

# REFLECTIONS / REFRACTIONS

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University Lowbrow Astronomers Monthly Newsletter

January 2024, Vol 48, Issue 1

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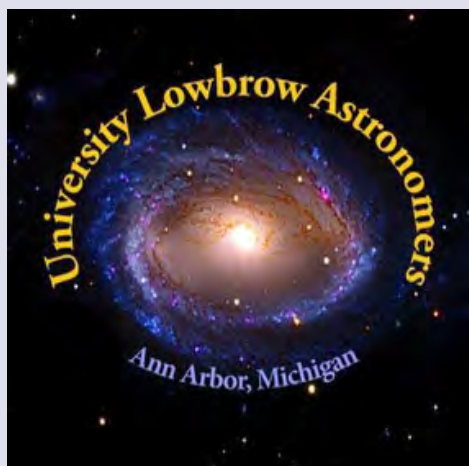
Running Man Nebula NGC1977 - Dec 14, 2023  
© Awni Hafedh

## RUNNING MAN NEBULA

90x3 min subs, close to 4.5 hours of integration time.

Celestron 9.25" with 0.7x reducer  
ZWO ASI533MC Camera  
Astronomik filter  
iOptron CEM60 mount ■

**BY AWNI HAFEDH**



# BLACK COATINGS FOR OPTICAL INSTRUMENTS

BY TOM RYAN

## The Problem of Stray Light

I recently designed a combination “laser flashlight and light collector” for a customer who wants to look at the spectral reflectance of objects in the near-infrared. The design uses three infrared lasers to light up the target, and a gold mirror for collecting that light, and since no project is complete without doing a photon budget, it has one of those, too. The optics have narrow-band spectral coatings to exclude all light other than the laser wavelengths, but the sun and moon also shine at those wavelengths. And the sun is bright. Very, very bright.

The photon budget indicated that the device, running at just under the eye-safety limits of laser broadcast brightness, should be able to detect (using a signal-to-noise ratio of six) the light bouncing off target objects at a distance away of “X”.

At first, the device didn't meet these requirements. Not even close. The lasers were too dim, and the background noise levels were too high. Changes to the laser drive electronics fixed the first part (nothing works right the first time), but the background noise was still too high. So I did some research into the light reflectivity of instrument coatings.

I had assumed that black anodizing was really black. Ha ha, fool that I was.



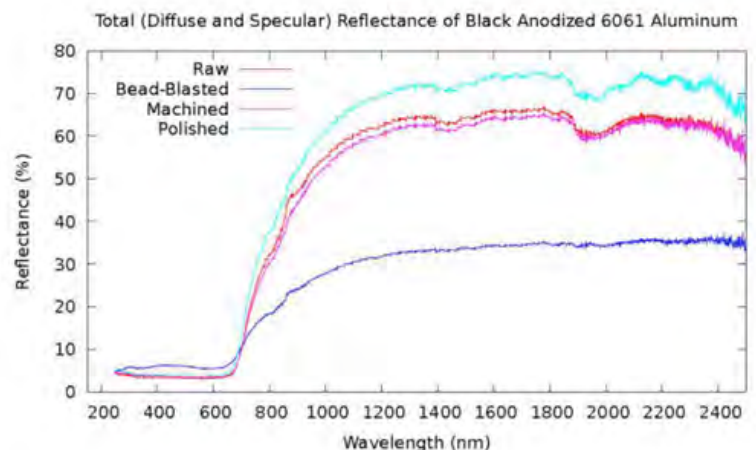
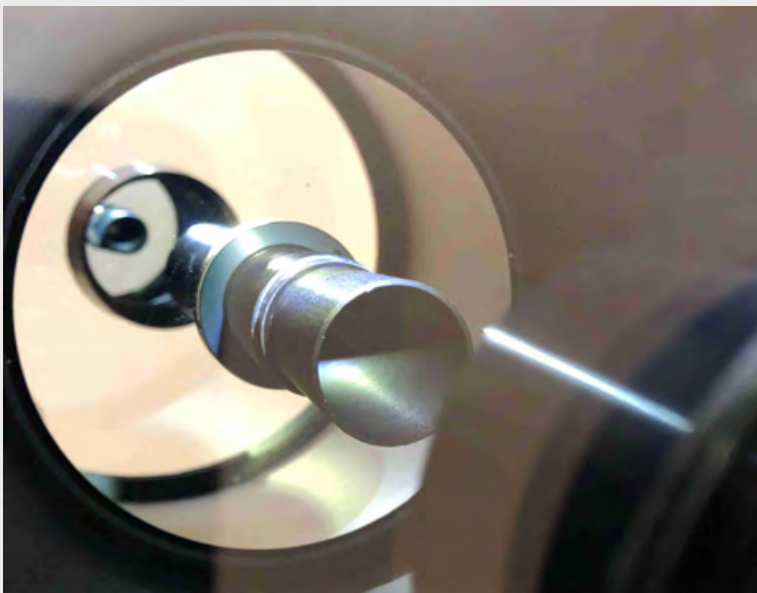
## Black Anodizing

