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The StarGazer

Newsletter of the Rappahannock Astronomy Club No. 3 Vol. 11 November 2022–January 2023

Annals of the Mark Slade Remote Observatory: An Observation of a Remarkable Recurrent Nova in M31 (November 2021)

By Myron Wasiuta

[*Editor's note:* This article is the first in a series of occasional articles about past activities involving the MSRO. These articles will become part of an archive record stored by MSRO of its accomplishments over the years.]

Located in one of the outer spiral arms of the Great Andromeda Galaxy (M31) is a recurrent nova with the shortest known recurrence period. This object—known as M31N 2008-12a—is a binary star system involving a high-mass white dwarf (1.38 solar masses) and a red giant star in close orbit undergoing a high rate of mass transfer (about 1.6 10-millionths of a solar mass/year). This mass (mostly hydrogen), which is being pulled off the red giant by the white dwarf's immense gravitational field, is heated to extreme temperature as it accumulates on the surface of the white dwarf. Eventually, a critical temperature and pressure are met, which allows the hydrogen to undergo runaway nuclear fusion. The star explodes and increases in brightness to become a nova!

Various studies of this star by professional astronomers place the recurrence rate at about 351 days (+/- 13 days) with others placing it at about half this at 174 days (+/-10 days). Because each outburst does not expend all the mass accumulated after the previous outburst, the mass of the white dwarf is increasing. Once it reaches a critical value (called the Chandrasekhar Limit, i.e., about 1.4 solar masses), the mass becomes so great that the white dwarf collapses and becomes a Type Ia supernova. Thus, M31N 2008-12a is destined to become an even more exotic object—either a black hole or a neutron star. At the current rate of mass transfer, this transformation may happen within the next 500,000 years.

Figure 1. MSRO 10-inch, F7.9 TPO Chretien telescope, Source: Myron Wasiuta

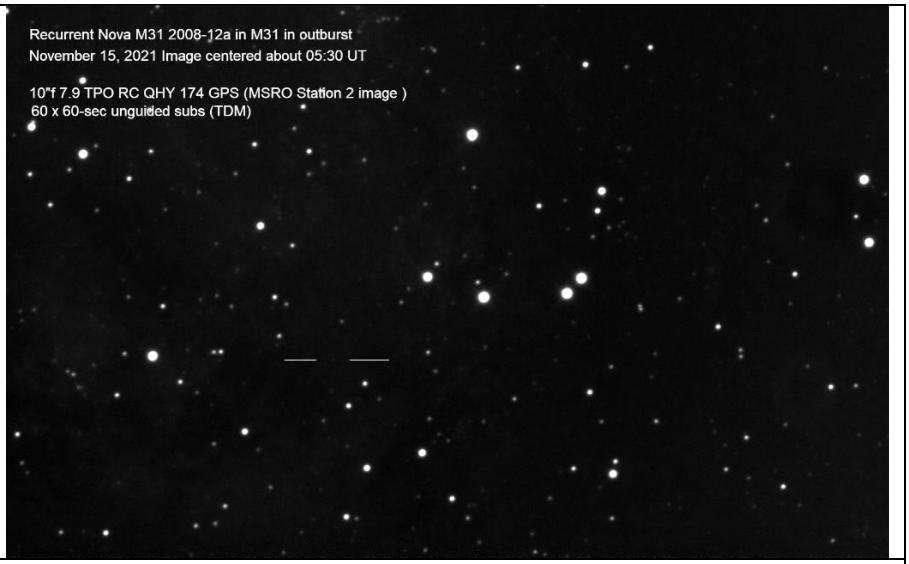

Figure 2. Recurrent Nova M31N 2008-12a, taken November 15, 2021. Source: Myron Wasiuta

On the evening of November 15, 2021, I used the Mark Slade Remote Observatory MSRO Station 2 10-inch f7.9 TPO Ritchie-Chretien telescope (see Figure 1) to take an image of a small part of the Andromeda Galaxy around the location of M31N 2008-12a (see Figure 2). ***(Continued on page 4)***

How to Join RAC

RAC—located in the Fredericksburg, Virginia, area—is dedicated to the advancement of public interest in, and knowledge of, the science of astronomy. Members share a common interest in astronomy and related fields, as well as a love of observing the night sky.

