Visual Observing

What I’ve learned from over 50 years under the stars

Michael Prochoda
(Moloka’i, Hawaii)

Philosophy – Questions to ask…

- What does the night sky mean to me?
- What does astronomical observing mean to me?
- Why go out, in the dark, in the cold, away from civilization and family, to gaze into the black of night?

Astronomy as nature's "big screen"

- Modern life is consumed by our "little screens"
- The night sky has always been there as our "big screen" ever since the dawn of humanity.
- The night sky has been mankind's clock, calendar, compass, and companion for millennia.
- Exciting events happen on the "big screen" – lunar phases, planetary alignments, eclipses, comets, novae, aurorae, etc.
- Predicting these events and their recurrences, and eventually understanding these phenomena, became the focus for entire classes of humans (shamans, oracles, astrologers, and eventually, mathematicians, and scientists).

Astronomical Observing

- For me, astronomy is a source of grounding and orientation in an otherwise dizzying and at times chaotic world. It has been the one “constant star” in my life.
- Some of my earliest childhood memories was a fascination with the moon in the sky.
- As a toddler, I remember taking the kitchen colander outside and showing my mother how the colander was like the stars in the sky.
- I read beginning science and astronomy books voraciously.
- I pestered by parents endlessly to buy me a telescope.

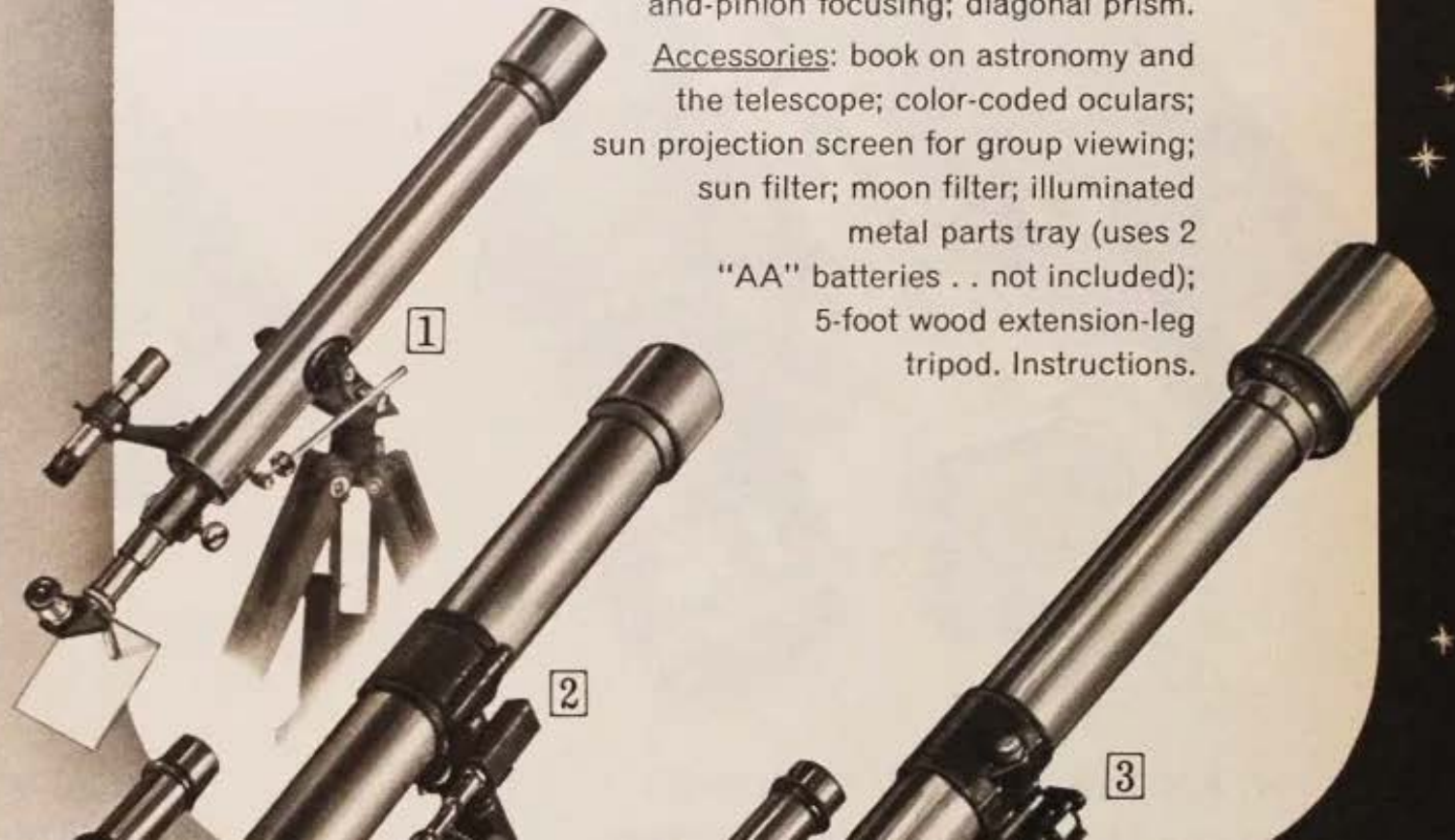
Visual Observing

- In 3rd grade my parents finally bought me an inexpensive spyglass. I was disappointed with the views of the heavens in this telescope as it had poor optics and a very narrow field-of-view (and it was hand-held, making pointing difficult).
- Further pestering tortured my parents into buying me a proper telescope, a Sears Discoverer 2.4” refractor on an alt-az mount (60mm aperture, 700 mm FL doublet objective) for my 8th birthday.
- It had 4 “eyelenses” – 20mm K, 6mm HM, 4mm SR and a 2x singlet barlow. I soon learned that only the 20mm Kellner eyepiece was of any use (35x).

SEARS PROFESSIONAL-MODEL ASTRONOMICAL TELESCOPES

also convert for land viewing

