation.nasa.gov/

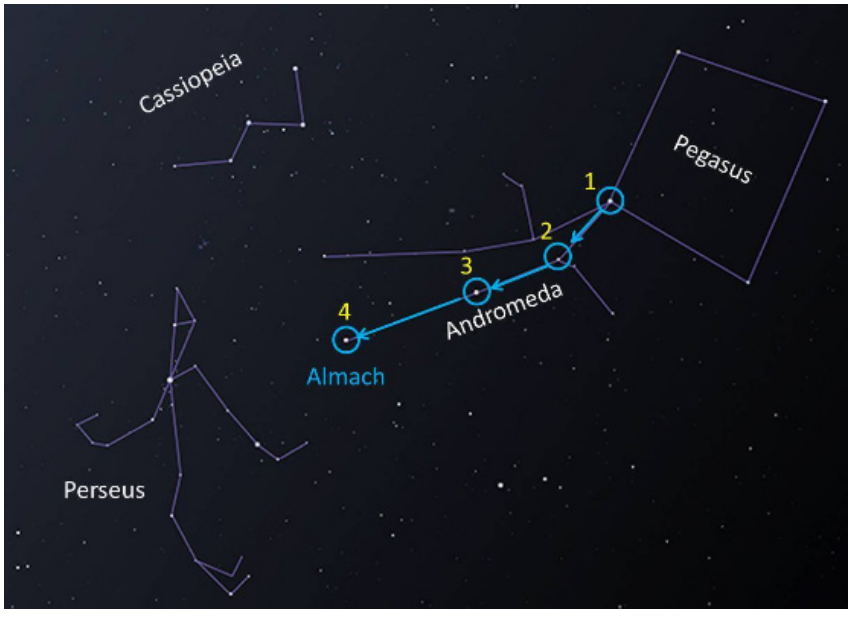
Want to see the International Space Station as it flies by? It is visible to the naked eye as the site says, it looks like a fast-moving plane only much higher and traveling thousands of miles an hour faster! NASA has provided the site below for ISS watchers to get information on when it passes by and much more. Check it out at the link below.



ADVICE TO A BEGINNER AMATEUR ASTRONOMER

By Carl Milazzo

1. Never be afraid to ask a question, many questions, even those that seem to be dumb questions.
2. Ask for advice from many of the club's most active meinbers, not just one.
3. Ask the members who are active in the cold weather months,how do they stay warm on long cold nights.
4. Ask how to find high quality observing sites,that are fairly safe,dark ,free of trees, dew fog, bugs,and traffic.
5. Observe with some of the most experienced members, you will then make quick progress.
6. Inquire about the many helpfull observing techniques,and simple tools.
7. Get help with learning the basics, like the scale system of the sky, like coordinates, degrees, magnitudes, charts, planetsphere, magazines, and books.
8. You will never regret having binoculars,a lounge chair,and a note book,along with a dull red filtered flashlight.
9. Work with many of the best members who are active with computer programs and the internet.
10. Go to several large and small outdoor amateur astronomy conventions, amateur observatories, and local group observing sessions [Star Parties aka Star Nights].interests are, and the conditions of your main observing locations.
11.Now finally ask several long-term members,what type scope to purchase, or build. Tell them what your main interest are and the conditions of your main observing locations.



Learn to Skywatch

The Double Star "Almach" (Gamma Andromedae) One star is Gold, the other is Indigo Blue!
Provided o the left: 3 Star Hops

Multimessenger Astronomy - Providing Real Answers

By Randy Boswell

Long predicted by general relativity field theory, the existence of gravitational waves was first proven on September 14, 2015. Researchers used twin apparatuses known as the Laser Interferometer Gravitational Wave Observatory (LIGO) to observe them. One was situated in Livingston, Louisiana and the other at Hanford, Washington. The LIGO apparatus consisted of 2, 4-kilometer tubes set at right angles to each other. The idea behind this is that a laser-beam shot from one end of each tube hits a mirror at the other end and is reflected back, with its travel time measured. According to physicists, the presence of a gravitational wave moving through the tubes would compact and stretch the tubes by a minute amount or one part in 10^21, which would be reflected in a change in the travel times of the laser-beam.

