ASTROFILES

Auburn Astronomical Society Newsletter

November 2019 *Newsletter Editor — John Wingard — jwin1048@gmail.com*

Moon Phases

November 19 — Last Quarter

November 26 — New Moon

December 4 — First Quarter

December 12 — Full Moon

December 19 — Last Quarter

December 26 — New Moon

January 2 — First Quarter

January 10 — Full Moon

Stay in touch with us

http://www.auburnastro.org

https://www.facebook.com/groups/79864233515/

Upcoming Events

In keeping with our formal meeting schedule that we have observed for the past couple of years, our next formal club meeting is set for Friday, February 7, 2020. The meeting location will be in Room 215 of Davis Hall (Aerospace Engineering) on the AU campus. Meeting time will be 7:45 PM CT.

We have a star gaze tentatively scheduled at Kiesel Park in Auburn on Saturday, February 1, 2020. This is in support of the Kreher Preserve & Nature Center. Additional details will be posted later as we get closer to the date. Kiesel Park is located just West of Auburn on Chadwick Lane. Chadwick Lane can be accessed from either Hwy. 14 on the North end or from Wire Road on the South end. The Hwy. 14 intersection is located just across from the University Station RV Park.

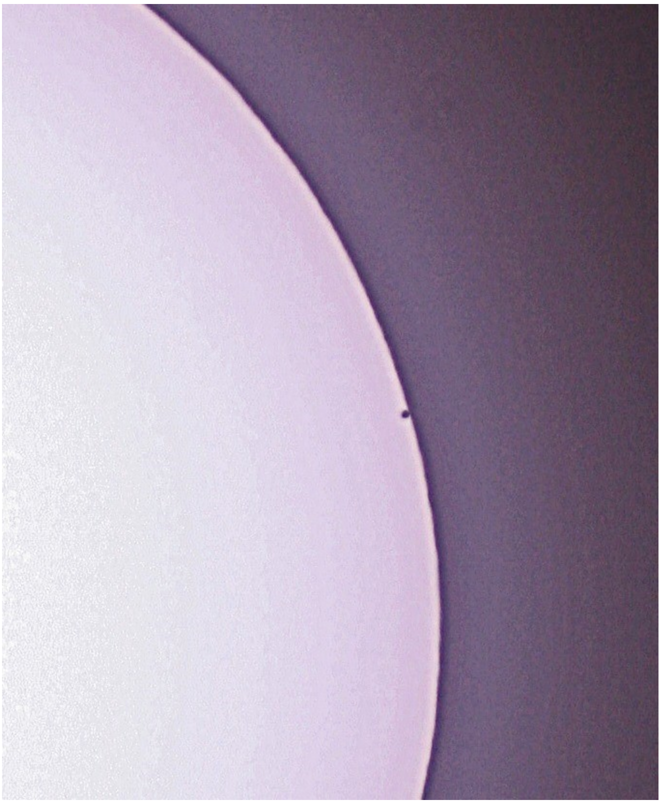
AAS Website Update

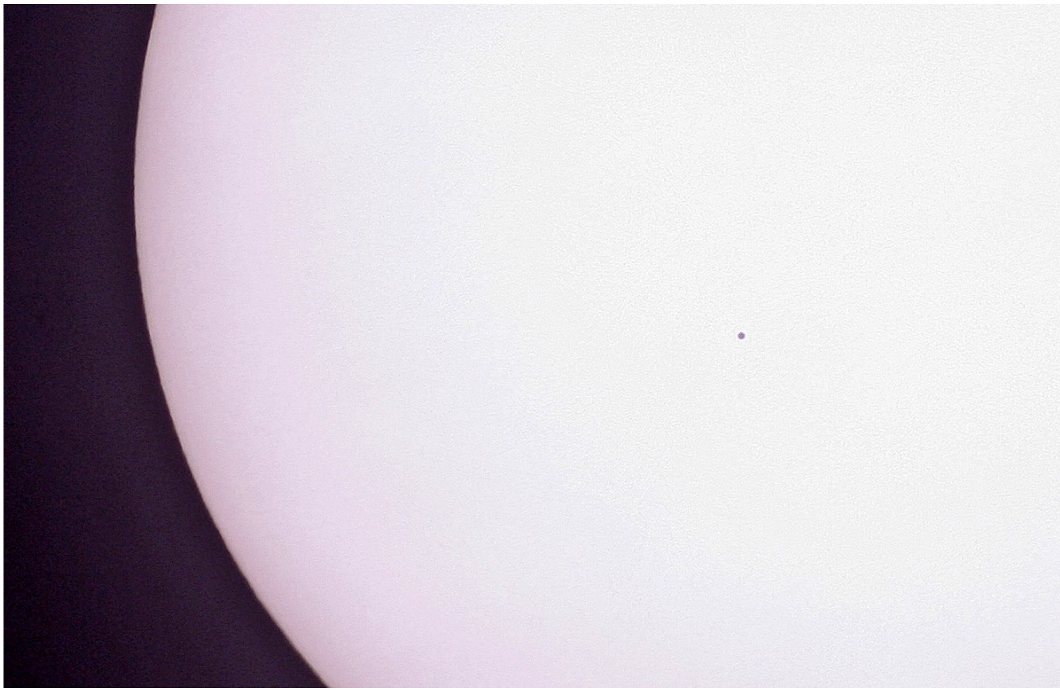
The transfer of our old web page to a new hosting service has finally been completed. Our web page URL is still the same as it has been but it will now take you to our new site. It is still a work in progress. AAS member Christopher Ward is in the process of adding elements and information to it while continuing his studies at AU. If anyone has any comments or suggestions regarding the new web page,

Important...For those that have registered with Russell Lands for use of the Heaven Hill observing site, you will need to renew your registration after the first of the year for 2020. I will include a copy of the registration form in the December newsletter.

