AURORA
The Royal Astronomical Society of Canada - Windsor Centre
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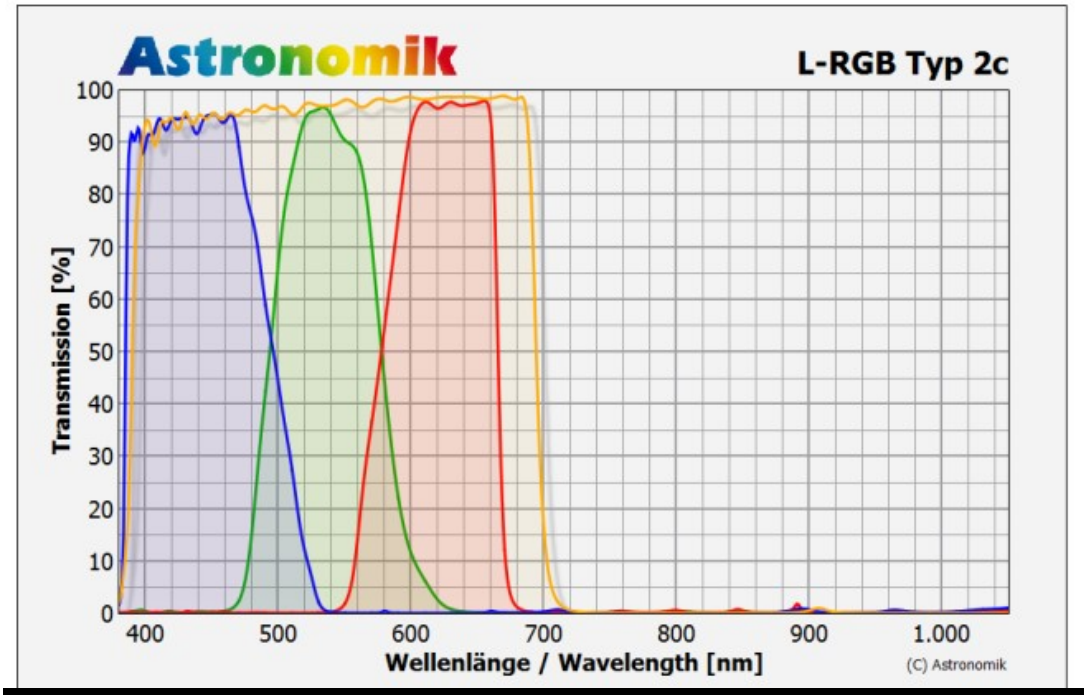
Narrowband Imaging by Steve Mastellotto

The chart above illustrates the range of wavelengths of light in nanometers (nm) that make up the broad range of visible light. When taking a photograph our cameras respond to this broad range by using a special set of red, green and blue (RGB) filters that are arranged over the monochrome (B&W) sensor in the camera and the software in the camera combines the individual RGB filtered monochrome images into a colour photograph. The most common way the RGB filters are arranged is called a Bayer Matrix which means for each 2x2 area of pixels there are RGGB filters - one for each pixel. With millions of pixels in a camera sensor these filters are very tiny and because the final colour image uses 4 pixels to create each pixel's colour information the overall resolution of the image is less than if you could use one pixel to determine colour. This is the typical first step many astrophotographers take in improving their imaging - they buy a monochrome camera and a set of RGB filters. The chart below shows the spectral response to a typical set of RGB filters used in astronomical imaging. Each filter lets a broad band of wavelengths (100 - 150nm) pass for each colour and this includes the wavelengths represented by light pollution. The chart

(Continued on page 5)



In This Issue

Calendar of Events

Our next meeting…

April 20, 2021
at
Online Zoom Meeting begins at 7:30 p.m.

Main Speaker…

To Be Determined

Topic…

To Be Announced

Director of Observing Report
by Nancy Ng/Jessie Passa

Activities...