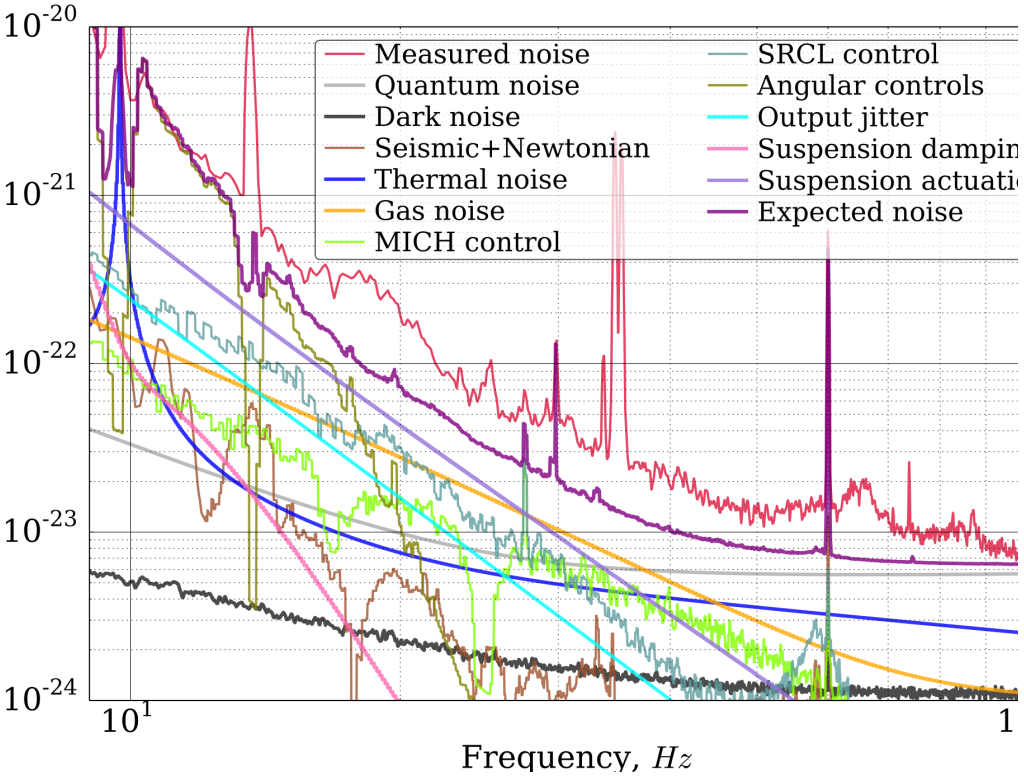
According to general relativity, when two black holes collide the end result is a strong burst of gravitational waves. And this is what the twin LIGO Observatories detected on September 14, 2015. Scientists estimated that the black holes were around 29 and 36 solar masses and the collision took place about 1.3 billion years ago. This marked the first confirmation of the existence of gravitational waves and also marked the first direct proof of the existence of black holes. Although the idea of black holes was put forth as early as the 1800's, up to this point they remained a theoretical construct. LIGO changed that.

Moreover, LIGO brought about a significant change in observational astronomy. By combining the detection of gravitational waves with observations in the electromagnetic spectrum a new vista was opened on the cosmos. Known as multimessenger astronomy, it is providing real answers to enduring questions.

A salient example of this centered on a kilonova or the collision of two neutron stars. On August 17, 2017 a LIGO Observatory in Italy, called Virgo detected gravitational waves. Less than 2 seconds later the Fermi orbiting telescope observed a burst of gamma-rays. Scientists dubbed the event, GW170817 and concluded that it was the collision and merger of two neutron stars. Researchers using ground-based observatories and orbiting telescopes set to the full range of the electromagnetic spectrum located the source to a nearby galaxy, NGC 4993. Electromagnetic radiation was detected in every wavelength, i.e., radio, infrared, visible, ultraviolet, x-ray and gamma-rays. GW170817 was the first time astronomers observed gravitational waves and electromagnetic radiation emanating from the same source. By putting the pieces together, astronomers came up with answers to longstanding problems. Scientists proposed that gravitational waves are generated just before two neutron stars smash into each other as they are spiraling towards each other. The multiple observations that pinpointed GW170817 to a kilonova verified this concept. Moreover, a perennial mystery was solved. The source of the particular type of gamma-ray burst that the Fermi

telescope detected, long unknown to astronomers, was finally determined to come from kilonovae.