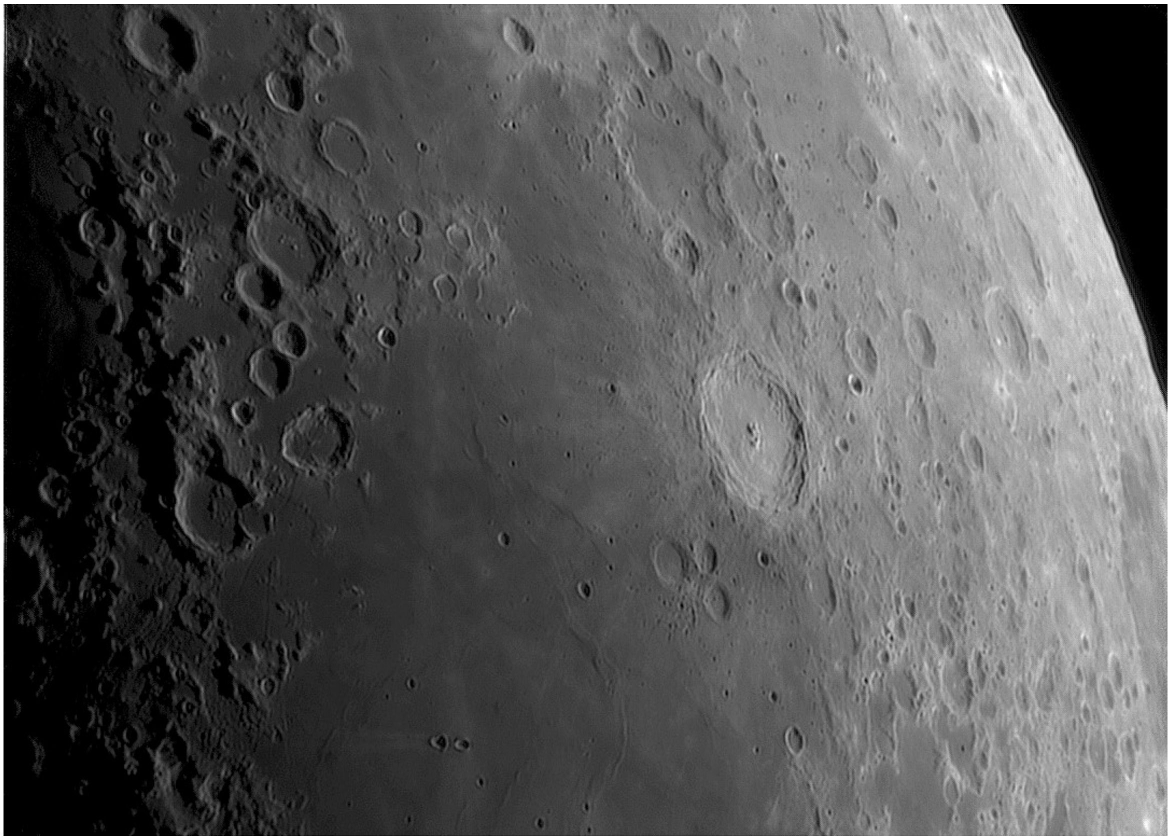
Mercury Transit of 2019

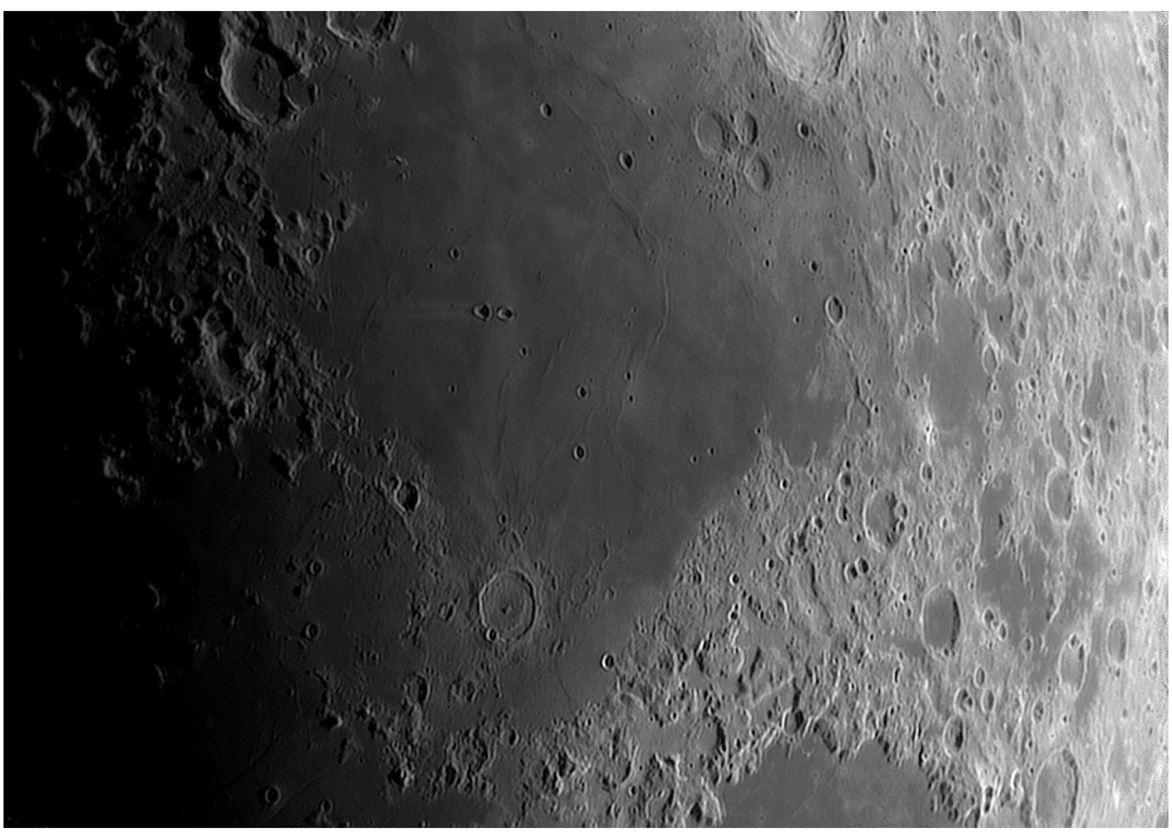
The much anticipated transit of the planet Mercury across the face of the Sun has come and gone. We hope that you had a chance to view this semi-rare phenomenon, the next of which will not occur until the year 2032. AAS member Mike Lewis was set up at his location near Alexander City, AL on the morning of November 11, 2019 and provides a shot of his equipment setup and a couple of shots of the transit itself. These photos serve to illustrate just how big the Sun is in relation to most of the planets. You would have needed a telescope to even make out the tiny "dot" of Mercury as it crossed in front of the Sun. Mike shot these with a 127mm ED doublet refractor with a solar filter and a DSLR camera.





