

STAR STUFF

Ford Amateur Astronomy Club Newsletter

Star Stuff

This newsletter is published eleven times per year by:

Ford Amateur Astronomy Club P.O. Box 7527 Dearborn, MI 48121-7527

Officers

President:	Mike Brunc
Vice President:	John McGill
Secretary:	Cheri Grissom
Treasurer:	Arica Flores

Departments

Webmaster:	Liam Finn
Membership:	Doug Bauer
Newsletter:	Tim Campbell
Equipment:	Jeff Gorman
Speakers:	Sandra Macika

Club Information

The Ford Amateur Astronomy Club meets on the fourth Thursday of each month, except for the combined November/ December meeting which meets on the first Thursday of December – at Henry Ford College Administration Services and Conference Center in Dearborn.

President's Corner

by Mike Bruno

After a year of no beginner's nights, it was time to get with the times and on April 10th Virtual Beginner's Night took place. It was a success! Of course, planning an Astronomy event guaranteed cloud cover that evening. But through planning, dedication and knowing we live in Michigan, the support of our knowledgeable membership we went live at 8pm and did not sign off until after 12AM! A Big Thank You to EVERYONE that joined, participated, help organize this broadcast! If you missed it go to the Astronomy for Everyone YouTube channel and see everything that was discussed.

In the not-so-distant future we are hoping to start to get together for an observing night at Island Lake. This will be a club member only activity (the parks limit organized gatherings to no more than 50 people). Contact was made with the park to discuss what plans or precautions were needed if we would like to observe. The park requires that we have a COVID Action Plan (the State Parks have guidance on what must be included in the plan and are providing us with that information) which would be followed for anyone if they chose to join us. As the plan comes together, we will share this with the club, basically standard precautions will be necessary and of course social distancing is one and we will also be able to cordon off an area just for our club. We will discuss further at our upcoming General Meeting on April 22nd and an announcement will be published through Groups.io.

I hope everyone has been staying healthy and been enjoying the random clear skies and look forward to seeing everyone Virtually this Thursday! Clear skies!

Club Information

Refer to our website for a map and directions:

www.fordastronomyclub.com

Observing

The FAAC primary observing location is Spring Mill Pond located within the Island Lake State Recreation Area near Brighton, Michigan. The Club maintains an after-hours permit. Club members can contact any club officer for procedures to enter or exit the park when the main gate is locked.

The club also has use of a private observing site near Gregory Michigan. See the FAAC Groups.io Group for more information.

Inquiries can be directed to info@fordastronomyclub.com

Membership

Membership is open to anyone with an interest in amateur astronomy. The FAAC is an affiliate of the Ford Employees Recreation Association (FERA).

Fees

Annual - New Members: \$30 Annual - Renewals: \$25 (\$30 if not renewed by Jan 31)

Benefits

Membership includes the Star Stuff newsletter, discounts on magazines, discounts at selected

Secretary's Report

by Cheri Grissom

FAAC General Meeting – March 25, 2021

Our videoconference meeting was called to order by President Mike Bruno at 7:05 p.m. All board members present except Arica Flores. A total of 28 people were listed as being in attendance. Several guests introduced themselves.

Member Observing Experiences:

Doug Bauer was up at the Seven Ponds Nature Center where he was able to catch the Lunar X and V. On his way home, he also caught sight of a huge bolide. Craig Perry was able to get up to the dark sky park near Mackinaw City with his granddaughter where they had a nice time observing the Moon and Mars, as well as several meteors. Gary Gibson also observed the Lunar X and shared a nice photo of it with us. James Lawlis has been doing some binocular observing, and Gordon Hansen has been sharing some bino observing with his grandkids. A few of our members have been able to observe or even photograph the new nova in Cassiopeia.

What's Up:

Gordon Hansen gave the presentation. Our asterism of the month is the Diamond of Virgo. Virgo is a constellation rich in galaxies for those willing to seek them out. Gordon also discussed the new nova that can be seen in the constellation of Cassiopeia. Apologies to everyone that part of this talk was missed by your secretary due to temporary loss of internet connection.

Club Reports:

Secretary's Report: Cheri advised that we are running low on the neck lanyards and plastic sleeves that we give out to new members for showing their name badges at club events. We don't have to worry about this too much for now, since there are no in-person events happening, but Cheri wanted to get a head start on stocking up for when we are able to hold events again. Doug Bauer was aware of where we had previously ordered these and will check into that and advise at our next board meeting. or's Report. Arica was

Treasurer's Report: Arica was absent but had let Mike know that our current treasury balance is holding fairly steady at \$10,317. We have had very few expenses this year.