In conclusion, multimessenger astronomy represents a new era in astronomy according to researchers. The integration of gravitational wave observations with observations in the electromagnetic spectrum versus observations exclusively in the electromagnetic spectrum is likened by one scientist as comparing an IMAX 3D movie to a black-and-white movie. End.



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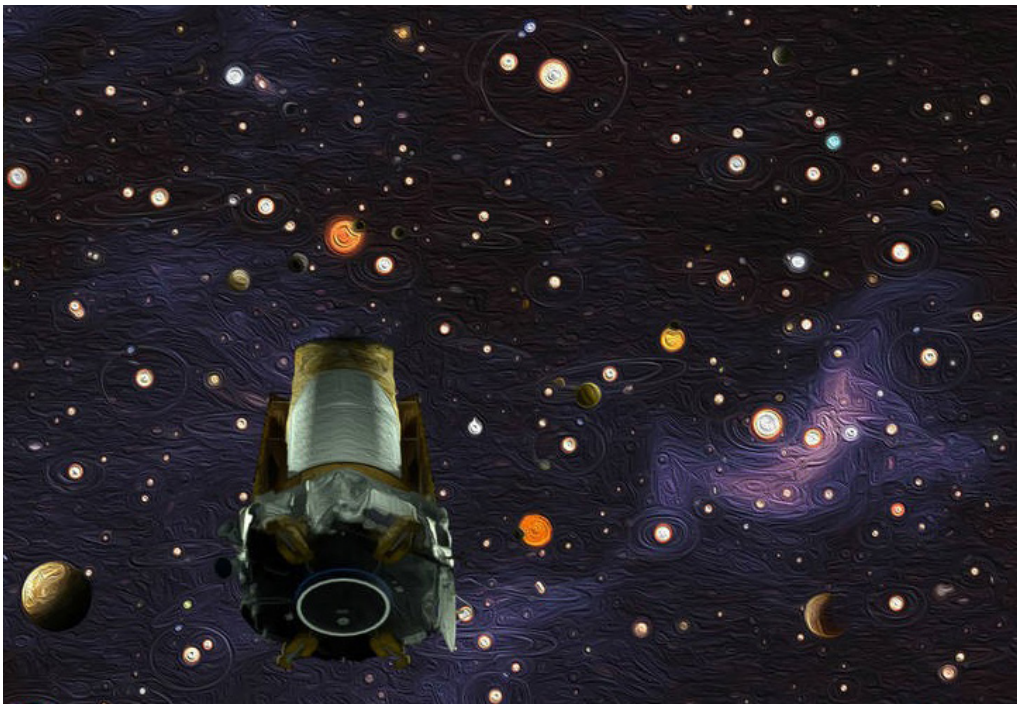
NASA Retires Kepler Space Telescope, Passes Planet-Hunting Torch



This illustration depicts NASA's exoplanet hunter, the Kepler space telescope. The agency announced on Oct. 30, 2018, that Kepler has run out of fuel and is being retired within its current and safe orbit, away from Earth. Kepler leaves a legacy of more than 2,600 exoplanet discoveries.Credits: NASA/Wendy StenzelMore: A New View of Our Starry Night

After nine years in deep space collecting data that indicate our sky to be filled with billions of hidden planets – more planets even than stars – NASA's Kepler space telescope has run out of fuel needed for further science operations. NASA has decided to retire the spacecraft within its current, safe orbit, away from Earth. Kepler leaves a legacy of more than 2,600 planet discoveries from outside our solar system, many of which could be promising places for life.

"As NASA's first planet-hunting mission, Kepler has wildly exceeded all our expectations and paved the way for our exploration and search for life in the solar system and beyond," said Thomas Zurbuchen, associate administrator of NASA's Science Mission Directorate in Washington.