(1 thru 3) Precision engineered: fine coated optics; all-metal outside. Versatile performance: erecting prism converts for terrestrial use; Barlow lens lets you about double each power. More quality: optical view finder with cross-hairs; rack-and-pinion focusing; diagonal prism. Accessories: book on astronomy and the telescope; color-coded oculars; sun projection screen for group viewing; sun filter; moon filter; illuminated metal parts tray (uses 2 "AA" batteries . . not included); 5-foot wood extension-leg tripod. Instructions.



Magnifies up to 350 times . .
has 700mm focal length

$59.98

1 **Lets budding Galileos** see moons of Jupiter through 2.4-inch refractor objective. Altazimuth mount lets scope tilt up-down, rotate side-to-side . . slow motion altitude control. Three different power eyepieces (SR 4mm, HM 6mm and K 20mm). 5x24mm viewfinder scope.
4 G 6309C—Shipping wt. 18 lbs.
$6.00 monthly . . . . . Cash $59.98

Magnifies up to 450 times . .
has 900mm focal length

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2 **Permits serious hobbyists** to view Saturn's rings on a clear night through 2.4-inch refractor objective. Counter-balanced 3-axis equatorial mount to move telescope at any angle . . ideal for star tracking. Calibrated hour, declination, latitude circles. Slow-motion cable controls. 3 different power oculars (SR 4mm, HM 9mm, K 22mm). 6x30 view finder. Wood cabinet.
4 G 6305L—Shipping weight 30 lbs.
$9.00 monthly. . . . . Cash $99.98

Our biggest capacity model
magnifies up to 600 times . .
has 1200mm focal length;
5 different power oculars

$199.98


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Visual Observing

- Despite the limitations of poor eyepieces and a flimsy mount, I managed to “discover” Saturn, Jupiter, Mars, Venus, sunspots, the lunar surface, and a handful of open clusters with my little refractor. But galaxies and most nebulae eluded me.
- Over the next few years, directed Christmas and birthday gifts afforded me a better mount (Edmund EQ mount), and four University Optics Orthoscopic eyepieces to upgrade my Sears Discoverer.
- By the time I was in high school, I managed to purchase and majorly renovate a used 8”, F/7 Newtonian on a Pacific Instruments EQ mount, which I obtained from the Denver Astronomical Society’s annual auction. This instrument was my golden ticket to the objects of Messier, the NGC, and beyond.