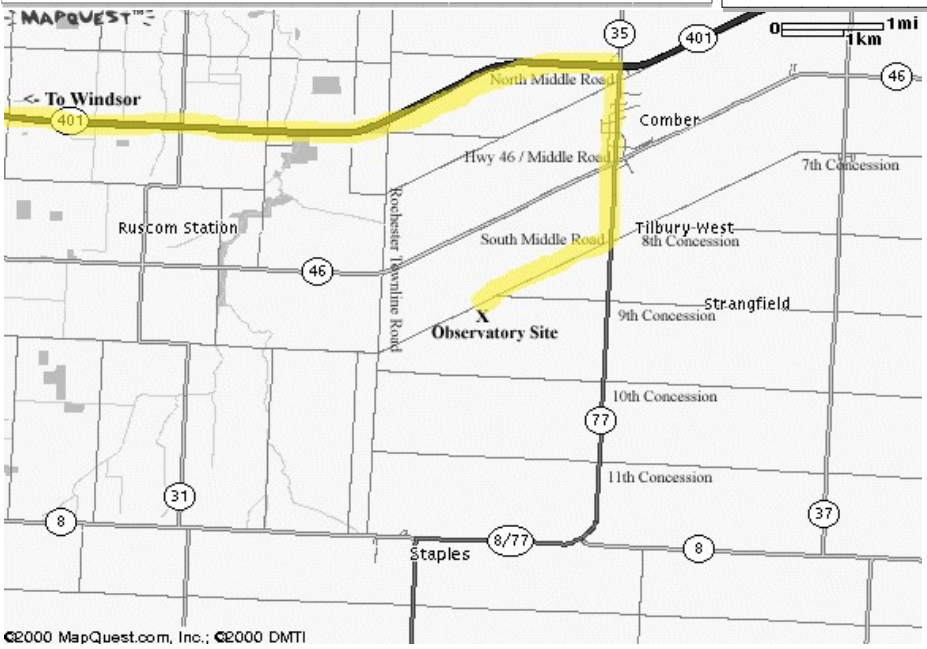
Spring Equinox: Spring officially arrives for the Northern hemisphere at 5:37 a.m. EDT on Saturday March 20th.

Moon and M35: On Sunday March 21st the 1st Quarter Moon will be near M35 in the evening sky.

Venus: Is in superior conjunction on Friday March 26th and too close to the Sun to be seen.

Saturn, Jupiter and Moon: On Tuesday and Wednesday morning April 6th and 7th the Moon will pass about 5 degrees from Saturn and then Jupiter respectively.

Lyrid Meteor Shower: Peaks at **8:00 a.m. EDT on Thursday April 22nd.** Earlier in the morning you should be able to see 15-20 meteors per hour in relatively good conditions with the Moon just past first quarter and not in the early morning sky.



Hallam Observatory Site

Directions: The map at left shows the Comber area and it includes the major highways (401, 77, 8 and 46) that are in the area of the observatory.

The most direct route from Windsor is "highlighted" on the map which is to take Highway 401 East to Highway 77 South to South Middle Road. Turn right onto South Middle Road and go about 1 kilometer and just after the point where Concession 9 joins it (it is hard to see this intersection) you will find the observatory site on the South side (left) of the road. 3989 South Middle Road.

If you hit the Rochester Townline Road (you come to a stop sign) you have gone too far.

Submissions

Aurora is published monthly except for July, August and December. The September, October, January, March and May issues are full newsletters (usually 6 pages) with a number of member submitted articles. The November, February, April and June issues are short flyers (2 pages).

Submitted articles can be of any length from a paragraph to multiple pages. I can scan pictures and/or diagrams (both prints and film) to support your article and the originals will be returned to you.

Submission deadline is the 1st of the month.

Editor: Steve Mastellotto Email: mmastellotto@cogeco.ca

Membership

The Windsor Centre of The Royal Astronomical Society of Canada meets on the 3rd Tuesday of every month (except July and August) at the Ojibway Park Nature Centre. In addition to regular meetings the centre hosts a number of observing nights, a picnic and a December social. Members receive a copy of the Observer's Handbook, a subscription to SkyNews magazine and access to the Centre's library and telescopes. Optionally the RASC Journal is available in print form—online version free.