"Not only did it show us how many planets could be out there, it sparked an entirely new and robust field of research that has taken the science community by storm. Its discoveries have shed a new light on our place in the universe, and illuminated the tantalizing mysteries and possibilities among the stars."

Kepler has opened our eyes to the diversity of planets that exist in our galaxy. The most recent analysis of Kepler's discoveries concludes that 20 to 50 percent of the stars visible in the night sky are likely to have small, possibly rocky, planets similar in size to Earth, and located within the habitable zone of their parent stars. That means they're located at distances from their parent stars where liquid water – a vital ingredient to life as we know it – might pool on the planet surface.

The most common size of planet Kepler found doesn't exist in our solar system – a world between the size of Earth and Neptune – and we have much to learn about these planets. Kepler also found nature often produces jam-packed planetary systems, in some cases with so many planets orbiting close to their parent stars that our own inner solar system looks sparse by comparison.

"When we started conceiving this mission 35 years ago we didn't know of a single planet outside our solar system," said the Kepler mission's founding principal investigator, William Borucki, now retired from NASA's Ames Research Center in California's Silicon Valley. "Now that we know planets are everywhere, Kepler has set us on a new course that's full of promise for future generations to explore our galaxy."

Launched on March 6, 2009, the Kepler space telescope combined cutting-edge techniques in measuring stellar brightness with the largest digital camera outfitted for outer space observations at that time. Originally positioned to stare continuously at 150,000 stars in one star-studded patch of the sky in the constellation Cygnus, Kepler took the first survey of planets in our galaxy and became the agency's first mission to detect Earth-size planets in the habitable zones of their stars.

"The Kepler mission was based on a very innovative design. It was an extremely clever approach to doing this kind of science," said Leslie Livesay, director for astronomy and physics at NASA's Jet Propulsion Laboratory, who served as Kepler project manager during mission development. "There were definitely challenges,

but Kepler had an extremely talented team of scientists and engineers who overcame them."

Four years into the mission, after the primary mission objectives had been met, mechanical failures temporarily halted observations. The mission team was able to devise a fix, switching the spacecraft's field of view roughly every three months. This enabled an extended mission for the spacecraft, dubbed K2, which lasted as long as the first mission and bumped Kepler's count of surveyed stars up to more than 500,000.

The observation of so many stars has allowed scientists to better understand stellar behaviors and properties, which is critical information in studying the planets that orbit them. New research into stars with Kepler data also is furthering other areas of astronomy, such as the history of our Milky Way galaxy and the beginning stages of exploding stars called supernovae that are used to study how fast the universe is expanding. The data from the extended mission were also made available to the public and science community immediately, allowing discoveries to be made at an incredible pace and setting a high bar for other missions. Scientists are expected to spend a decade or more in search of new discoveries in the treasure trove of data Kepler provided.

"We know the spacecraft's retirement isn't the end of Kepler's discoveries," said Jessie Dotson, Kepler's project scientist at NASA's Ames Research Center in California's Silicon Valley. "I'm excited about the diverse discoveries that are yet to come from our data and how future missions will build upon Kepler's results."

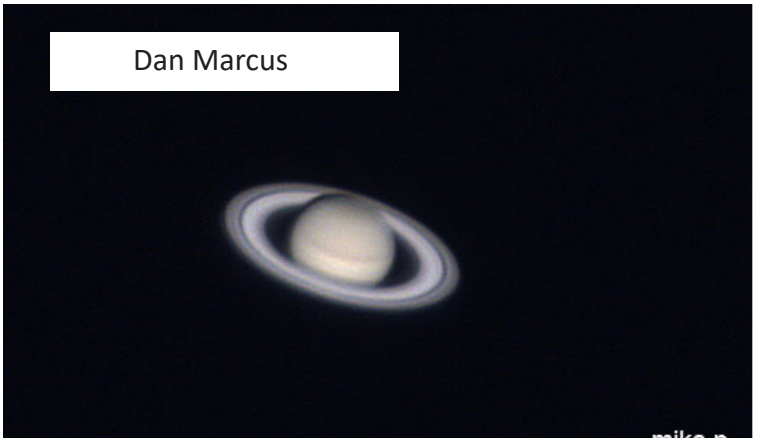
Before retiring the spacecraft, scientists pushed Kepler to its full potential, successfully completing multiple observation campaigns and downloading valuable science data even after initial warnings of low fuel. The latest data, from Campaign 19, will complement the data from NASA's newest planet hunter, the Transiting Exoplanet Survey Satellite, launched in April. TESS builds on Kepler's foundation with fresh batches of data in its search of planets orbiting some 200,000 of the brightest and nearest stars to the Earth, worlds that can later be explored for signs of life by missions, such as NASA's James Webb Space Telescope.