Membership is open to anyone interested in astronomy, regardless of his/her level of knowledge. Owning a telescope is not a requirement. All you need is a desire to expand your knowledge of astronomy. Most RAC members are from the Fredericksburg area, including, but not limited to, the City of Fredericksburg and the counties of Stafford, Spotsylvania, King George, and Orange. We also have several members who live outside Virginia and have joined to have the opportunity to use the Mark Slade Remote Observatory (MSRO)—one of the benefits of membership.

RAC offers you a great opportunity to learn more about the stars, get advice on equipment purchases, and participate in community events. We meet once a month and hold regular **star parties**. Our website, www.raclub.org is the best source of information on our events.

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Website: www.raclub.org
Groups.io: Members-only group. When you join RAC, you will receive an invitation to join from the RAC President.

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John Maynard Internet Administrator
Scott Busby Equipment Loan
Jerry Hubbell Astrophotography
Myron Wasiuta Mark Slade Remote Observatory (MSRO)

Options for Dues Payment

RAC annual membership is $20 per family. Student membership is $5.00. *[Editor's note: the student membership has been lowered from 7.50 to 5.00.]* You can pay your dues in two ways. (For reference, the RAC membership year is January–December.) If you join anytime in the last quarter, your membership covers the upcoming year. Astro League dues run July to June.

- **By Mail:** Make out a check to RAC Treasurer and send it to Matthew Scott, RAC Treasurer, PO Box 752, Fredericksburg, VA, 22404-0752. Both new and renewing members should also print out the membership application here, fill it out, and return it with their payment to keep our records up to date.
- ***By PayPal***: You can also pay your dues online. Simply go here, scroll down, and select the appropriate membership type from the dropdown box and click *Pay Now*. You do not need to complete an application because the notification the club receives of your payment will contain all the additional info needed. NOTE: If you pay using PayPal, your actual charge (including the PayPal usage fee) will be: Single/Family $21.23, Student $5.69, Single/Family & AL $29.00, Student & AL $13.46.

President's Corner

Dear Members—

RAC's business meetings are at 8 o'clock on the third Wednesday of each month. Please consider joining us and participating. If a presentation is scheduled, it will begin at 7 o'clock and will be announced in advance. If a presentation is not scheduled, I will host a social hour at 7 o'clock so members can chat and socialize before the meeting.

I send Zoom meeting invitations to RAC members via our Groups.io email list. Please make sure you are subscribed to get the meeting invitations, and to get timely club emails and to participate in club conversations. Non-members may join our meetings by sending me a request at president@raclub.org. The invitation email will specify the meeting time and if there is a presentation.

The club meetings are far more interesting when they begin with a presentation. Please consider giving a presentation on a topic or piece of astronomical equipment that interests you. Perhaps some of you can dust off and update a presentation you gave years ago that many of our new members haven't seen.

Monthly star parties are now held at three locations—Belmont Observatory, Bowling Green, and Caledon State Park (upon request). Check your email or the RAC website for latest status. (See additional details below in Star Party Update.)

May God bless you with transparent skies and excellent seeing.

Glenn Faini
President

PS: Anyone can attend a RAC meeting via Zoom—just email president@raclub.org for an invitation.

Star Party Update

Recently, RAC greatly expanded its outreach efforts (see listing below). However, the list of **Upcoming Events** shows only those events currently scheduled. Additional events may be scheduled between now and the next newsletter (end April), so be sure to check the website. To request an event, please contact Glenn Faini.

We have also changed the location of our regular monthly star parties. Weather permitting, events will be held simultaneously at Belmont Observatory near Lake Anna in Spotsylvania County and at the VDOT parking area at the intersection of Rtes. 2 and 301 in Bowling Green (Caroline County). To attend a Belmont star party, please contact Scott at (540) 273-0063 for info and directions. To attend a Bowling Green star party, contact Corey at (757) 329-7611 for info. Also, please check the banner on our website for updates on our public star parties.