Speaker:

Andrew Macica, Public Programs Telescope Operator at Lick Observatory in California. His experience includes 30-plus years as an astronomical observer, 20-plus years as an astrophotographer, 20 years as a volunteer at Lick, five years as the 36" Great Refractor Telescope operator, and two years on staff at Lick. Andy gave a talk on "A New Variation on Planetary Imaging." He imaged the Jupiter/Saturn conjunction of December 21, 2020 in daylight!

The challenges were many, including finding the best location for making the images. Lick Observatory was closed due to the pandemic, and the recent wildfires impacted other possible sites. Andy ended up making the images in his own backyard at only 171 feet above sea level. He went on to describe in detail the equipment he used, including focusers, cameras, filters, as well as his image processing techniques and software programs used.

A question-and-answer period followed. The meeting adjourned at approximately 9:10 p.m.

Board Meeting – April 1, 2021

(Videoconference meeting.) All board members present. Nine additional members attended. Doug Bauer advised that there are 19 people who have not renewed their membership. If dues are not received soon, they will have to be removed from access to the Groups.io site.

We discussed the eventuality of resuming our in-person general meetings. This will depend on when HFCC gives the okay. When we are able to do so, we are looking into the possibility of continuing to offer them as Zoom meetings, as well, for those who might be more comfortable attending virtually for a while. We also discussed holding some club-only observing nights in the near future, and holding a "virtual" Beginners' Night. Dates for upcoming events will be posted on our website calendar and all of our social media sites.

Cheri advised that she will have to miss the first hour or so of the next three meetings, but the plan is to record them, and she can prepare minutes in that way. John McGill advised that there is a new episode of "Astronomy for Everyone" up on YouTube, featuring the Northern Lights.

Astronomy or Sky & Telescope magazine discounts are available by contacting the FAAC club treasurer <u>treasurer@fordastronomyclub.com</u> for the discount form. The form should be sent to the respective publisher with your subscription request and payment. Do not send money directly to FAAC.

The FAAC has a pool of equipment including telescopes, cameras, and other gear used for outreach. Much of the gear can be borrowed for personal use in the interest of furthering your knowledge and experience in astronomy.

Please see the equipment list for further information.

Club Wear

Club logo-wear (embroidered with club logo) can be ordered directly through <u>LLBeanBusiness.com</u>

See the <u>groups.io</u> files section for ordering information and instructions on how to request the correct logo.

Communication

The FAAC uses Groups.io for our email distribution list (both formal and informal discussion.)

Observing nights & locations (scheduled and unscheduled as weather permits), equipment questions, events, outreaches, etc. are normally discussed via this list.

Join by visiting <u>https://groups.io/g/</u> <u>FordAstronomyClub</u> to request membership.

Articles & Submissions

Your submissions to Star Stuff are welcome! Send your story and/or images to the editor at: <u>starstuff@fordastronomyclub.com</u>

Observatory

The FAAC maintains and operates the Hector J Robinson Observatory (HJRO) at Lincoln Park Schools.

The observatory houses a 14" Celestron C14 Schmidt Cassegrain Telescope as well as other instruments and can be used by club members.

The observatory is adjacent to the athletic field situated between the Lincoln Park Middle School and High School buildings near

1701 Champaign Rd. Lincoln Park, MI 48146

The school system has designated four "key-holders" within the club who have the ability to open the observatory.

Call (313) 444-5850 to learn when the observatory is opening (or request an opening).

Virgo's Galactic Harvest

by David Prosper



May is a good month for fans of galaxies, since the constellation Virgo is up after sunset and for most of the night, following Leo across the night sky. Featured in some ancient societies as a goddess of agriculture and fertility, Virgo

offers a bounty of galaxies as its celestial harvest for curious stargazers and professional astronomers alike.

Virgo is the second-largest constellation and largest in the Zodiac, and easily spotted once you know how to spot Spica, its brightest star. How can you find it? Look to the North and start with the Big Dipper! Follow the general curve of the Dipper's handle away from its "ladle" and towards the bright orange-red star Arcturus, in Boötes – and from there continue straight until you meet the next bright star, Spica! This particular starhopping trick is summed up by the famous phrase, "arc to Arcturus, and spike to Spica."