NASA's Ames Research Center in California's Silicon Valley manages the Kepler and K2 missions for NASA's Science Mission Directorate. NASA's Jet Propulsion Laboratory in Pasadena, California, managed Kepler mission development. Ball Aerospace & Technologies Corporation in Boulder, Colorado, operates the flight system with support from the Laboratory for Atmospheric and Space Physics at the University of Colorado in Boulder.

For the Kepler press kit, which includes multimedia, timelines and top science results, visit: https://www.nasa.gov/kepler/presskit

For more information about the Kepler mission, visit: https://www.nasa.gov/kepler


Dennis Bartkowiak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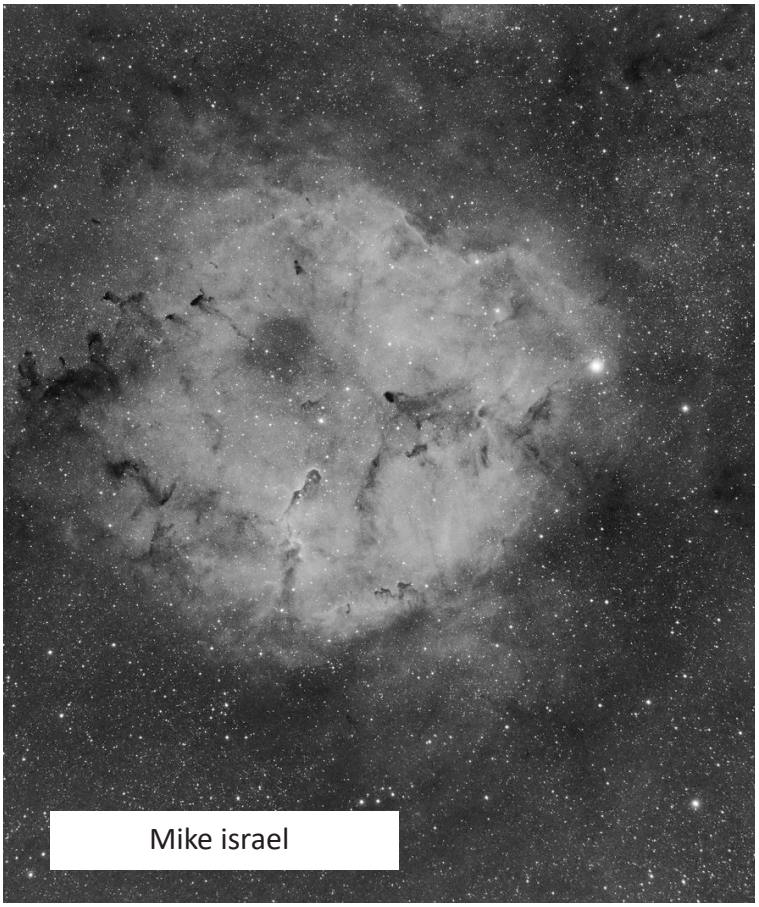
Mike Israel