Annual Membership Fees: Please see the RASC website at **www.rasc.ca** for current rates.

Contact Greg Mockler (greg.mockler@live.com) or visit our website at: http://www.rascwindsor.com for more information.

February 2021 Meeting Minutes by Nancy Ng

The general membership meeting was held on **February 16, 2021 at 7:40 p.m. EST via Zoom** online meeting and hosted by **RASC Windsor Centre President - Mahayarrahh-Starr Livingstone**. Starr welcomed members and guests to the Zoom meeting. Also present was the guest speaker for the evening from RASC Yukon Centre, Dr. Christa Van Laerhoven. Starr began with acknowledgement of the sudden passing of our member Rick Marion. Ricks' memorial is written in the February issue of the Aurora newsletter. Members were invited to review the minutes from the January 19, 2021 meeting. A **motion to accept the minutes** as presented was made by **Susan Sawyer-Beaulieu** and seconded by **Greg Mockler** and the **motion carried.**

Director of Observing Report: Steve Mastellotto. Steve began by inviting members to share their astronomy activities and images from the past month. There were not very ideal conditions for viewing the sky since our last meeting however many of our group were active on the few clear nights available in January. **Randy Drumm**, a recent new member shared two contrasting images of **IC410, the Tadpole Nebula**. Within his processing technique he was able to remove all of the stars from one of the images producing a unique view of this emission nebula. **Brian Simpson** also shared two perspectives on his image of galaxy **M33**. In one shot he included the many streaks left by satellites crisscrossing the field of view which served as a reminder of how crowded the night sky is becoming.

Steve assured us that the long-awaited **Spring** season for the Northern hemisphere will begin on **March 20th at 5:37 a.m.** as the Sun crosses the celestial equator. The upcoming planetary events were put forward. **Mercury will be at greatest western elongation on March 6th** and visible now quite close to the horizon in the early morning sky. During the **first week of March** after sunset **Mars** will offer a nice photo opportunity as it sails slowly by the **Pleiades** in Taurus constellation. March 18th and 19th will see a thin waxing crescent moon join Mars below the Seven Sisters. On March 1st before sunrise in the morning sky on you may watch Saturn rise at 5:42 a.m. with Jupiter close behind at 6:07 a.m. The two distant, illusive pale blue planets Uranus and Neptune will be in conjunction with the Sun on April 30th and March 11th respectively. Steve indicated there will be a close **conjunction of Mercury and Jupiter** before sunrise on March 5th at 6:30 a.m. The two planets will find themselves 5 degrees above the horizon and 20 arcminutes apart. This apparition in the northern hemisphere follows along the line of a shallow ecliptic and Steve displayed the same view from Sydney, Australia. Here the ecliptic is much steeper and Mercury is now found 20 degrees above the horizon. The moon will join this view on March 10th. To round off the activity of the planets Steve added that **Venus will be at superior conjunction** on March 26th.

Steve reminded us that **Daylight savings time returns** at 2:00 a.m. on **Sunday March 14th** and the **sun will set at 7:37 p.m.** on this date compared to 6:06 p.m. tonight. The phases of the moon were presented and it was noted that after the February 27th full moon there will be a few weeks of good viewing available through to the new moon on March 13th.

Exoplanets: The Weird and Wonderful by Dr. Christa Van Laerhoven, RASC-Yukon Centre PhD Planetary Sciences, BEd Secondary: Physics and Math. Dr. Van Laerhoven gave an interesting presentation on the discovery and formation of some of the more than 4,000 exoplanets known today. She began by noting that when scientist look at exoplanet systems orbiting their host stars they are also learning more about our own solar system and the underlying physics of its formation. Before the discovery of any exoplanets it was thought that they would be **arranged similar to our own solar system**. She noted that our large gassy planets like Jupiter and Saturn have extended hydrogen and helium atmospheres and they orbit much farther away from the sun than Earth does. Mercury a much smaller rocky planet is found orbiting close to the sun. She displayed the relatively flat shape to our solar system and the very circular orbits which the planets follow around the sun with the exception of Mercury's slightly more eccentric orbit. Christa also highlighted our single star at the centre of our solar system which was predicted to be a common arrangement throughout the Milky Way galaxy. However the search for exoplanets revealed **much greater variety** in the organization of exoplanets. One of many unusual discoveries was a system with **multiple planets orbiting two stars** in a perplexing pattern. Another unexpected discovery which ended up being quite common was the prevalence of **large gassy planets orbiting closer to their sun than Earth** is to ours. This close distance to their host stars translated into very high temperatures and these exoplanets are known as **Hot Jupiters**.