This large constellation is home to the Virgo Cluster, a massive group of galaxies. While the individual stars in Virgo are a part of our own galaxy, known as the Milky Way, the Virgo Cluster's members exist far beyond our own galaxy's borders. Teeming with around 2,000 known members, this massive group of galaxies are all gravitationally bound to each other, and are themselves members of the even larger Virgo Supercluster of galaxies, a sort of "super-group" made up of groups of galaxies. Our own Milky Way is a member of the "Local Group" of galaxies, which in turn is also a member of the Virgo Supercluster! In a sense, when we gaze upon the galaxies of the Virgo Cluster, we are looking at some of our most distant cosmic neighbors. At an average distance of over 65 million light years away, the light from these galaxies first started towards our planet when the dinosaurs were enjoying their last moments as Earth's dominant land animals! Dark clear skies and a telescope with a mirror of six inches or more will reveal many of the cluster's brightest and largest members, and it lends itself well to stunning astrophotos.

Virgo is naturally host to numerous studies of galaxies and cosmological research, which have revealed much about the structure of our universe and the evolution of stars and galaxies. The "Universe of Galaxies" activity can help you visualize the scale of the universe, starting with our home in the Milky Way Galaxy before heading out to the Local Group,

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FAAC members are volunteer operators for the Hammond Planetarium at Henry Ford College.

Planetarium shows are free and open to the public.

Four seasonal planetarium shows are offered per year with the stars and constellations of the current season as well as a multi-media presentation featuring select planets.

Public planetarium shows are normally offered each Wednesday at 7:30pm and every 2nd Saturday at 3:00pm – however there are some exceptions. Please see the planetarium schedule for specific times. It is posted here:

fordastronomyclub.com/hfcplanetarium

Social Media

The FAAC has several social media accounts. Members are encouraged to join and follow them.

Facebook

facebook.com/FordAstronomyClub

Twitter twitter.com/Ford_Astro

MeetUp meetup.com/Ford-Amateur-Astronomy-Club

Scheduled Club Events



Upcoming Club Meeting Topics & Speakers

Meeting	Speaker	Торіс
April 22nd	Don Klaser	Skylore & Mythology
May 27th	Jeffery (Buddy) Stark	
June 24th	Elinor Gates	What's Up at Lick Observatory
July 22nd	Dr. Rajib Ganguly	The Universe Through Superman's Eves

April Talk Details

Skylore & Mythology of Spring & Summer

Don Klaser

FAAC Club Member & Host of Astronomy for Everyone, Planetarium Presenter for Michigan Science Center and Cranbrook

"Skylore and Mythology – Stories from around the World" explores the stories told about the constellations, Moon, Milky Way and prominent asterisms by many cultures around our world and across time. You'll hear similar tales told about the same star patterns along with completely different ones too. This presentation is the first of two on this topic, with the Spring & Summer sky covered now and the Fall & Winter sky later in the year.

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Virgo (Cont'd from page 4)

Virgo Cluster and well beyond! You can find it at bit.ly/ universeofgalaxies. You can further explore the science of galaxies across the Universe, along with the latest discoveries and mission news, at nasa.gov.



The first image of a black hole's event horizon was taken in the center of one of the most prominent galaxies in Virgo, M87! This follow up image, created by further study of the EHT data, reveals polarization in the radiation around the black hole. Mapping the polarization unveils new insights into how matter flows around and into the black hole - and even hints at how some matter escapes! More details: apod.nasa.gov/apod/ap210331.html

Credit: Event Horizon Telescope Collaboration

March Talk (Cont'd from page 5)

Bio:

Don is a 25 year member of the Ford Amateur Astronomy Club, having served as President, Vice-President and Secretary. He is also the host and producer of our clubs YouTube Channel show "Astronomy For Everyone."

Don is employed at both the Michigan Science Center and the Cranbrook Institute of Science, where he gives presentations in the Planetarium.



Find Virgo by "arcing to Arcturus, then spiking on to Spica." Please note that in this illustration, the location of the Virgo Cluster is approximate - the borders are not exact.

Astrophotography: Signal to Noise Ratio (SNR)

by Gordon Hansen

During the Virtual Beginner's Night session a question about signal to noise ratio (SNR) came up, but, the question was lost in the conversation. During many an astrophotography conversation the term SNR frequently has come up and the term is clouded in confusion. I will attempt to clear up some of this confusion.