Below left is a picture of the black anodized baffles inside my Celestron C-8 Schmidt-Cassegrain telescope. The baffles are threaded, which is nice but not perfect, and you can see that there are reflections of the illuminating light source coming off the baffles. These reflections bounce around inside your telescope until they find their way to your detector, where they do to your image what Wite-Out does to print.

OK, you say, it could be worse. That 5% to 8% reflectivity of the black anodizing is way lower than the 88% reflectivity of the un-anodized aluminum baffles.

Well, yes it is, in the visible. But in the infrared, just beyond the visible but at wavelengths that your silicon detector can easily see, the reflectivity of the black anodizing rises to about 60-70%, which is higher than polished stainless steel.

However, there is a black anodizing process called “Optical Black,” which uses dyes different from the ones used in normal anodizing, and that process is what I specified we use on a different project that needed to exclude stray light to  $10^{-6}$  levels.



BLACK COATINGS continues, p. 3

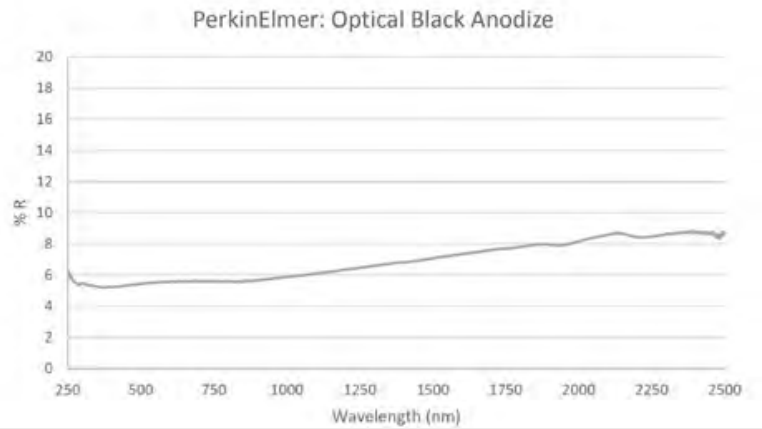
### “Optical Black” Anodizing

“Optical Black” anodizing doesn’t have the problem of high reflectivity in the infrared that normal anodizing does. It reflects between 6 and 9% of the incident light, from 250 nm right out to 2500 nm, as shown in the graph. It’s black to your eyes, and black to your detectors.

The instrument box shown at the right has been anodized with “Optical Black” anodizing, and it’s pretty dark in there. The instrument also uses a Lyot stop, a re-imaged field stop, and baffles placed where Zemax said they should go, but it also relies on dark, dark coatings (“Optical Black” anodizing) to keep the stray light, coming from a bright out-of-field source, off the detector.

But what do you do if you have a telescope or an infrared flashlight that already has the normal black anodizing on it?

Well, they make a paint for that. Several paints, in fact.