Christa illustrated **three of the more prolific methods** of finding exoplanets. The **first two** approaches **require the star and exoplanet which are being observed to be in line from our vantage point**. The radio velocity/doppler technique takes advantage of the similar properties of sound waves and light waves. When planets and their star are moving towards or away from Earth the changes produced in the light waves can be documented. The data collected in this manner can provide **information on orbital size and planet mass**. The **transit method** of detecting exoplanets takes advantage of the slight reduction in the brightness of a star which occurs when a planet passes in front of it. Christa presented a graph which demonstrated how the light curve will show a dip in brightness as the exoplanet passes in front of the star. Information on the **planets orbit and the size of the planet itself** may be calculated with this data. Christa stated that this method was used by the now retired Kepler Space Telescope which discovered 2,662 exoplanets. A **third method of direct imaging** used for discovering and observing exoplanets entails a new perspective, literally. Here exoplanet systems are **viewed from above** and when monitored over extended periods of time the planets may be seen moving in their orbit.

Christa explained a few of the characteristics of some of the over 4,000 now known exoplanets. There were some **planets which are described as eccentric**. This eccentricity referred to the exoplanets which have non-circular orbits. Also found were complex systems of exoplanets **orbiting more then one star**. These circumbinary configurations presented a challenge in sorting out the orbital patterns. Dr. Van Laerhoven offered up yet another unusual system with multiple exoplanets, some as numerous as eight, found orbiting extremely close to their host star. **Planets have been found which are 10 to 11 billion years old**. Early planets formed after the Big Bang relied on supernova explosions of stars to create the heavier elements needed for their construction. This seemed to have happened earlier than was previously known. Christa stated that this is a very exciting field of study and, "interesting science is yet to come."

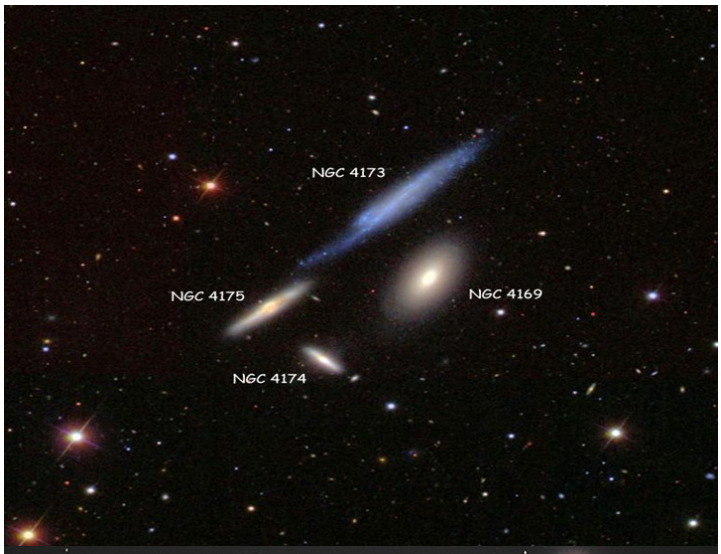
Starr thanked everyone, especially Dr. Christa Van Laerhoven for attending the meeting.

The meeting was adjourned.

At The Eyepiece: The Box by Mike Ethier

As I finish up work on Orion, which has taken me several winter seasons to do, I am readying my charts for spring work. For astronomers, spring is a season that zooms past at breakneck speed. These galaxy heavy constellations are visible for far less time than their summer and autumn counterparts. This is because the amount of daylight is increasing rapidly at this time of year, and the constellations appear to move across the sky much faster.