AAS member John Wingard captured these two lunar photos on November 1, 2019 as the moon was in it's waxing crescent phase. Both images feature the area around Mare Fecunditatis or The Sea of Fertility. Images were taken using a Questar 3.5" scope with a 3X focal extender and ASI174-MC camera. Processing was in Autostakkert 3.0, Registax 6 and Photoshop CC.





This article is distributed by NASA Night Sky Network
The Night Sky Network program supports astronomy clubs across the USA dedicated to astronomy outreach. Visit nightsky.jpl.nasa.org to find local clubs, events, and more!

The Orion Nebula: Window Into a Stellar Nursery

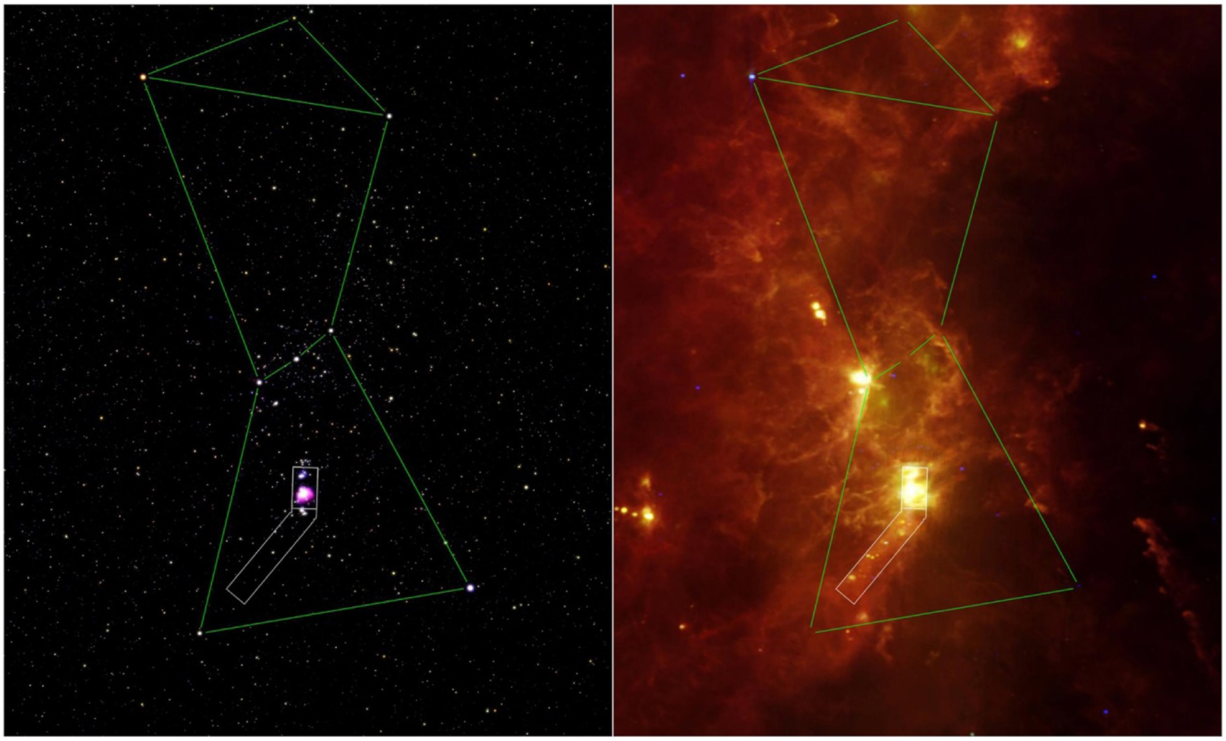
By David Prosper

Winter begins in December for observers in the Northern Hemisphere, bringing cold nights and the return of one of the most famous constellations to our early evening skies: Orion the Hunter!

Orion is a striking pattern of stars and is one of the few constellations whose pattern is repeated almost unchanged in the star stories of cultures around the world. Below the three bright stars of Orion's Belt lies his sword, where you can find the famous Orion Nebula, also known as M42. The nebula is visible to our unaided eyes in even moderately light-polluted skies as a fuzzy "star" in the middle of Orion's Sword. M42 is about 20 light years across, which helps with its visibility since it's roughly 1,344 light years away! Baby stars, including the famous "Trapezium" cluster, are found inside the nebula's whirling gas clouds. These gas clouds also hide "protostars" from view: objects in the process of becoming stars, but that have not yet achieved fusion at their core.