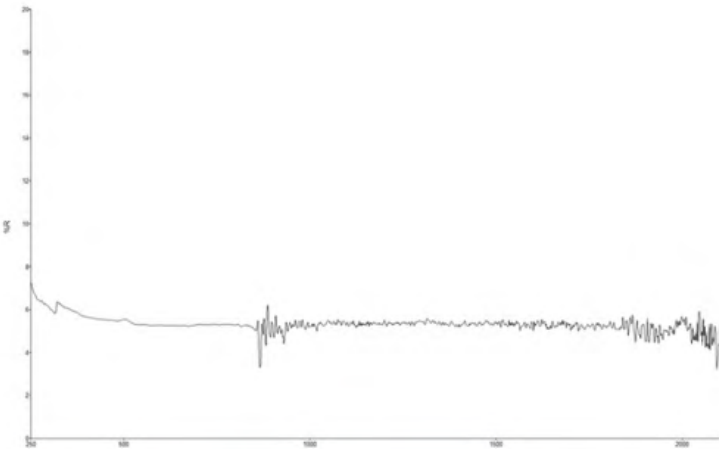


### Black Paint Standard

Krylon makes an industrial spray paint, Krylon #1602 Ultra Flat Black, which has a perfectly flat reflectivity of about 6% from 250 to 2500 nm, which dries fast and sticks well and is the black standard of industrial optical paints. (Krylon moved it from Commercial to Industrial so their customers don’t breathe the stuff.) And you can buy it from Krylon industrial distributors for about \$8/can.

So, I did, and I painted the inside of the infrared flashlight with it. You can see the results in the picture on the left. The outside wall has normal black anodizing on it and has a high specular reflectivity, while the inside surfaces have Krylon painted over the black anodizing, and they are darker and diffuse. Most importantly, they are 6% black in the infrared.

The result of painting the inside of the optical can with Krylon 1602 was that the infrared flashlight met its performance goals for target detection in the infrared. The background noise dropped to the noise floor of the electronics, which is where it was designed to be. All good at this point, for the infrared flashlight.



PerkinElmer spectral reflectance for Krylon Ultra Black



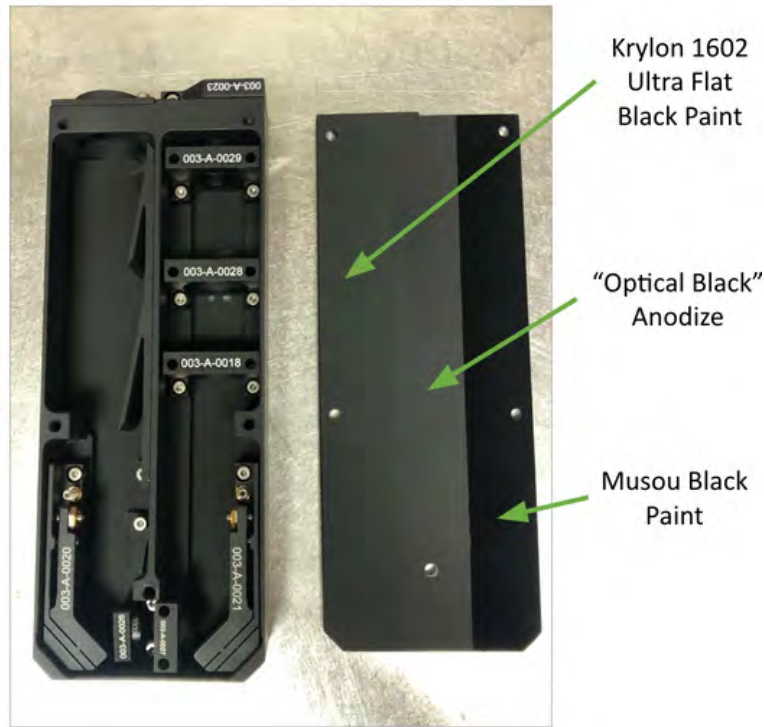
### More Black Paints

Krylon 1602 has been a standard for black paints for decades, but time marches on towards a better world in which I own a jetpack and Pan Am tickets to the moon, and paints have progressed, too. What might be available in paints today, if you don't need infrared performance?

I looked around and the most practical paint for the price is Musou Black. It's not all that cheap and needs an airbrush to best apply it, but it advertises a reflectivity of 0.6% in the visible (not the infrared) as opposed to the 6% of "Optical Black" anodizing and Krylon 1602. What does that 10X difference look like, visually?

I took a cover plate from the Lyot instrument, already anodized with "Optical Black," and painted stripes down the length of it with Krylon 1602 and Musou Black.

The Krylon 1602 and the "Optical Black" are so similar that I suspect that the "Optical Black" people reverse-engineered the Krylon paint for their dyes. The Musou Black paint, however, makes the others look gray.



### Conclusions

At high grazing angles of incidence for light, as in baffles that run parallel to the incoming light, almost all surfaces become specularly reflective. Not Musou paint. The stuff is a black hole for light when applied with an airbrush. It is not, however, nearly as durable as anodizing, so it should not be used where you are going to rub up against it all the time.