Upcoming Events	
Star Party, Motts Run	February 8
Star Party, Belmont & Bowling Green	February 18
Star Party, Belmont & Bowling Green	March 18*
Star Party, Belmont & Bowling Green	April 22

Recent Events Completed	
Moon Night, Chancellor Elem Sch.	November 2
Star Party, Louisa High School	November 22
Scouts Star Party, Amer. Legion Post 320	December 2
Star Party, Motts Run	December 13
Star Party, Leander McCormick Observ.	December 13
Star Party, Caledon State Park	December 17
Girl Scouts Outreach, Bowling Green	December 22
Homeschoolers Outreach, Bowling Green	January 15
Star Parties, Belmont & Bowing Green	January 21
Homeschoolers Outreach, Caledon State Park	January 21
BSA Troop Astro. Badge Star Party, Staffd Cty	January 23

*Messier Marathon

Did You Know? **by Scott Busby**

In 1872, Dr. Henry Draper, of New York, obtained the first successful stellar spectrum—of our old friend Vega. Dr. Draper's equipment afterward came to Harvard, and with improved apparatus and more speedy plates, Professor Pickering began the long task of recording the characteristics of the stars as shown by their spectra. Thus, he laid the foundation for the Draper Catalogue, recently published, which contains more than 200,000 stars.

Source: *Universe of Stars: Radio Talks from the Harvard College Observatory,* Harlow Shapley et al, The Harvard Observatory, Cambridge, MA, 1926.

Recurrent Nova in M31 (November 2021) *(Continued from page 1)*

Earlier in the day, I was alerted to the outburst by fellow MSRO Observer Alex Filothodoros. The nova had been detected about a day earlier and was now at about magnitude 18.5. Alex and I discussed this object via texting, and it was determined it should be possible to record it with a series of 60-second exposures if focus and seeing were good. As darkness fell on this night, the telescope was slewed to the location in M31. Imaging began with a series of sixty 60-second images. When stacked, a fairly deep image resulted, reaching to almost 19th magnitude. Clearly visible was a faint but definite image of M31N 2008-12a! It was at about magnitude 18.5. It was amazing to me that a 10-inch telescope had been able to record a transient nova—an individual star—in the Andromeda Galaxy 2.5 million light-years distant! In 1924, Edwin Hubble had done this using emulsion plates but needed a 100-inch telescope!

The next opportunity to image the area of M31N 2008-12a came on the night of November 23, 2021. Although the same telescope and exposure times were used, the star had faded to well below the detection limit. In fact, referencing the rochesterastronomy.org webpage for this object showed it had faded to magnitude 20.3 about 2 days after MSRO's initial observation on November 21. We had no chance of detecting it. However, thinking it would be interesting to make an animation showing it fading away—I created just that showing the recurrent nova blinking on and off on the two nights we imaged the area in M31. I posted this on our MSRO Facebook page and almost immediately was contacted by RAC member Scott Busby. He noted another object blinking in and out of visibility at the upper left of the frame. He was able to identify this second object as an extra-galactic cepheid variable in M31! So as unlikely as it would seem, our observation on each of the two nights captured two variable transients in M31—a recurrent nova and cepheid variable (click here to see Figure 3, which is a video).

So. if the past recurrence rate continues, the next eruption of this remarkable pre-supernova is due any time. I will be patrolling the area of M31 with the MSRO Station 2 telescope, and if anything happens I will post the images!

Update: On the night of December 2, 2022, this remarkable nova exploded again! Once again, thanks to a heads-up from Alex, I was able to secure an image on the night of December 4, 2022—only 32 hours after discovery of this outburst—using the 10-inch RC in Station 2 (see Figure 4). The following night I re-imaged the area using the 4-inch APO refractor in MSRO Station 3 in hopes of getting a nice color image of the nova (see Figure 5).

Figure 4. Recurrent Nova M31N 2008-12a, taken December 4, 2022. Source: Myron Wasiuta