Mike israel

MEMBER IMAGES

Ernie Jacobs

Ernie jacobs

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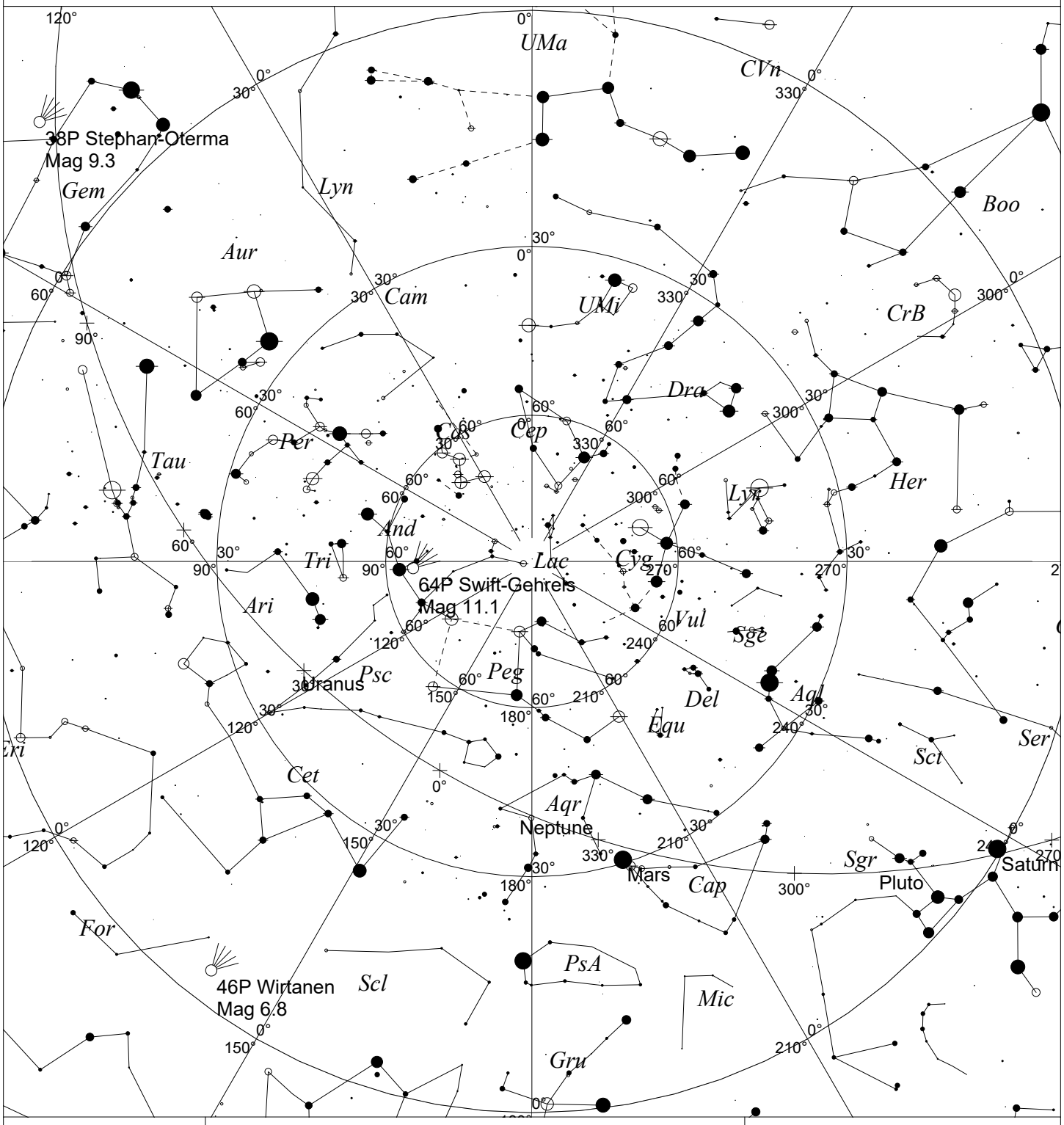

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1.5	4
2	4.5
2.5	>5
3	

SYMBOLS		
Multiple star	Dark nebula	Radio source
Variable star	Globular cluster	X-ray source
Comet	Open cluster	Other object
Galaxy	Planetary nebula	
Bright nebula	Quasar	