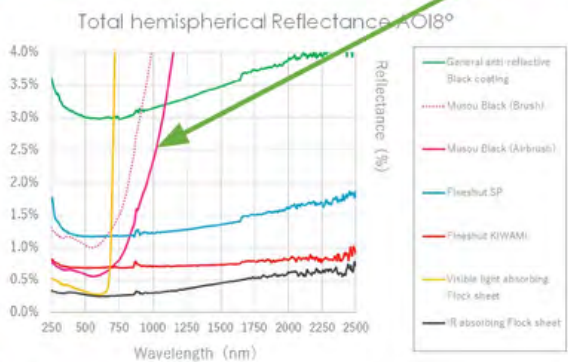
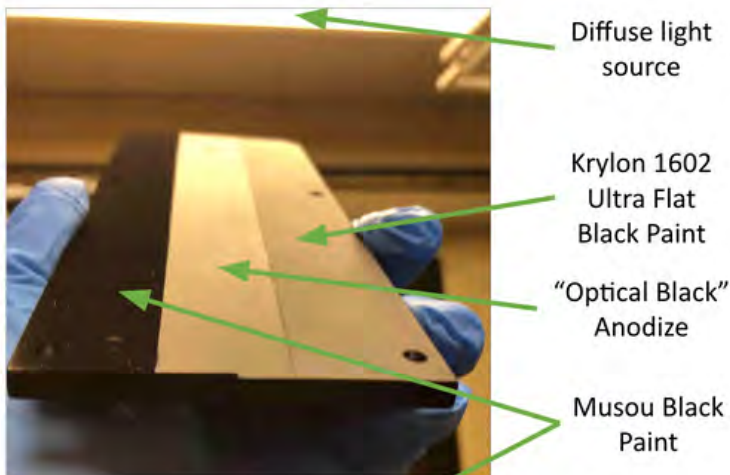
Nor is it very black in the infrared. The Musou people provided the chart on the left, and you can see that the reflectivity of Musou Black starts to skyrocket around 750 nm, towards that of regular anodizing.

Not discussed is the use of fabric or black velvets, which can be very black but which can shed particles onto your optics.

Basically, if you need a black paint in the visual, and it's not subject to abrasion, use Musou Black.

If you need a paint that is pretty durable and black in the infrared, use Krylon 1602 Ultra Flat Black.

If you need a coating that won't come off in spacecraft shake tests, use "Optical Black" or Vantablack or Acktar Black, but be prepared with your grant money to pay for these. ■



# OVER THE HORIZON

BY JACK SPRAGUE

2024! I cannot be among the only ones out there thinking I'd never last this long!

## Observing: (all times EST)

Average Sunrise 07:57, Sunset 17:03.

## The Winter Snapshot:

Between now (the January edition of Reflections) and the first of April, all we seem to get is a brief one or two-night break in the gloom which is Michigan.

Am I exaggerating? Sure. We get nearly seven nights of partially clear skies!

Most of these wonderful opportunities will feature a nearly full moon. At least, that's what my sky journal says and who can distrust the written word? (Ignore that.)

I'm going to insert a plug for Sky & Telescope here as Don Ferguson has an excellent article on p. 36 of the February issue which completely covers our snapshot window observing opportunities in the coming month. He calls them "Driveway Planetaries" and I find the idea delightful.

The following are perfect for ready targets during the winter nights but be warned, they are somewhat dim and small. We'll cover some more attainable topics in the last part of this article. Beware, these small planetaries demand clear skies of the sort we know from only the coldest, clearest nights. Nevertheless, for the suitably brave (and well-warmed) astronomers, a list of targets:

- IC 289 (Cassiopeia) – 3hr 10.3' x 61° 19'. Size 48". Mag 13.2.
- NGC 1501 (Camelopardalis) – 4hr 7.0' x 60° 55'. Size 52". Mag 11.5.
- NGC 2022 (Orion) – 5hr 41.1' x 9° 05'. Size 39". Mag 11.6.
- Abell 12 (Orion) - 6hr 2.3' x 9°39'. Size 37". Mag 12.0.
- Minkowski 1-7 (Orion) – 6hr 37.3' x 24° 01'. Size 37". Mag 13.0.
- Abell 21 (Canis Major-Gemini border) – 7hr 29.1' x 13° 15'. Size 615". Mag 10.3.
- Minkowski 1-16 (Monoceros) – 7hr 37.3' x -09° 39'. Size 14". Mag 13.0. (tiny!).
- NGC 2610 (Hydra) – 8hr 33.4' x -16° 9'. Size 42". Mag 12.7.