The Orion Nebula is a small window into a vastly larger area of star formation centered around the constellation of Orion itself. NASA's Great Observatories, space telescopes like Hubble, Spitzer, Compton, and Chandra, studied this area in wavelengths we can't see with our earthbound eyes, revealing the entire constellation alight with star birth, not just the comparatively tiny area of the nebula. Why then can we only see the nebula? M42 contains hot young stars whose stellar winds blew away their cocoons of gas after their "birth," the moment when they begin to fuse hydrogen into helium. Those gas clouds, which block visible light, were cleared away just enough to give us a peek inside at these young stars. The rest of the complex remains hidden to human eyes, but not to advanced space-based telescopes.
We put telescopes in orbit to get above the interference of our atmosphere, which absorbs many wavelengths of light. Infrared space telescopes, such as Spitzer and the upcoming James Webb Space Telescope, detect longer wavelengths of light that allow them to see through the dust clouds in Orion, revealing hidden stars and cloud structures. It's similar to the infrared goggles firefighters wear to see through smoke from burning buildings and wildfires.

Learn more about how astronomers combine observations made at different wavelengths with the Night Sky Network activity, 'The Universe in a Different Light," downloadable from bit.ly/different-light-nsn. You can find more stunning science and images from NASA's Great Observatories at nasa.gov.