My early spring work is in the constellation of Sextans, and I will have more to say about this area in a future article. For seven years my main spring constellation was Leo, and I still return each year to view favourite objects in that area. But a few years ago I moved on to another constellation that promises to keep me occupied for many more spring observing sessions. Coma Berenices is quite a playground for observers who love galaxies. And the galaxies come in all sizes, shapes, levels of brightness, and groupings. While preparing my pre-observing notes and stats for Coma, I was intrigued to find "The Box" labelled on my Uranometria charts (#54 and #72 of the all-sky edition), and couldn't wait to see what that was all about.



Top - The Box, a group of four galaxies, in Coma Berenices.
Bottom - M99 by Mitch Arsenault

The Box is a group of four galaxies, roughly in rectangular shape, and can be found in the far north preceding area of Coma, close to the border with Ursa Major. While groups of four galaxies are anything but rare in Coma, photographs certainly do show an interesting group. All of the galaxies are pretty faint, though in good skies a 25cm scope should show three. Here is a list of galaxies and their specs, and a photo from cseligman.com:

eg 4169: 1'.8' x 0'.9: Visual magnitude 12.2; surface brightness 12.6.
eg 4173: 5' x 0'.7: Vis. 13; SB 14.2.
eg 4174: 0'.6 x 0'.3: Vis. 13.4; SB 11.4.
eg 4175: 1'.8 x 0'.4: Vis. 13.3; SB 12.8

I had my chance to view these galaxies on May 5th, 2019, using my 30cm Orion Dob. It is a push-to scope, and the group was found easily enough using the little computer. Though all four galaxies can be seen at 136x, 4173 is very faint. Thus it seems more like a triplet. The brightest part of this very faint member lies just north of 4169. And 4169 is the first galaxy one sees, and it remains bright and very oval up to 250x. At 187x a few decent glimpses of the very long and thin 4173 are enjoyed, using averted vision. 4174-75 are easily viewed at 136x, both objects appearing pretty bright, pretty small, with notable stellar cores. At 200x and 250x 4175 becomes quite a bit larger now, and very elongated. In this range 4174 appears a bit brighter that 4175, becoming oval in shape but quite small. I hope you get a chance to view this minor but fun little group someday. The club's 35 cm scope would be an ideal instrument.

Messier of the Month: Messier 99

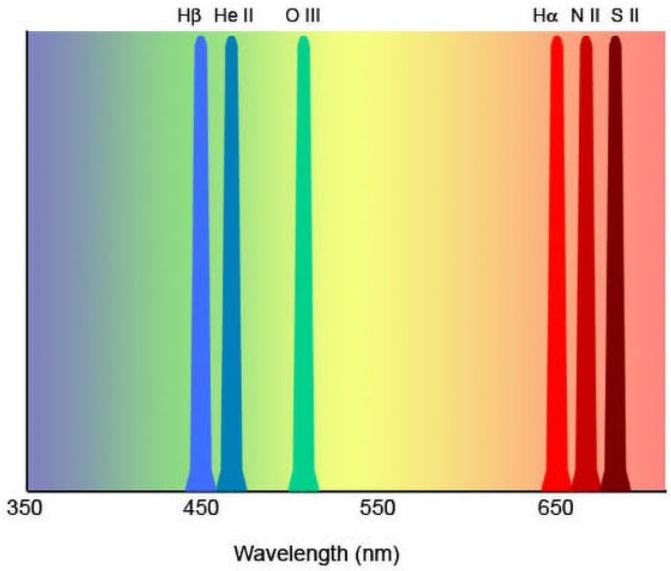
Staying within the boundaries of Coma Berenices, but moving about 14 degrees south and a few minutes following The Box, Messier 99 pops into the eyepiece, a bright and nearly round galaxy easily viewed with small telescopes. It was discovered in mid March 1781 by Pierre Mechain, and seen a month later by Charles Messier. My first look came considerably after that, in mid May of 1980. I was at Lake Penage west of Sudbury, and it was a humdinger of a night! It was 3 C and spectacularly clear. I was able to see the galaxy with my 8" scope stopped down to 4", at 36x. Full aperture showed it relatively large and round. At 56x the galaxy is surrounded by tiny stars, one just within the outer haze of the arms. 72X offered the best view. While the centre remains bright at higher powers, the envelope itself starts to fade.