The Moon Phases:

Date	Day	Phase	Rise	Set
03 Jan	Tuesday	Third Quarter	Rise 23:54 (2 <sup>00</sup> )	set 12:07
11 Jan	Tuesday	New Moon	Rise 08:40	set 17:28
17 Jan	Tuesday	1 <sup>st</sup> Quarter	Rise 11:14 (16 <sup>00</sup> )	Set 00:02
25 Jan	Tuesday	Full Moon	Rise 08:20	Set 17:31

I personally plan to try all of these in the near infrared using the IMX662 imaging chip. The Hubble Site has a very interesting visual comparison of the Helix Nebula (C63 / NGC 7293 in Aquarius) for those interested in exploring this fascinating means of defeating the eroding Bortle zones.

[<https://hubblesite.org/contents/media/videos/1150-Video.html?Format=06-frame-sets>]

## Visual Targets for Driveway Viewing:

Using our criteria of sudden and often unpredictably rare observing chances theme from above, here are some eyeball-worthy targets for the frigid Michigan nights.

## Planets

In January, Venus (37° ahead of the Sun) and Mercury (18° ahead of the sun) are morning standouts. As the quarter progresses, they fall more and more into the dawn but in the first half of January, these are great targets. Astronomers never sleep anyway, right? Jupiter, Saturn, Uranus, and Neptune are evening delights and are best seen early in the quarter. Saturn is lost to us by mid-February. Neptune is lost just a few days later. [ Planets are the Objective Lens topic for February ].

## Others:

M42 (NGC 1976), the Orion Nebula. 5hr 35' 17" x -05° 23' 28". Size 60'. Mag 4.0. (Enormous).

C14 (NGC 869/864), The Double Cluster of Perseus. 2hr 20' x 57° 8'. Size 60'+/-. Mag 3.8.

M44 (NGC 2632), Praesepe or the Beehive Cluster. 8hr 40.4' x 19° 59'. Size 95'. Mag 3.8. (Clearly, more accessible later in the month).

M1 (NGC 1952), The Crab Nebula. 5hr 34' 32" x 22° 1'. Size 420" x 290" (planetary so it is smallish). Mag 8.4.

These cold nights are rarely cloudless for the long hours we'd desire. Grabbing what we can when we can is the best of all possible worlds, to echo Professor Pangloss in *Candide*. Good luck with your winter observing. ■

# REVIEW: SEESTAR S50

## ZWO Astro, \$499

BY DAVID COOKE

The Seestar is a 50 mm triplet refractor optimized for astrophotography. There is no eyepiece, and while it is possible to see “live” images on your phone, it isn’t designed to be used as a visual scope. It is very compact (about 5” x 5” x 10”) and weighs about 6 lbs, and it fits inside an airline carry-on bag. It has a built-in narrowband filter and dew heater (both can be turned off) and onboard automated image-stacking software. It is equipped with WiFi and Bluetooth and is controlled via a proprietary app for Apple iOS and Google Android phones and tablets. I use the iOS version and it sends images directly to my Apple Photos library. It comes with a case, a mini-tripod (you can use any standard tripod if you prefer), and a snap-on solar filter.

I bought a Seestar S50 device as my introduction to astrophotography and as a potential solution to the light-polluted hell I call my backyard. The imaging results have far exceeded my expectations. My backyard has bright porch lights directly facing me 50-100 feet away from several neighbors, and there are bright streetlights wherever there aren’t houses (see photo on page 7). Still, my Seestar produces images under these miserable viewing conditions that surpass what I see visually with my 8” SCT under dark skies. I’ve attached several examples; they are either unprocessed or mildly enhanced with Apple Photos.

The Seestar’s performance depends upon the kind of object you are viewing:

- Nebulae: Outstanding images with the aid of the narrowband filter.
- Galaxies: Works well for brighter galaxies such as M31 and M33; less so for dim ones
- Globular Clusters: Fair; the 50 mm aperture is too small to see them well.
- Open Clusters: Pretty good on both large and small clusters.
- Solar: Very nice images with the included solar filter.
- Planetary: Forget it. No better than binoculars; perhaps worse.