Before we can tackle SNR we need to understand the intrinsic properties of light itself. By light I include everything on the electromagnetic spectrum, not just the visible portion of the spectrum. Also, we will limit ourselves to the particle nature of light. As many of you are aware light sometimes behaves as if it consists of discrete particles (i.e. photons), and sometimes as a wave (the "color" of light can be described by its wave length.) The particle properties of light is where some of the SNR confusion originates.

All objects with a temperature above absolute zero (-273° C or 0°K) are emitting photons. The nature of those photons and the rate at which they are emitted is dictated by the absolute temperature of the object. The rate that the photons are emitted, however, and the direction they move is random. The processes that control the emission are defined by Quantum Mechanics. Unlike classical mechanics which is deterministic, quantum mechanics is inherently random which Albert Einstein could not accept and prompted his oft quoted "God does not play dice." If you placed a detector near an object of perfectly uniform temperature that also received no external radiation (the definition of a black body) and counted the number of photons hitting the detector per unit of time and plotted that data for many time periods, you would produce a normal distribution (bell shaped curve). This distribution follows a Poisson distribution and has the statistical properties that its standard deviation is equal to the square root of the mean value.

I also mentioned that the directions the emitted photons takes are also random. If instead of a single detector we had an array of detectors (think pixels of a camera) then for every time period each detector/ pixel will have a different value and the distribution of pixels values will have the same mean and standard deviation as before.

Now our first attempt at defining SNR. As you might expect, when we measure the brightness of our perfect black body object, the mean of our measurements is our Signal. The Noise is the amount of variation in the brightness and is defined to be the standard deviation or:

$$SNR = \frac{Mean\,Signal}{\sqrt{Mean\,Signal}}$$

This equation represents the highest or best SNR achievable. Other factors can only lower the SNR.

The equation does have a property that astrophotographers exploit. If the detector is linear (i.e. a quadrupling of time quadruples the mean signal) then:

$$SNR = \frac{(4 \times MeanSignal)}{\sqrt{(4 \times MeanSignal)}} = \frac{4 \times MeanSignal}{\sqrt{4} \times \sqrt{MeanSignal}} = \frac{2 \times MeanSignal}{\sqrt{MeanSignal}}$$

Increasing the time of the exposure by 4 doubles the SNR! In other words the SNR improves by the square root of increase in time. A little statistics will also show that averaging multiple frames results in a similar improvement in SNR. The SNR improves by the square root of the number of frames.

In this idealized case one long exposure or many short exposures adding to the same total time will produce identical SNR. (But not the same signal level!)

Now we need to move from the ideal black body object to the real sky which contains multiple sources of signal. Not all of these sources are wanted. Stars, nebula, galaxies, planets are among the sources of signal we want in our images. Sky glow (aka light pollution), clouds, airplanes, satellites, cosmic ray hits are among the things we don't want in our images but are there none the less and contribute to the signal.

There's one more source of signal that is present but invisible to our eyes. As I said earlier all objects emit radiation as a function of their temperature. That includes the detector itself. At room temperature and below the emitted radiation is in the infrared, which, while not visible, both CCD and CMOS detectors are sensitive to. Dedicated astro cameras have built in chillers to reduce this radiation. This unseen source is called the Dark signal.

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For emphasis, the unwanted light from unwanted sources is not noise. The variability associated with the unwanted signals is the noise.

The transient sources (satellites, planes, cosmic rays) tend to be limited to isolated portions of the image and can be dealt with statistical techniques later in processing. We'll ignore them for this discussion. Passing clouds and light pollution are our biggest sources of unwanted signal.

All of these sources of signal – both desirable and undesirable – add their own noise/variation to the image. If we now use the flux or photons/time:

 $TotalSignal = t \times (Target + Clouds + Skkyglow + Dark)$

One more factor not covered so far. Every digital camera has electronics that need to capture the photons translating them to electrons/charge, read the accumulated charge from each pixel and then condition and amplify the signal (gain) and convert to a digital number. This electronic circuitry adds another noise source called Read Noise. Unlike the noise associated with previously discussed signals, the read noise is added to every frame – short or long exposures alike.

The combined or "pooled" standard deviation of multiple signals is calculated by taking the square root of the sum of the squared individual contributions. Our Noise portion of the SNR now becomes:

$$Noise = \sqrt{TotalSignal + ReadNoise^2}$$

Increasing the time of exposure and/or stacking multiple frames still improves the SNR as before. However, the Read Noise diminishes the improvement. For very short exposures where the Signal is very low, the Read Noise can dominate the SNR and improvement in SNR by stacking may not have an equivalent SNR as one long exposure.