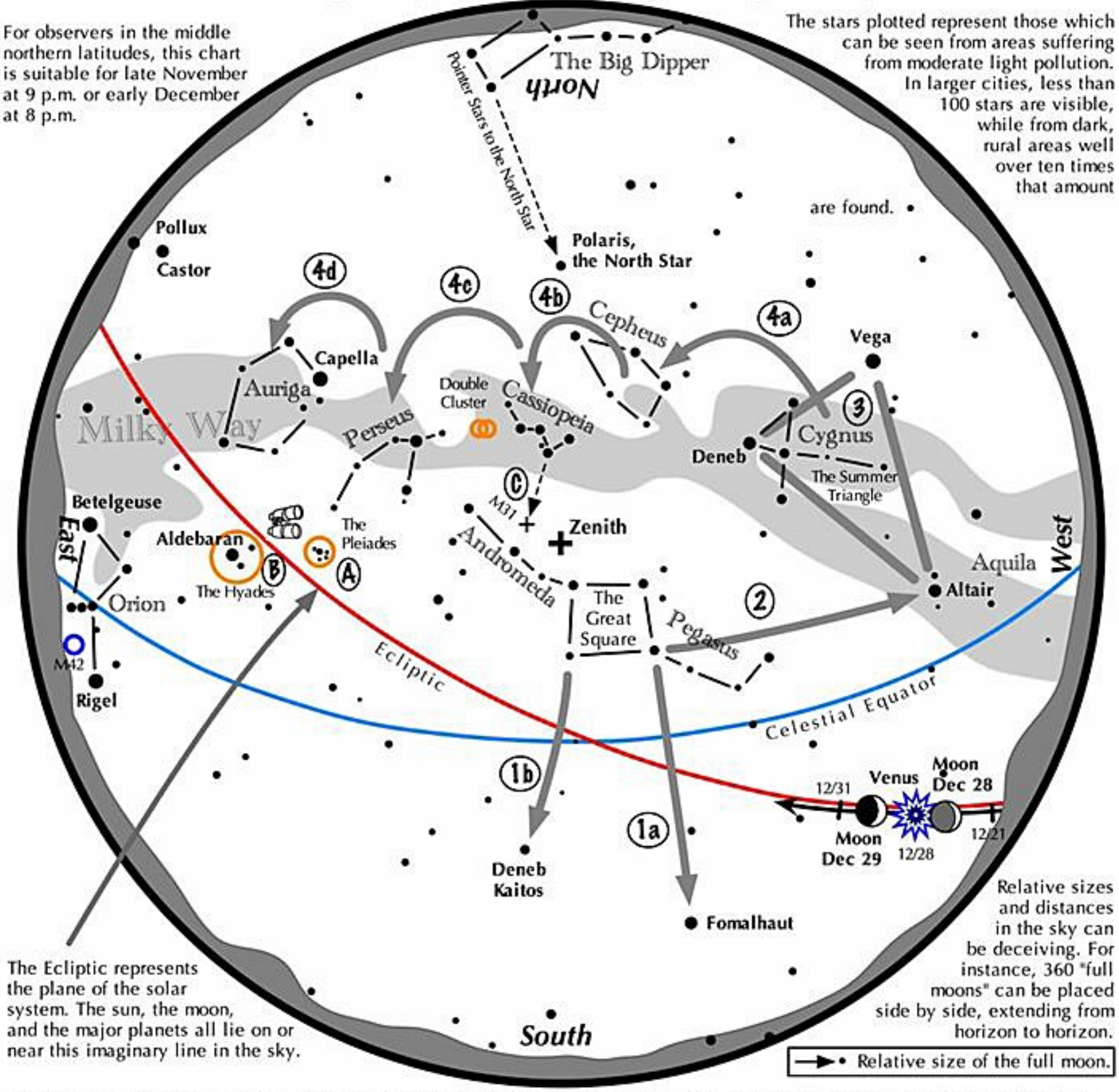


Caption: This image from NASA's Spitzer missions shows Orion in a different light – quite literally! Note the small outline of the Orion Nebula region in the visible light image on the left, versus the massive amount of activity shown in the infrared image of the same region on the right. Image Credit: NASA/JPL-Caltech/IRAS /H. McCallon. From bit.ly/SpitzerOrion

Navigating the December Night Sky

For observers in the middle northern latitudes, this chart is suitable for late November at 9 p.m. or early December at 8 p.m.

The stars plotted represent those which can be seen from areas suffering from moderate light pollution. In larger cities, less than 100 stars are visible, while from dark, rural areas well over ten times that amount are found.



The Ecliptic represents the plane of the solar system. The sun, the moon, and the major planets all lie on or near this imaginary line in the sky.

Relative sizes and distances in the sky can be deceiving. For instance, 360 "full moons" can be placed side by side, extending from horizon to horizon.

Relative size of the full moon.

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

1. Face south. Almost overhead is the "Great Square" with four stars about the same brightness as those of the Big Dipper. Extend an imaginary line southward following the Square's two westernmost stars. The line strikes Fomalhaut, the brightest star in the southwest. A line extending southward from the two easternmost stars, passes Deneb Kaitos, the second bright star in the south.
2. Draw another line, this time westward following the southern edge of the Square. It strikes Altair, part of the "Summer Triangle."
3. Locate Vega and Deneb, the other two stars of the "Summer Triangle. Vega is its brightest member while Deneb sits in the middle of the Milky Way.
4. Jump along the Milky Way from Deneb to Cepheus, which resembles the outline of a house. Continue jumping to the "W" of Cassiopeia, to Perseus, and finally to Auriga with its bright star Capella.

Binocular Highlights

A and B: Examine the stars of the Pleiades and Hyades, two naked eye star clusters.
C: The three westernmost stars of Cassiopeia's "W" point south to M31, the Andromeda Galaxy, a "fuzzy" oval.
D: Sweep along the Milky Way from Altair, past Deneb, through Cepheus, Cassiopeia and Perseus, then to Auriga for many intriguing star clusters and nebulous areas.

A Brief Introduction to Narrow-Band Astrophotography

If you have been following our AAS Facebook page recently you have probably seen some very good image captures from AAS members Jay Hall and Chris Young. These images are taken with dedicated astrophotography cameras and refractor telescopes. In most cases, they are captured using narrow-band filters as opposed to the filters used in more common color cameras. The field of high-end astrophotography can be very complex and involved and this brief article will only touch on some of the basic concepts.