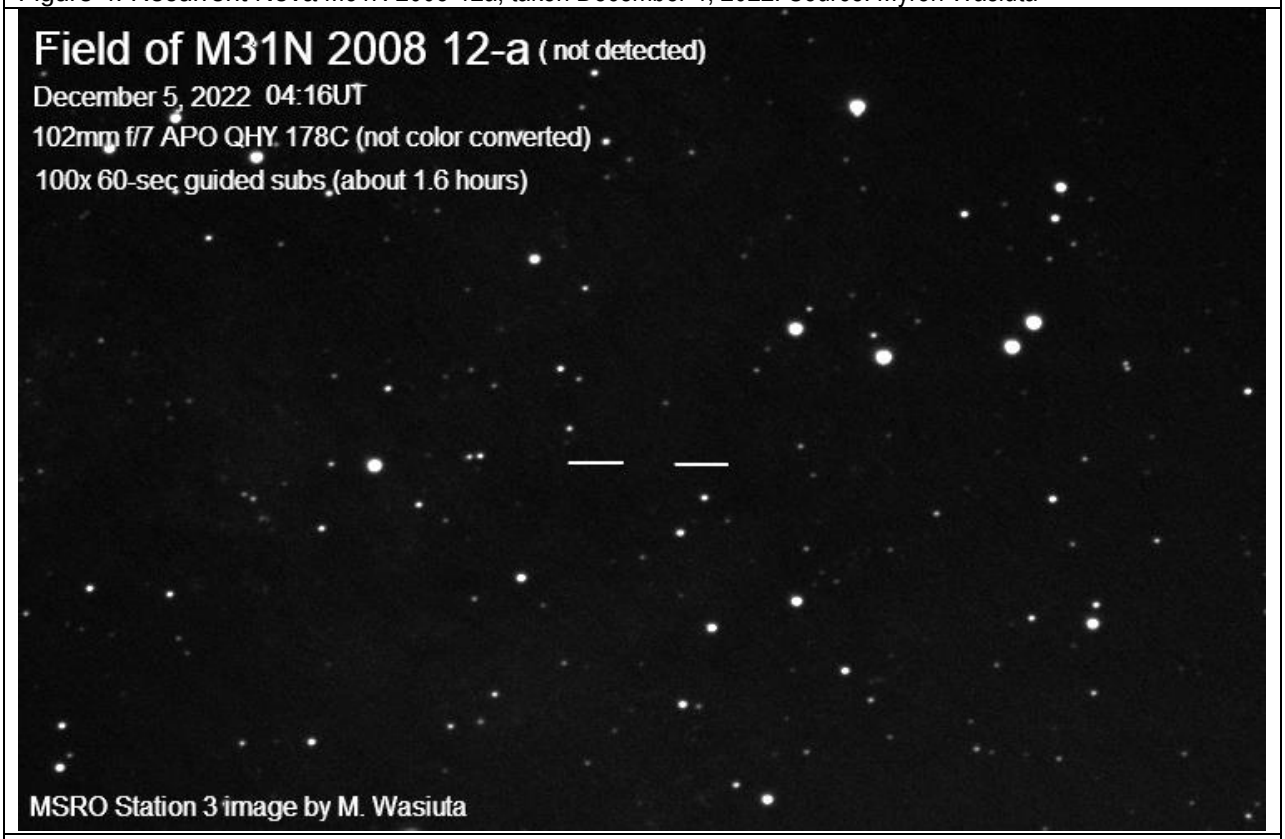


Figure 5. Field of M31N 2008-12a, taken December 5, 2022 (not detected). Source: Myron Wasiuta

Surprisingly, the nova had quickly faded below the detection limit of this telescope. The 2-hour image was deep enough that it should have been able to show the nova if it was as bright as the night before. However, no sign of it was present in the image. As chance would have it, RAC member Boris Starosta also imaged the same area with the 24-inch RRRT telescope on Fan Mountain that same night, and he reported to me that the nova was not visible on single 300-second exposures! It must have faded fast. It looks as though we won't see this star again until December 2023.

Outreach Report: Louisa High School Student Star Party

By Boris Starosta

We had a superb turnout for our event at Louisa High School on November 22—maybe 40 kids. All well behaved and appreciative. The excellent attendance at the event was organized by Sam the HS student—many kudos to him! We had 10 telescopes there, a good number for the crowd of students:

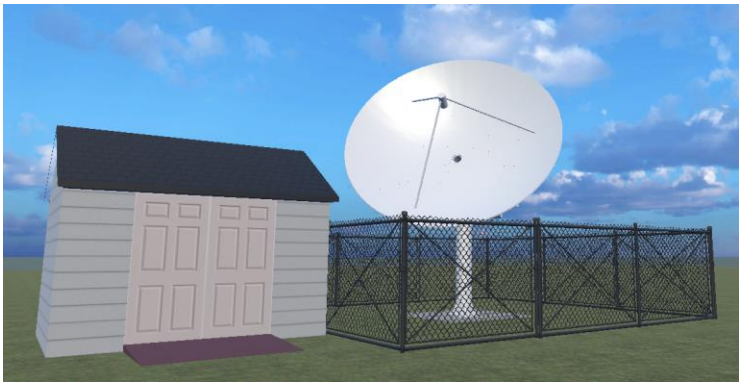
- Yours truly with my trusty old 10-inch SCT
- Liam's 4-inch Mak, operated by Sam
- New member Dave S. with Duresky's TV-85 refractor
- Rich D. with his 8-inch Newtonian reflector
- Ken H. with the eVscope
- Kathleen G. with the Vespera
- Karl with his 5-inch refractor (fantastic view of Jupiter late in the event)
- Corey D. from the RAC, with his 16-inch Newtonian rigged up with night vision gear (image intensifier), which blew everyone's mind
- Claire G. from the RAC with a C90 spotting scope
- Troy M. from the RAC with an 8-inch SCT.

I can't thank you all enough for your attendance and help! Along with the good weather, I think the event was an unmitigated success. The skies were clear, and we had excellent seeing (stable) for Jupiter and Saturn. I showed off Jupiter, Saturn, M15, and Uranus in my 10-inch SCT. We had some amazing views through Corey's 16-inch Dobsonian with image intensifier. When I left (reluctantly, but I had an early morning schedule), Drumm, Karl, and Dave S. were still there taking in views with Corey's setup. Considering I feared a fiasco, I felt so lucky that night! Many thanks again.

MSRO Collaborates with York County Radio Telescope Project

By Myron Wasiuta

Recently, Val Finnel, the president of the York County Astronomical Society (YCAS) (Pennsylvania) called, asking about how MSRO handles the remote observing using our optical telescopes. He was helping with a radio telescope project in York County that would make a 4.5-meter dish antenna available to amateurs, educators, and students interested in radio astronomy. Their model was one of public outreach and education—much like ours at MSRO. Val wanted to study our model of remote observing and access via the Internet and suggested that I contact the director of the project, Kerry Smith.



Drawing of YCAS Radio Telescope Facility to Open in Spring 2023. Source: http://www.astroyork.com/post/radio-telescope/

Kerry is a retired doctor and avid Ham radio enthusiast. He has had a dream for years of building a sophisticated radio telescope capable of being used for outreach and education. That dream is now almost a reality. The

telescope is a 4.5 m parabolic dish on a fully steerable alt-az mount and is the main instrument of the York County Astronomical Society (YCAS) observatory. It will be able to track the stars and has cryogenically cooled electronics in a Faraday-shielded enclosure. The radio telescope will be tuned to the wavelength of 1420 MHz and has the following specifications:

- Single frequency capability at 1420.405751 MHz (hydrogen line)
- Resolution beam width (3 dB point) of 3 degrees with a gain of 33 dB
- Feed horn with ¼ wavelength probe with single polarization specified for 1420 MHz
- Fully automated, steerable, trackable, and remotely controlled capability over WWW.

Val and I discussed areas where we could simultaneously observe interesting targets such as cataclysmic variable stars, intermediate polars, and possibly flare stars, which all emit in the radio frequency. It remains to be seen, however, whether the YCAS radio telescope has the sensitivity to detect these emissions. The idea though would be to use optical light curve data from MSRO and see whether we can correlate any observed radio frequency activity to certain places or features on the light curve. We know this is a long shot, but sometimes thinking "outside the box" has its rewards. Neither Val nor I know of any such collaborations at an amateur level.

The YCAS radio telescope should come online in spring 2023, and we hope to start observations with it then. If any members of RAC have an interest in applying for time on the telescope or helping with the MSRO/YCAS RT collaboration project, email me for more information. Another great resource for members who are interested in radio astronomy in general is Basics of Radio Astronomy for the Goldstone-Apple Valley Radio Telescope, which you can download from here.