Visual Observing

- Doing observational astronomy in the 60s and 70s meant learning the sky by using star charts, and star-hopping to find objects.
- A 30mm aperture **A. Jaegers** finder, and the "***Skalnate-Pleso Atlas of the Heavens***" star charts were my guides to finding things in the night sky
- Favorite book at the time: "***The Sky Observers Guide***" (Golden guide series).

A. BECVAR

SKALNATE PLESO
ATLAS OF THE HEAVENS

1950.0

Published by

SKY PUBLISHING CORPORATION

Harvard College Observatory

Cambridge 38, Mass.

Printed in the United States of America


A. BECVAR
SKALNATE PLESO
ATLAS OF THE HEAVENS
1950.0
SKY PUBLISHING CORPORATION

A GOLDEN GUIDE®

THE SKY OBSERVER'S GUIDE

Full-color, Easy-to-Use

Visual Observing

- 50+ years later, here is what I’ve found to be helpful…

The Telescope Mount

- The alt-az mount is king for visual use.
- John Dobson had it right – KISS principle
- The eyepiece stays at a constant orientation with respect to the ground (no rotation about the axis of the telescope tube)
- Typically, there is no need for a counterweight
- Inherently much more stable for a given mass

The Telescope Mount

- Many alt-az mounts allow for tandem telescope mounting (wide field scope along with a long focal-length scope).
- Overmounting your telescopes makes for happy observing
- Technology now allows for extremely accurate pointing and tracking (plate-solving), so an EQ mount is unnecessary


TEC APO 140
2005 9 12


IlluMounts, Inc


CORONADO


MEADE
STARFINDER
MEADE
2009 7 31


ASTRO-PHYSICS
MAKNIGHT

Tip - Velcro!

- One of the most useful things I've learned to make my observing life easier is the multiple uses for adhesive strips of Velcro.
- Stuff stays secure and within reach.
- Eyepiece caps
- Finder caps
- Control paddles for mounts
- Dew heater controllers and accessories
- Small tools
- Counterweights for dobs