First, a little color theory

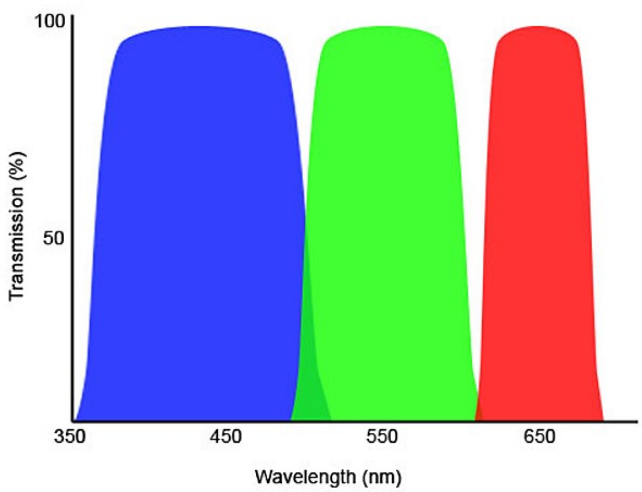
The range of visible light that we can see consists of a spectrum of different colors that range in wavelengths from approximately 400 nanometers to about 700 nanometers. Bluish colors are on the low end of the spectrum and reddish colors are on the high end. All of the other colors fall somewhere in between the two extremes. In the human eye, there are three groups of color receptors, or cones, in the retina that are sensitive to three primary segments of the visible spectrum, red, green and blue. When you see the term RGB, that is what it is referring to. The human brain takes the signals from these three receptors in the eye and combines them into what we then perceive as a color image. So in effect, the human eye is an RGB device. Similarly, when you use a typical digital camera to take a photograph, the sensor in the back of the camera is designed in such a way that there are individual cells, or pixels, that have either a red, green or blue filter over them. As an image is taken, the camera sensor then generates a signal from each one of the three color channels and records it on a memory card as a digital file. This file can then be displayed on a color monitor, also an RGB device, or perhaps printed out on a color printer. Without getting into the details here, most common printers like ink-jet and laser printers use four ink colors—cyan, magenta, yellow and black, or CMYK. Software within the printer converts the RGB image information into equivalent CMYK information that is then sent to the printheads in the printer. The result is a reasonable facsimile of the original scene.

Color Astrophotography

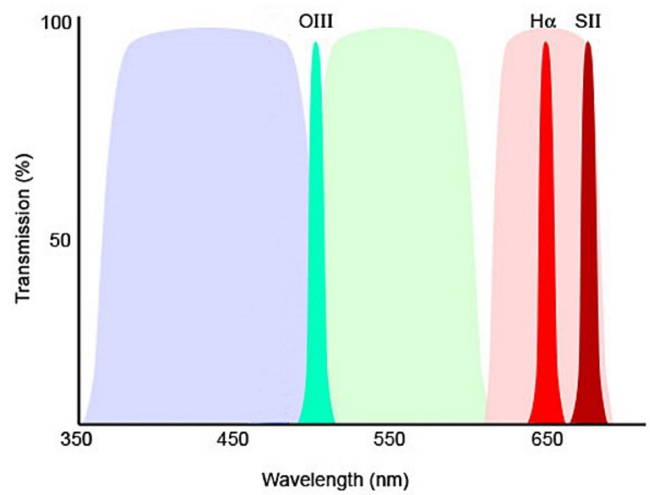
There are two basic approaches to capturing color images with telescopes and cameras. The easiest and most direct way is to simply use a full-color camera. This could either be a dedicated astrophotography camera, a standard digital single-lens reflex camera (DSLR,) or even a color cell phone camera. You have probably seen many outstanding images of astronomical objects that have been acquired using this method and there is certainly nothing wrong with it. However, unless you are fortunate enough to live in an area with reasonably dark skies, there are some issues with this approach. Most of the typical astronomical targets such as nebula and galaxies are very, very faint. When viewing them through a telescope by eye, most of them still appear as very faint, wispy objects. That’s why we sometimes call them “faint fuzzies.” In order to capture more detail, we must resort to using sensitive cameras and very long exposures. Here is where you will run up against the enemy of practically all astrophotographers, light pollution. Light from local sources such as floodlights and streetlights, combined with light from cities and towns combine to scatter this light up into the atmosphere where it will severely interfere with photographing or even viewing faint astronomical objects.