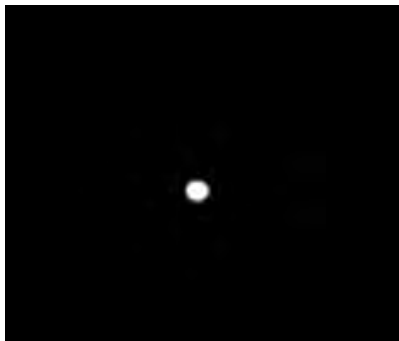
Owl Nebula above, Bubble Nebula below.



SEESTAR review continues, p. 7

It is surprisingly easy to set up. Once you have registered the app for first use, you just turn the scope on, launch the app, and connect. It needs to be leveled at the start of each session; you adjust the tripod until two circles merge on your phone screen. However, it does not require any alignment at all; it finds its way with a compass and plate-solving. I simply selected an object from its large database, and it quickly and accurately pointed to it. I hit the on-screen start button and it began taking pictures and stacking them. The screen shows the stacking results live, so the image updates as you watch.

The Seestar has limitations that may be deal-breakers for seasoned astrophotographers. You cannot adjust exposure length and the maximum exposure is only 10 seconds. The 50 mm lens cannot show the detailed images you see in larger scopes. Magnification is fixed; you can digitally zoom on your phone, but there is no physical zoom lens, and you can't zoom out. The imaging sensor is quite good, but there are better ones on the market. The Seestar's control app takes some getting used to, as it is a bit quirky and the function labels were created by engineers who are not native English speakers.



Jupiter, left  
M2, bottom  
M42, right



**The “dark sky” area where the Seestar photos were taken**

All of that said, as someone who has never taken astrophotographs before and lacks the time to learn complex image processing software, I'd say it is perfect. I just set it up, select a target, shoot while I stay indoors with my wife during 20 degree weather, and let it do the post-processing work for me.

I'm definitely not giving up on visual astronomy, and it's possible that I will eventually want to graduate to higher end astroimaging gear. However, I've still got about 5 years before I move north to much darker skies, and I expect the Seestar will keep me quite happy until then. ■

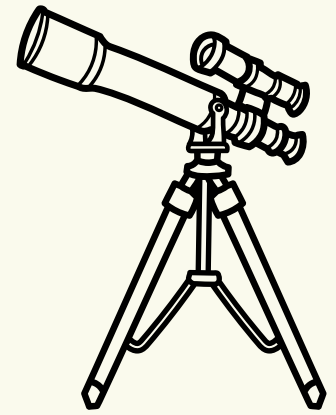


See more of David's Seestar photos in this month's Objective Lens.

# UPCOMING TOPICS FOR THE OBJECTIVE LENS

BY JACK SPRAGUE

Our Lowbrow photographic roll features images from snapshots, eyepiece imaging, EAA captures, and astrophotography. All images are welcome and while we have a monthly theme, we love any submission.



**February** – Planets! Jupiter and Saturn have been lovely this fall but Mars becomes a star in January. Get the ADC out and make all preparations for lucky imaging. I know there has to be some awesome image captures we haven't seen in our photo roll yet!

**March** -- Observers. It is always fun to see Lowbrows at the scope. The March edition encourages the images of Polar Observers (aka Michiganders) preparing for the rare winter outings. Let's see those parkas! Boot packs? Get them in frame. Do we have any Lowbrow toboggan caps? The Tigers have them. Maybe we should, too! ■

## UPCOMING MEETING SPEAKER SCHEDULE

**January 19:** Melissa Kaelin, Michigan Aurora Chasers

Topic: *Outsmart Space Weather Forecasts to Catch Aurora in Your Backyard*

**February 16:** Rosalyn Friend, EMU Physics graduate

Topic: *Atmospheric Gravity Waves and Solar Eclipses*

**March 15:** Jim Shedlowski

Topic: *Searching for the Dark Universe*

**April 19:** Jeff Kopmanis, Club Online Coordinator

Topic: *Automated Astrophotography (On the Cheap)*

**May 17:** Gary Nichols

Topic: *How Smart Are They? A Comparison of the New Breed of All in One Smart Telescopes*

**June 21:** Club members Ed Hernandez, Jeff Kopmanis, Ken Leitch, Marcus Clarke, Jack Sprague, Dmitri Tsahelnik, Glenn Kaatz, Brian Ottum

Topic: *Timed Showings of Astrophotography by Club Members*



# University Lowbrow Astronomers

## Monthly Club Meeting Minutes

15 Dec 2023, 7:32 pm. Location: Detroit Observatory and on Zoom

President Charlie Nielsen called the meeting to order and then introduced our speaker.