Astronomy Math—The Next Level (TNL)

By Scott Busby

If you review the October *StarGazer*, you'll see I ended with this equation:

$$P=\sqrt{D^3}/M \qquad \text{(Eq. 11)}$$

The value of D is equal to 237,000 miles or 0.00255 A.U. The value of M is equal to the mass of the Earth expressed in Sun masses. The Earth's mass is 1/332,500 of the Sun or 0.000003 Sun masses. Substituting these values into Equation 11, we find that P, the period of revolution, comes out to 0.0745 years, or 27.3 days.

It happens that the Moon is an average distance of 237,000 miles from the Earth, and it happens that its period of revolution (relative to the stars) is 27.3 days. Consequently, Kepler's harmonic law, as corrected by Newton, applies as much to the Earth–Moon system as to the Sun–planet system.

Furthermore, because the distance of the Moon from the Earth and the Moon's period of revolution are both known, and because the distance of the Earth from the Sun and the Earth's period of revolution are also both known—then if the mass of the Earth is known, the mass of the Sun can be calculated from Equation 9. Or, if the mass of the Sun is known, then you can calculate the mass of the Earth.

The mass of the Earth was worked out by a method independent of the harmonic law in 1798. After that, it was quick to determine the mass of any astronomical body that is at a known distance from Earth, has a body circling it at a known distance, and has a known period (all these qualities being easy to determine within the solar system). For this reason, the masses of Mars, Jupiter, Saturn, and Neptune, all with satellites, are known with considerable accuracy.

The masses of Mercury and Venus, which lack known satellites, can only be worked out by more indirect means and are known with considerably less accuracy.[1] It might seem unreasonable that the mass of Venus is less well known than that of Neptune when the latter is a hundred times farther from us, but now you see why.

By the time you read this *StarGazer* newsletter, the DART mission will have already resulted in an impact of a small moon of a known near-Earth binary asteroid. DART's target is asteroid (65803) Didymos and its moonlet Dimorphos. The DART mission is the first planetary defense mission that tests asteroid deflection methods. Do you think you could use the equations presented in Astronomy Math to determine with relative accuracy, the masses and orbital periods of revolution of both Didymos and Dimorphos? Try starting with Equation 8. Happy star gazing!

What's Bortle and Why Should I Care?

By Linda Billard

Astronomers often refer to "Bortle X skies," where X is a number from 1 to 9. (See Wade Allen's description of his photo that appears as the Picture of the Quarter at the end of this newsletter—he mentions "Bortle 5.") What, exactly, does this mean? In 2001, John Bortle published (in *Sky and* Telescope) his Bortle scale, which measures the night sky's brightness at a particular location. It attempts to define how well celestial objects can be seen and the level of light pollution. Its purpose is to help amateur astronomers assess the darkness at a single observing site or to compare sites. The scale ranges from Class 1, the darkest skies available on Earth, to Class 9, inner-city skies. Each Bortle number is defined by a number of criteria, including the naked-eye limiting magnitude (NELM). The table below summarizes the scale. FYI, although there are still quite a few Class 1 sites in the United States, the nearest ones to us are in New Hampshire, Maine, and upper Michigan!

Class	Descriptor	NELM	Approx SQM*	Characteristics**
Class 1	Excellent dark sky site	7.6–8.0	21.99–22.0	• Visible, colorful zodiacal light • Many constellations barely recognizable amid large no. of stars • M33 (Triangulum Galaxy) is a naked-eye object
Class 2	Typical truly dark sky site	7.1–7.5	21.89–21.99	• Visible, yellowish zodiacal light • Summer Milky Way highly structured • M33 is a naked-eye object
Class 3	Rural sky	6.6–7.0	21.69–21.89	• Zodiacal light striking in spring and autumn with color visible • Some light pollution at horizon • M33 is an averted vision object
Class 4	Rural/suburban transition	6.1–6.5	20.49–21.69	• Zodiacal light still visible but truncated • Light pollution dome visible in several directions • M33 is difficult averted vision object and only high in the sky
Class 5	Suburban sky	5.6–6.0	19.50–20.49	• Hints of zodiacal light on best spring/autumn nights • Light pollution in most directions • Milky Way very weak or invisible at horizon
Class 6	Bright suburban sky	5.1–5.5	18.94–19.50	• Zodiacal light invisible • Light pollution makes sky within 35° of horizon grayish white • M33 invisible
Class 7	Suburban/ urban transition	4.5–5.0	18.38–18.94	• Light pollution makes entire sky light gray • Milky Way is nearly invisible • M31 and M44 may be seen but without detail

[1] Note that my series of articles, Astronomy Math—The Next Level (TNL), is based on Isaac Asimov's book, *Asimov on Astronomy* (Bonanza Books, 1979). In the book, Asimov includes Pluto as "having no known satellites." Likely the book was in press when Charon was discovered.