Wide-band vs. Narrow-band

To combat the problem of light pollution, short of moving to a darker site, we can employ some ingenious techniques to permit us to capture some very good images. But first, we need to learn a little more about the astronomical targets that we are trying to capture. Many of the nebulas that astronomers like to image are known as "emission" nebulas. What this means is that the nebulas are composed of clouds of gasses that have been blown off of stars that are imbedded within them. Radiation energy from these embedded stars cause the gas clouds to actually glow and emit light, hence the name emission nebulas. We find that the bulk of these gasses are made up from three major elements, hydrogen, oxygen, and sulfur. Hydrogen is the most plentiful element, followed by oxygen, and lastly by sulfur. The light emitted from each of these three elements are very narrow in terms of their wavelength. Traditional wide-band RGB filters, which cover the entire visible spectrum, also capture much of the light-pollution wavelengths of light as well, thus interfering with what we are trying to image. Instead, why not use three filters centered around the three wavelengths coming from the emission nebula. All of the essential information is captured while all of the non-essential information is rejected. This is the basic concept behind narrow-band imaging. Below are two diagrams that illustrate the filter response of traditional RGB filters vs. narrow-band filters.



Typical RGB filter widths. These are what you would find in most standard color cameras.



The widths of typical narrow-band filters superimposed on the RGB filter widths.

The second part of the narrow-band technique is to use a black & white or monochrome camera and shoot individual exposures through each one of the narrow-band filters. Typically, instead of shooting one long exposure, many shorter exposures are captured and then merged together into a single image for each of the three filters. This results in an image with less noise and greater resolution. The actual technique of processing these images is very complex and far beyond the scope of this article. If you would like to learn more about high-end color astrophotography, there are a number of good books and video tutorials available. **One important thing to note:** after all of the capturing and image processing is done through the narrow-band filters, the final image must be converted back into RGB because all of our displays, monitors, printers, as well as our eyes are RGB devices. Typically, the Hydrogen Alpha image (Ha) is assigned to the Green channel, the Oxygen III image (OIII) is assigned to the Blue channel, and the Sulfur II image (SII) is assigned to the Red channel. The result is a color image of the desired object showing detail and structure.

As mentioned earlier, we have enjoyed seeing some of the outstanding work that is being done by Jay Hall and Chris Young. The following example from Jay Hall shows Heart Nebula (IC 1805), an emission nebula located in the constellation of Cassiopeia. It is approximately 700 light-years distant and was discovered by William Herschel in 1787. Shown below are the three individual narrow-band images (Ha, OIII and SII) along with the final combined and processed color image. Jay said that he also used a duplicate of the Ha image as a Luminance channel in the processing software to give the final image more tonality with less noise. The technique of post-processing is rather complex and is still part science and part art.

Image through Hydrogen Alpha (Ha) filter. Total time from multiple exposures: 7 hours.

Image through Oxygen III (OIII) filter. Total time from multiple exposures: 5.5 hours.

Image through Sulfur II (SII) filter. Total time from multiple exposures: 5 hours.

And here is the final result, a beautiful image that captures all of the structure and detail in this particular object. A combination of 17.5 hours of telescope time (likely over multiple nights) coupled with many hours of tedious post-processing were required in order to produce a single final color image.

I hope that I have not overwhelmed everyone with too much technical detail, but hopefully you now have a better understanding of how the narrow-band capture process works. As was mentioned earlier, it is a way to image under less than ideal sky conditions. As you view other images in the future, you will be in a position to better appreciate the investment in time and skill required to produce such images. Thanks to Jay Hall for providing all of the images that I used. I will try to feature more images in future newsletters.

Auburn Astronomical Society

Membership Application Form

Name:

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Address:

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City: ________________________________ **State:** _____ **Zip:** __________

Phone: ____________________________ **Date of Application*** _____/_____/_____

E-mail:

____

Telescope(s):

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Area(s) of special interest:

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Enclose: $20.00 for regular membership, payable in January. *Full-Time* student membership is half the Regular rate.

If you are a NEW member joining after the first of the year, refer to the prorated table below

Jan $20.00	Feb $18.33	Mar $16.66	Apr $14.99	May $13.33	Jun $11.66
Jul $10.00	Aug $8.33	Sep $6.66	Oct $4.99	Nov $2.33	Dec $1.66

Make checks payable to: Auburn Astronomical Society and return this application to:

Auburn Astronomical Society
c/o John Wingard, Secretary/Treasurer
#5 Wexton Court
Columbus, GA 31907

For questions about your dues or membership status, contact: jwin1048@gmail.com

Thank you for supporting the Auburn Astronomical Society!