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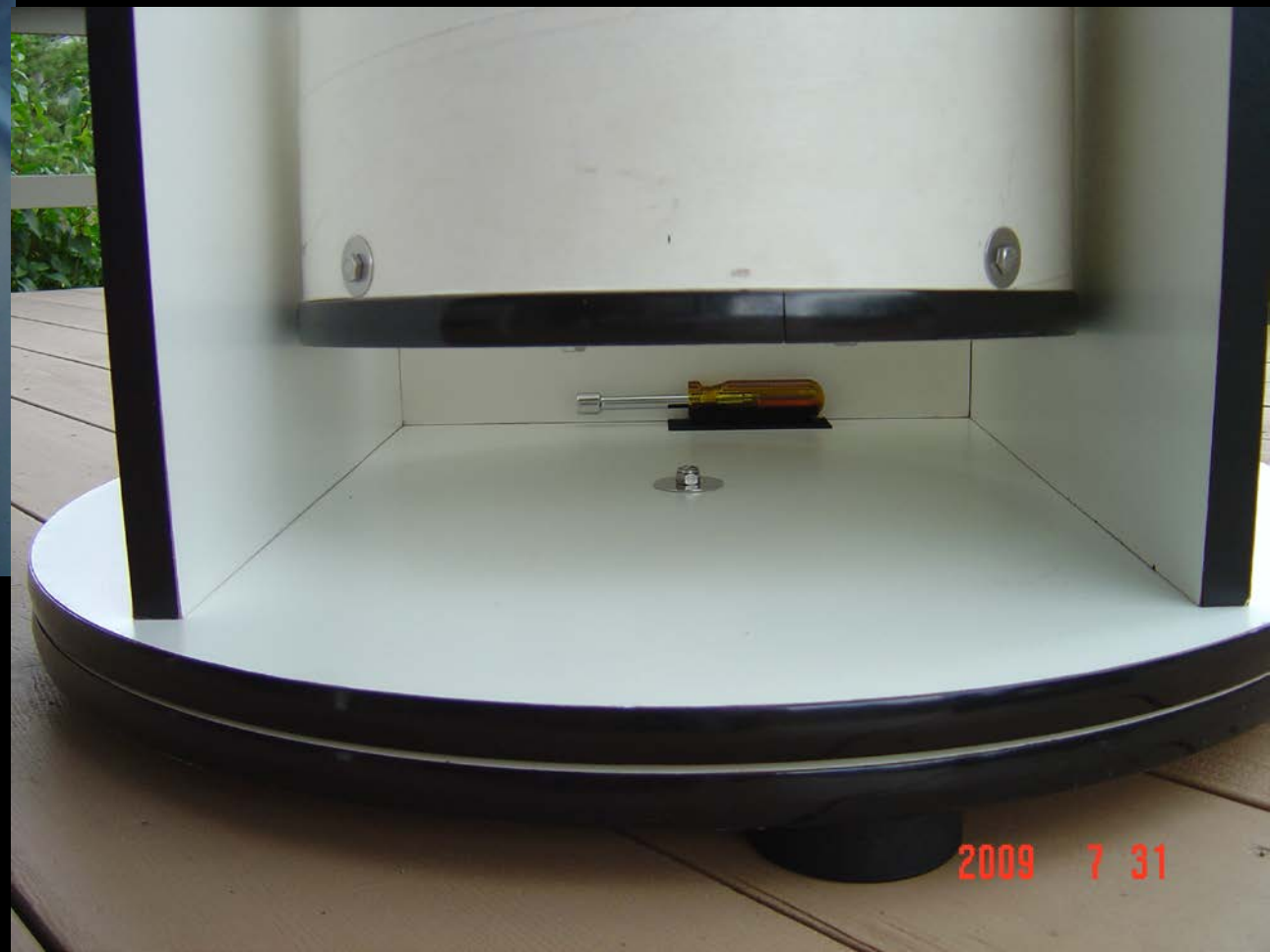
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The Telescope

- Question: What is the best telescope?
- Answer: The telescope that gets used!
- Second answer: The telescope that gets used!
- Longer answer: It mostly depends upon what type of objects you really love to observe…
- All telescopes will provide worthy views of all astronomical objects, but certain telescope types excel for certain object categories.

The Telescope

- Lunar / Planetary / Double star work
  - APO refractors
  - Catadioptrics – a close second
- Open Clusters
  - APO refractors
  - Fast Newtonians for smaller clusters
- Globular Clusters
  - Catadioptrics and Newtonians

The Telescope

- Diffuse Nebulae
  - Newtonians and SCTs
- Planetary Nebulae
  - Catadioptrics and Newtonians
- Galaxies
  - Newtonians and SCTs

The Telescope

- So what type of telescope do I use?
- All of them! (he replies sheepishly)
- However, imagine you could only keep a single instrument. Which telescope would you choose?
- My answer: My TEC 140 mm triplet APO refractor on my DiscMounts DM6 alt-az mount. It's the one that gets used, and it has a reasonable aperture.
- However, I have an AstroTech 90 mm triplet APO refractor, which I use even more than any of my other telescopes.
- Why? Because it takes me less than 60 seconds to have the 90 mm APO ready to observe under the night sky. The TEC 140 refractor takes me less than 5 minutes to set up.

Tip - Nylon thumbscrews on accessories

- Nylon thumbscrews can hold most accessories without any kind of damage to eyepiece barrels, dovetail rail, etc.
- Less of an issue with the latest equipment because most manufacturers currently use eyepiece barrel compression rings, even with their cheaper equipment.
- “Finder shoe mounts” are one of the big remaining culprits.
- Legacy equipment can be easily converted to nylon thumbscrews with minimal effort.