### Speaker

**Who**

Professor David Gerdes, U of M Department of Physics & Astronomy

**Subject**

Shadow of a Fossil: Stellar Occultations and Lucy's Mission to the Trojan Asteroids

The talk can be found on our YouTube Page.

After the talk and Q&A Session, Charlie called the business meeting to order.

### Business Meeting

Name	Topic
Charlie Nielsen, President	<ul style="list-style-type: none"><li>Read emails of officers who sent in reports electronically. Those reports will be reproduced here in these minutes.</li></ul>
Doug Scobel, Treasurer	<ul style="list-style-type: none"><li>We have 197 memberships.</li><li>I made our usual monthly payment to AT&amp;T for our Open House "hotline", and paid the newsletter editor's cost of printing and mailing the printed version of our newsletter.</li><li>I paid observatory director Jack Brisbin \$206.62 for the new space heater and electrical outlet for the observatory.</li><li>As of this writing we have six RASC observer's calendars and one observer's handbook available to purchase.</li></ul>
Dr. Brian Ottum, V.P.	<ul style="list-style-type: none"><li>As you may know, we Lowbrows support Astronomy at the Beach every year. It is the largest public astronomy event in Michigan, and drew over 3000 last September. The new 501c3 nonprofit status means the event is in great shape financially. We Lowbrows support the event financially, as well as bringing many telescopes. In addition, we have always had someone serve on the board. Going back a decade we had Shannon and Joe, then Paul Walkowski, Brian Ottum, Jeff Kopmanis, John Wallbank and Adrian Bradley. Now the board needs new helpers. Jeff will not be running for Secretary again. Brian will not be running for communications/marketing coordinator. Please let Brian Ottum know if you are interested or have any questions.</li></ul>
Adrian Bradley, V.P.	<ul style="list-style-type: none"><li>Will step down from V.P. but continue to support the club through organizing outreach events through the club's communication committee.</li><li>Put in a motion for the club to donate to the Vatican Observatory Foundation. Charlie amended the motion to make it an annual</li></ul>

	<p>donation of \$100.</p>
Amy Cantu, Newsletter	<ul style="list-style-type: none"> <li>• Since the call for newsletter submissions typically comes out on the 25th with a due date of the 1st -- and both dates are holidays this time -- I'll send out the call on the 22nd and extend the submission deadline to Jan 2.</li> </ul>
Jeff Kopmanis, Communications	<p>1) RASC Handbooks and Calendars: all are here for pickup if you've pre-paid for them. 3 handbooks and 7 calendars are still available for purchase: \$26 for handbook, \$19 for calendar. Best way is to PayPal to Doug Scobel (<i>I'll let you decide if you want to take cash at the meeting</i>).</p> <p>2) A new <b>Observing Sites</b> page is now online on the new web site under <b>Resources</b>. We're interested in collecting info and images for Members' favorite sites that may not be listed. If members have sites they'd like to add, I'd ask that they give us some descriptive stuff--just email Jeff at <a href="mailto:kopmanis@gmail.com">kopmanis@gmail.com</a> with:</p> <ul style="list-style-type: none"> <li>• Short summary description</li> <li>• What amenities it has</li> <li>• Pros (what you like about it)</li> <li>• Cons (what you don't like about it, or stuff that's lacking)</li> <li>• A website URL, if they have one</li> <li>• An address or Google Maps location so we can include a map</li> </ul> <p>This same list is published in the December newsletter.</p>
Dave Snyder, VP	<ul style="list-style-type: none"> <li>• Discussed ways to get more involvement by club membership, based on the results of the recent club survey.</li> <li>• Because there will be a new VP opening in April, a newer club member is encouraged to run for this position.</li> <li>• Members are encouraged to join one of our committees. We have an observatory committee and a communications committee. A new astrophotography committee was discussed.</li> <li>• Our new website will feature a link for members to easily join one of these committees.</li> </ul>
Jack Brisbin, Observatory	<ul style="list-style-type: none"> <li>• The attached photo shows the installation of the new Observatory Heater. Myself and Doug Nelle installed it on Wednesday afternoon. Instructions say to let it run continuously for 48 to 72 hours. I checked on it Saturday afternoon when I left Saturday morning physic's (Fred Adams). So far so GOOD.... I left the data logger running I will go backout Tuesday to check on it again. Monday night and Tuesday night it is supposed to drop in the 25 degree range. I want to see how well the heater works. The cost is 249.99 BUT...I bought it on Black Friday /CyberMonday sale for 20% off and free FedEx shipping, Total \$199.96</li> </ul>