Class	Descriptor	NELM	Approx SQM*	Characteristics**
Class 8	City sky	4.1–4.5	<18.38	• Gray/orange sky • Constellation patterns weak • M31 and M44 barely visible
Class 9	Inner-city sky	4.0		• Sky is brilliantly lit • Fainter constellations invisible • No naked-eye Messier objects except the Pleiades

*SQM = Sky Quality Meter reading in mag/arcsec^2
**Not a complete list

Highlights of Recent RAClub Presentations

Abstracted from Bart Billard's Meeting Minutes

December 2022—Star of Bethlehem Video

Attendees viewed a DVD video on the science of the "Star of Bethlehem." It was also shown at the September 2009 RAC meeting when Scott Busby presided and is available online at The Star of Bethlehem website. The website presents the study by Frederick Larson, the narrator of the DVD, on astronomical events that can be calculated precisely with modern planetarium software and appear to fit with the Biblical and historical references to phenomena in the sky around the time of the birth of Jesus. The events he found can be calculated with Starry Night or other planetarium software. In the video, Larson, a lawyer, recounts a last-minute Christmas display he made one year that he decided needed the star to be complete. What he read about it for making the display got him interested in learning more.

Larson presents an interesting discussion of what went into finding what he interprets as the phenomena fitting the Biblical accounts and historical records (and why making those connections has taken so long). First, Kepler's laws were needed to accurately reproduce the appearance of the ancient skies. Kepler made an attempt, but he had to make voluminous calculations by hand. Also, Larson disagrees with the dates Kepler used, which came from a then widely circulated record of the time of Herod's death. These dates led him to calculate the sky as it was 2 years earlier than the dates Larson favors. With modern computers and software, many possible dates could easily be considered.

Larson favors the period starting in September of 3 BC, when Jupiter began a series of three conjunctions with the star Regulus. The September conjunction was unusually close. It also preceded Jupiter's transition to retrograde motion when it appeared to stop its eastward wandering before wandering westward for a period. Larson also found that 9 months later, in June of 2 BC, Jupiter had a very close conjunction with Venus that he says would have looked like a single star, brighter than any other. He suggests the magi would have been interested in astronomy/astrology and aware of these motions of Jupiter. The combination could have influenced their decision to travel to Judea for an audience with Herod, where they related their interpretation that the celestial phenomena suggested a child had been born to be the new king. Larson says Herod then sent them to Bethlehem to search for the child, with orders to return to report where he was. In the wee hours of the night in December 2 BC, the magi would have seen Jupiter in the direction of Bethlehem from Judea.

January 2023—Use of White Phosphor Night Vision Equipment for Astronomy

Corey Dallmeyer gave a presentation on his white phosphor night-vision equipment. He started with a slide with two sample images and a picture of the setup attached to the focuser of his telescope. One image was part of the California Nebula, and the other was part of the Rosette Nebula. The image train on the telescope included a coma corrector on an extension tube, a Televue 55-mm Plossl eyepiece, and an eyepiece adapter on the Plossl to attach his PVS14. He called it a "$5,000 foot-long" but said with the 8-inch Dobsonian he was showing, you could get away with just an eyepiece and the PVS14. The extension tube was mainly for the Plossl eyepiece, and the coma corrector was more necessary with a larger telescope.

Image Train for NV Observing Source: Corey Dallmeyer, Telescopeboss.com

Corey showed three more pictures, two of which looked more bluish. They were 10-second cell-phone shots of the North America Nebula and M81 and M82, taken at James River State Park. (He mentioned using a phone adapter, which was not in the setup he showed earlier.) The greenish image was the Cygnus Wall.