Jump to May 26th, 2020. On May 26th the temps were hovering around 20 C, and conditions were excellent at my Kent County viewing site. I began by using my 20 cm (8") aperture stop, locating the galaxy at 60x. It had been just over 40 years since I had last seen this object! At full aperture (30 cm) and 100x the core is stellar and very bright. The galaxy is large, showing a very bright centre around the brilliant core, surrounded itself by a large, fainter envelope of haze. Viewing M 99 is like seeing an unresolved globular cluster. 187X and 272x show the envelope to be unevenly lit, no doubt hinting at the spiral arms. A bright area of haze seems to precede the very bright central area, followed by a darker area, and then a brighter area again. It is such views that often give us aperture fever, and makes me wish I had a 1 metre scope (in high Earth orbit)! Longer views are rewarding at high power, so stay with Messier 99, and use as much magnification as conditions allow. Messier 99 is about 50 million light years away, something to think about when viewing it.

Messier 99 (eg 4254): 5'.4 x 4'.7: Visual mag. 9.9; Surface Brightness mag. 13.2.

Narrowband Imaging (continued from page 1)

below illustrates the wavelengths that typical narrowband (NB) filters pass and the most common NB filter set used includes SII, Ha, and OIII filters.



One of the most important things to notice is how narrow the bandpass is for each filter. Typically it is 5nm but ranges between 3 - 12nm. This is very important since you can now avoid the wavelengths of typical light pollution and shoot in suburban backyards. For the three filters in the red end of the spectrum you can even shoot when the moon is in the sky! The downside is that you are using much less light so your exposures need to be longer in order to collect enough data however, with little to no light pollution longer exposures are now only limited by your mount and ability to guide the telescope on the object.

It is then up to the astrophotographer to combine these NB monochrome images into a colour photo. By looking at the chart above you could map these filters into the RGB channels using the logical sequence of the reddest filter is SII so that goes to red, Ha goes to green and OIII to blue which is called an SHO palette and that is exactly what the Hubble Space Telescope does so it is also known as the Hubble palette. The Canada-France-Hawaii telescope uses a different mapping that puts the filters in HOS order. Since these are all false-colour representations there is no right answer but these are the two most commonly used for displaying narrowband images.

Brian Simpson recently took a series of NB images from his light polluted yard in LaSalle of the California Nebula (NGC1499) and from left to right below presents images using the SHO, HOS, and HSO palette.

Remember there is no “correct” answer on how to combine the data into a final image and it is up to the astrophotographer to tease out as much detail in their images.

For Sale

Celestron CGEM Mount - 'Hyper-tuned': 40lb capacity Computerized German Equatorial Mount, including counterweight. Recommended for up-to 8" telescopes. $750 OBO. Good condition. (Hyper-tuned = replaced with ceramic bearings, re-greased and general tune-up)

Celestron 102GT Achromatic 1000mm f/9.8 telescope, Alt-Az Computerized Mount and 5-piece ocular kit. Like new, great for beginners. Used for only 1 season. $150.

Contact: Brian Simpson (simpsonb@gmail.com or 519-817-9100)