## PLACES & TIMES

Monthly meetings of the University Lowbrow Astronomers are held on the third Friday of each month at 7:30 p.m. The location is usually the Judy & Stanley Frankel Detroit Observatory. The Observatory is located at 1398 E. Ann St., Ann Arbor. The Ann Street Parking Structure (M86), the Catherine Street Structure (M5), the Glen Street Structure (M61), and the School of Public Health II Lot are usually open after 6:00 p.m. Mon-Fri. The M86 structure is closest to the Detroit Observatory.

Peach Mountain Observatory is the home of the University of Michigan's 25-meter radio telescope and McMath 24" telescope, which is maintained and operated by the Lowbrows. The entrance is addressed at 10280 North Territorial Road, Dexter MI, which is 1.1 miles west of Dexter-Pinckney Rd. A maize and blue sign marks the gate. Follow the gravel road to the top of the hill to a parking area south of the radiotelescope, then walk about 100 yards along the path west of the fence to reach the McMath Observatory.



## PUBLIC OPEN HOUSE / STAR PARTIES

Public Open Houses / Star Parties are generally held on the Saturdays before and after the New Moon at the Peach Mt. Observatory but are usually canceled if the forecast is for clouds or temperatures below 10 degrees F. For the most up-to-date info on the Open House / Star Party status call: (734) 975-3248 after 4 pm. Many members bring their telescope to share with the public and visitors are welcome to do the same. Mosquitoes can be numerous, so be prepared with bug repellent. Evenings can be cold so dress accordingly.

Lowbrow's Home Page  
<http://www.umich.edu/~lowbrows/>

## MEMBERSHIP

Annual dues are \$30 for individuals and families, or \$20 for full time students and seniors age 55+. If you live outside of Michigan's Lower Peninsula then dues are just \$5.00. Membership lets you access our monthly newsletter online and use the 24" McMath telescope (after some training). Dues can be paid by PayPal or by mailing a check. For details about joining the Lowbrows, contact the club treasurer at: [lowbrowdoug@gmail.com](mailto:lowbrowdoug@gmail.com)

Lowbrow members can obtain a discount on these magazine subscriptions:

**Sky & Telescope** - \$43.95/year

**Astronomy** - \$34.00/year, \$60.00/2 years or \$83.00/3 years

### Newsletter Contributions:

Members and non-members are encouraged to write about any astronomy-related topic. Contact the Newsletter Editor: Amy Cantu [cantu.amy@gmail.com](mailto:cantu.amy@gmail.com) to discuss format. Announcements, article, and images are due by the 1st day of the month as publication is the 7th.

### Telephone Numbers:

President:	Charlie Nielsen (734) 747-6585
Vice President:	Adrian Bradley (313) 354-5346
	Jim Forrester
	Brian Ottum
	Dave Snyder
Treasurer:	Doug Scobel (734) 277-7908
Observatory Director:	Jack Brisbin
Newsletter Editor:	Amy Cantu
Key-holders:	Jim Forrester
	Jack Brisbin
	Charlie Nielsen
Webmaster:	Krishna Rao
Online Coordinator:	Jeff Kopmanis

**A NOTE ON KEYS:** The Club currently has three keys to the Observatory and the North Territorial Road gate to Peach Mountain. University policy limits possession of keys to those whom they are issued. If you desire access to the property at an unscheduled time, contact one of the key-holders. Lowbrow policy is to provide as much member access as possible.

Email to all members  
[Lowbrow-members@umich.edu](mailto:Lowbrow-members@umich.edu)



# University Lowbrow Astronomers