Corey skipped a couple of slides to talk about the PVS14. His was a generation 3 PVS14, white phosphor, which avoids the green look many people think of when talking about night vision. He said they don't have brands like Televue, and each tube is different. There are ratings such as "halo" (what you might see around a bright planet), photocathode sensitivity, EBI (equivalent background illumination, and various measures of how clean the tube is (blemishes or spots in any of the zones, and such). He said he was interested in outreach and the ability to see the objects at the telescope without taking and processing images. Glenn Faini asked Corey how these images compared with what one would see just looking through the setup. Corey said they were a pretty good representation of what you would see, maybe cleaned up a little by the 10-second exposure time. You would see some fuzz, some noise, and some "scintillation" looking in real time. You could turn the gain up to see faint objects better but would see more noise or "sparkles."

Corey showed another set of images, including the Eagle Nebula that someone had taken using a long exposure with an iPhone. He said you could see the Pillars of Creation. He said you could easily see the Flame Nebula and Horsehead Nebula in another of the images. He mentioned taking a video, and Myron Wasiuta recommended everyone should watch it, saying that every 3 or 4 seconds, a bright satellite goes through, possibly Starlink satellites.

Corey showed a picture of the Televue eyepiece adapter and cautioned that it could be difficult to remove from an eyepiece, and that some eyepieces did not fit it. He mentioned eyepieces with higher magnification worked but at the expense of lower sensitivity. In response to a question by Glenn F., he said the adapter does not rely on eyepieces having threads to mate, but just kind of snugs onto the end. The top of the adapter does screw into the PVS14. Corey also mentioned Myron had lent him the 55-mm Plossl, but he had to buy a converter, which made it a 67-mm eyepiece. He said it gave the truest field of view and the brightest image with night vision. Corey also mentioned finding many nebulae he never knew about, regretting that he had left several images out of his presentation but showed one: the Jelly Fish Nebula.

He then showed the Swan Nebula with a 7-nm H_α filter and said it made a big difference and should be part of the stack for nebula viewing. For galaxies and globular clusters, he recommended no filter or a 685-nm IR pass filter. He then showed some images made by others, some of whom were using refractors and framing much larger areas than his telescope with its 1800-mm focal length. Myron asked him about the lifetime of the NV tubes. Corey thought it was 10,000 to 30,000 hours. He said it could depend on how you treated them and protected them from excessive light exposure. Myron wondered whether it would be a good idea to watch for weather conditions such as temperature in the summer versus winter, which had any effect on performance. When he asked Corey whether he noticed effects of the gain setting, Corey said he only recalled one time he had trouble with it, which turned out to be a weak battery needing replacement.

Myron also mentioned hearing about Corey from some people he knows from the Charlottesville Astronomical Society. They seemed to think he was in northern Virginia, and Myron had to correct them that he was in RAC. Corey said his wife looked for amateur groups online and wound up getting the northern Virginia group interested in a demo at one of its star parties, which he went to. Glenn F. asked whether anyone used something other than cell phones, a DSLR for example, for these images. Corey could only think of a professional photographer he knew who did not use a telescope, but he did not know what that person used to take the images and did not have any included in his presentation. Myron suggested they try live-streaming a meteor shower without a telescope using one of the cameras he had.

Corey had a few comments about purchasing a PVS14. He said he used an independent supplier who had some tubes in stock, and that Televue and TNVC (The Night Vision Company) currently have a 2-month waiting period, and have had this delay had for a long time. Also, these latter sources would not provide specs ahead of time. He said he had developed a business relationship with his supplier and was able to get specs before his purchase. Glenn F. asked about other configurations beside the monocular with eyepiece built in (Corey only knew of some binocular night vision formats), and then suggested trying a zoom eyepiece between the tube and telescope. Troy Major mentioned a couple of zoom eyepieces Corey could try out.

Image of the Quarter: The Pleiades

By Wade Allen

Wade said: This image was captured over Christmas Eve and Christmas Day evening with my Williams Optics Fluorostar 91 with .8 Flat Field Reducer that makes it 432 mm focal length Aperture was F5.9. The image represents 7 hours of data using a ZWO ASI6200MC single-shot color, full-frame camera. I used Pix Insights for all processing. The Bortle 5 skies here were amazing, allowing me to pick up some of the fainter nebulae.