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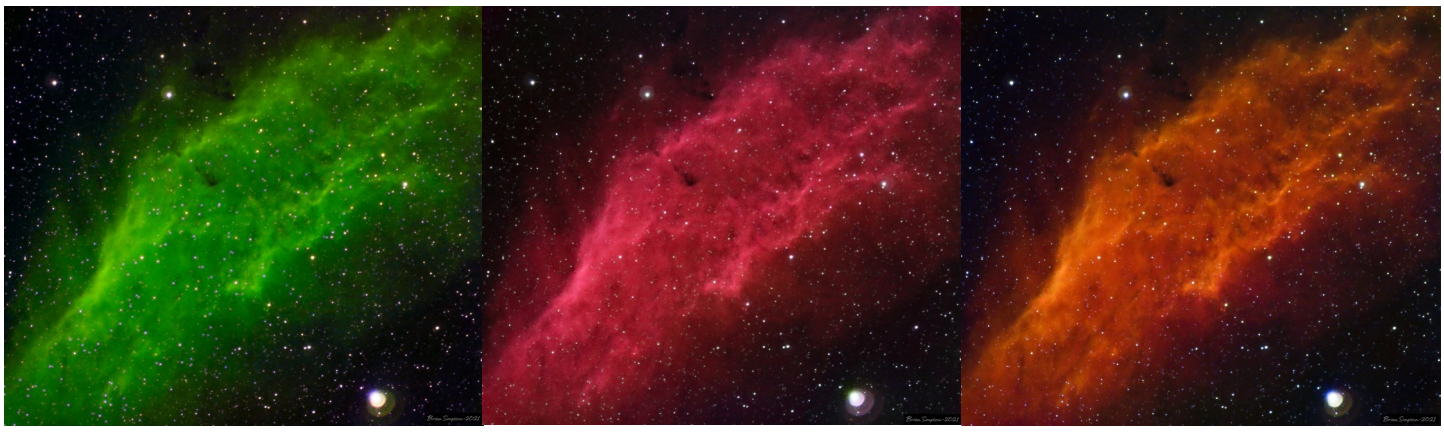
Astro-Tech 8" F/8 Ritchey-Chrétien Astrograph - Carbon Fiber Tube, two dovetail rails (Losmandy and Vixen), dual-speed focuser. OTA Only (no mount). $1,000.

Astro-Tech 10” f/4 Imaging Newtonian - dual-speed focuser, tube-rings, mirror fan, 8x50 finder, mirror center spotted, dust covers. OTA Only (no mount). $650.

Celestron Nightscape 8300 cooled CCD Camera - one-shot colour imaging camera, 8.3MP CCD sensor, Kodak KAF-8300 chip, TEC cooled, Mechanical Shutter, AstroFX software. $750.

Sky & Telescope magazines - I have every issue from January 1976 through current. I am going to start hauling the pre-2020 issues (44 years worth) out to the recycle bin in mid-April so if anyone wants them they are **FREE.**

Contact: Steve Mastellotto (steve.mastellotto@gmail.com or 519-735-9046)



Member Astrophotos

Top Left: The Seagull Nebula (IC 2177) was captured by Randy Drumm over three nights of March 2, 4, and 5th using a modified Canon 77D, L-Enhance filter and 205 images of 3 minutes each. Randy also captured calibration frames - 60 each of Bias, Dark and Flat and processed everything in PixInsight. ***Top Right:*** Thor's Helmet (NGC 2359) was also captured by Randy Drumm over the nights of February 2, 4, and 16th using the same equipment noted above and 240 images of 3 minutes each, 60 Bias, 40 Darks and 60 Flats - Randy commented on how cold it was over this time period. ***Middle Left:*** On the night of March 5th Nancy Ng captured Mars as it is passing through Taurus between the Hyades (V-shape on left) and the Pleiades (little "dipper" right of centre) from her backyard. ***Middle Right:*** Also on March 5th Brian Simpson captured a deeper shot of Mars passing the Pleiades with some nebulosity. Brian used a guided Nikon 200-500mm lens, ASI1600 camera with filter wheel and a combination of 16 and 32 second exposures. ***Bottom Left:*** March 5th was a busy night as Mahayarrahh-Starr and a number of others were out at Hallam Observatory where he captured M81 and M82. This image is a combination of 20 x 2 minute exposures. ***Bottom Right:*** The Cone Nebula (NGC 2264) was captured by Steve Mastellotto using a CDK17 in Chile. The LRGB image combines 15 x 20 minute exposures through each filter for a total of 20 hours of data. All processing and calibration was completed in PixInsight.