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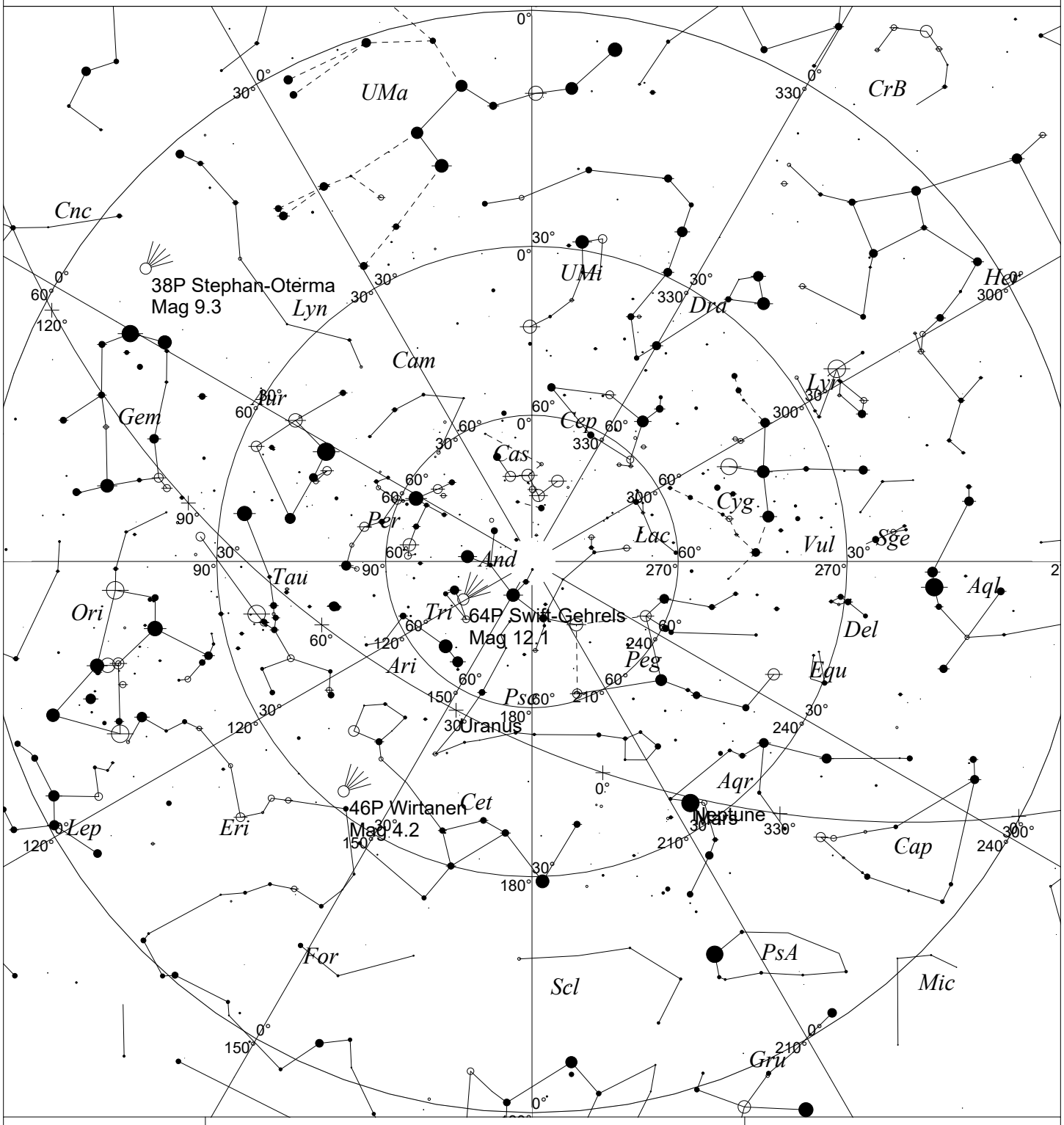
Buffalo 12/7/2018 20:00



STARS

<1	3.5
1.5	4
2	4.5
2.5	>5
3	

SYMBOLS

Multiple star	Dark nebula	Radio source
Variable star	Globular cluster	X-ray source
Comet	Open cluster	Other object
Galaxy	Planetary nebula	
Bright nebula	Quasar	