This SNR calculation is misleading. During image processing the Dark signal is subtracted from each

image during what's called calibration. The mean Dark is subtracted, BUT, the noise contribution is not. Similarly, the Skyglow can be eliminated from image through a couple of techniques, but, again the noise associated with the Skyglow remains. When images are taken in light polluted skies its signal can be many times greater than the signal captured from a faint galaxy. Subtracting the mean Skyglow can give you a nice dark background, but, the noise remaining in the dimmer portions of the galaxies arms can ruin the image. The important SNR equation now looks like this:

$$SNR = \frac{t \times Target}{\sqrt{TotalSignal + ReadNoise^2}}$$

I only touched on the high points of this topic. If you want a deeper dive I highly recommend a series of five articles written by Craig Stark. The first is titled Signal to Noise: Understanding it, Measuring it, and Improving it (Part I). You can find them on either of these links"

http://stark-labs.com/craig/articles/articles.html

http://www.cloudynights.com

I would welcome and questions, comments, or corrections to this article. Post a note on the Club's groups.io site and let's continue the conversation. If there's another topic you would like me to discuss post a note also.

Equipment

The FAAC maintain an equipment pool of telescopes, binoculars, cameras, and other equipment used for special events. Much of this equipment is available to members.

Each piece of equipment is either stored by a club volunteer who offers to be the caretaker of the item, or by the person who last borrowed the item. Most equipment can be borrowed for one-month durations. At the end of the month, the borrower can extend the loan if no other members have requested it.

Some items are reserved for special events use and are not normally available to be borrowed.

If you are interested in borrowing an item, please contact either the current holder of the equipment, or contact the club equipment manager, Jeff Gorman, at <u>equipment@fordastronomyclub.com</u>

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Telescopes		Display Items	
TK1 Coronado Personal Solar Telescope (Doublestack) w/Meade Autostar Goto Mount	Jessica Edwards	Astronomy Event Sign (3' x 6')	Gordon Hansen
TK5 4.5" Reflector on Fitz GEM mount	Bob MacFarland	Astronomy Event Signs 18x24" (x8)	Liam Finn
TK6 8" Orion XT8i Dobsonian	Sean Pickard	PVC Display Board - Folding	Sandra Macika
TK7 TPO 8" f/4 Newtownian Astrograph (OTA Only - no mount)	Gary Gibson	Banner - Small (24" x 32")	George Korody
TK8 20" f/5 Obsession Dob, Ladder & EP Kit	Liam Finn	Banner - Medium (24" x 72")	Sandra Macika
Presentation Tools		Banner - Large (32″ x 16′)	George Korody
Projector (older)	Jim Frisbie	Tri-Fold Presentation Boards	George Korody
Projector (newer)	Gordon Hansen	Other	
Projection Screen 8'	John McGill	Canopy (10' x 10')	Liam Finn
Projection Screen 6'	Liam Finn	Pop Cooler	Sean Pickard
Bullhorn	George Korody	TA Sky Quality Meter	Liam Finn
Speaker System w/Wireless Mic	Liam Finn	Demonstration Tools	
DVD Player	Dennis Salliotte	Weigh on Planets Scale	George Korody
		Lunar Phase Kit	Bob MacFarland
		100' Scale Model Solar System Kit	Bob MacFarland
		NSN Meteorite (Outreach) kit	Sandra Macika

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Imaging Cameras	
C2 Meade Deep Sky Imager Pro III w/Autostar Suite	Gordon Hansen
C6 Canon 60Da Astrophotography DSLR and accessories	Tim Dey
Other Imaging Equipment	
CA1 Rigel Systems Spectrascope	Gordon Hansen
C7 Canon EOS EF 70-200mm f/1.4L IS USM lens & tripod mounting ring (for Canon EOS cameras)	Gordon Hansen
Rokinon 8mm f/3.5 Fish-Eye Lens (Canon EOS Mount)	John McGill
Special Event Items - Not available for Loan Out	
BK2 Zhumell 25x100 Binoculars, hard case, & Zhumell TRH-16 tripod w/soft fabric bag	Sandra Macika
TAK1 Night Vision Image Intensifier for telescopes (2" barrel size)	George Korody