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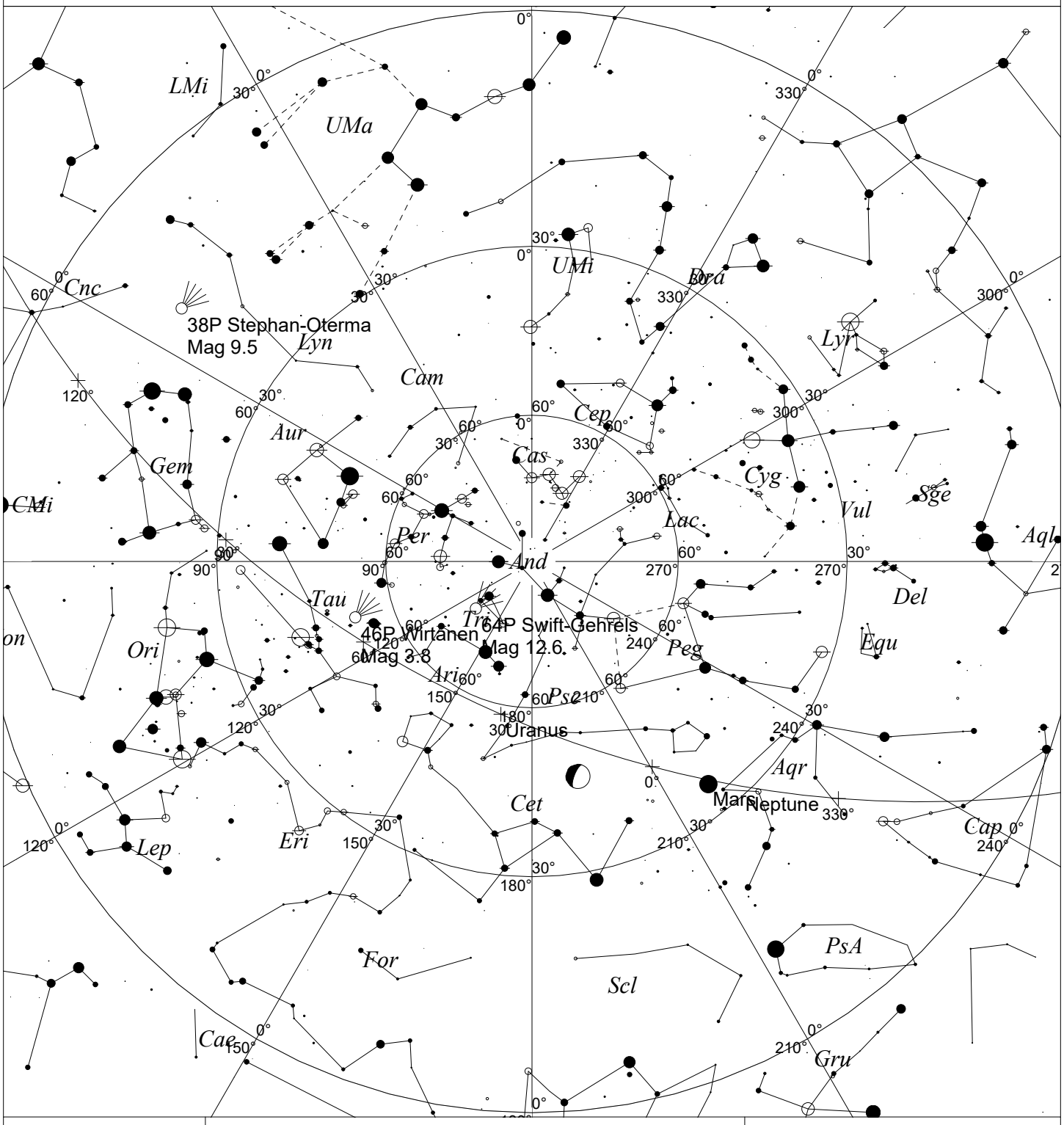
46P Wirtanen 12/16/2018 20:00



STARS			SYMBOLS					
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1.5	4		Variable star	Globular cluster	X-ray source
2	4.5		Comet	Open cluster	Other object
2.5	>5		Galaxy	Planetary nebula	
3			Bright nebula	Quasar	

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- A telescope loaner program -- borrow a BAA telescope and try observing for yourself!
- A monthly kids meeting, site orientation meeting, and general meeting with speakers of interest. Access to meeting videos on the BAA web site. - Opportunities to participate in programs that promote astronomy to the general public (such as Star Parties)
- Meet other amateurs and share experiences, learn techniques, and swap stories.

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