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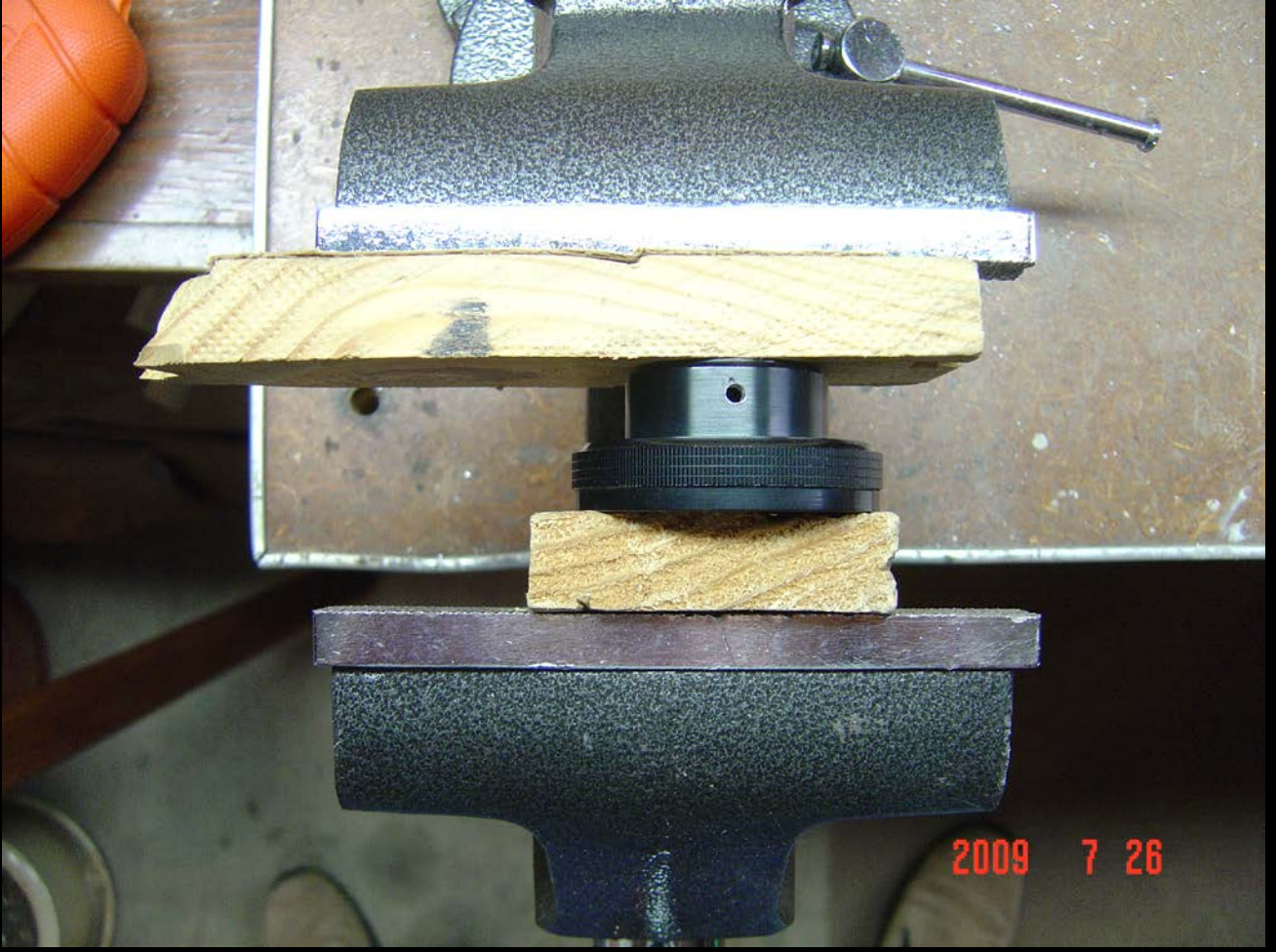
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SUPER OIL
THE PREMIUM HOUSEHOLD OIL
Shell Auto Wash
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Horsehead Nebula
M43/42
Great Orion Nebula
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Meissa
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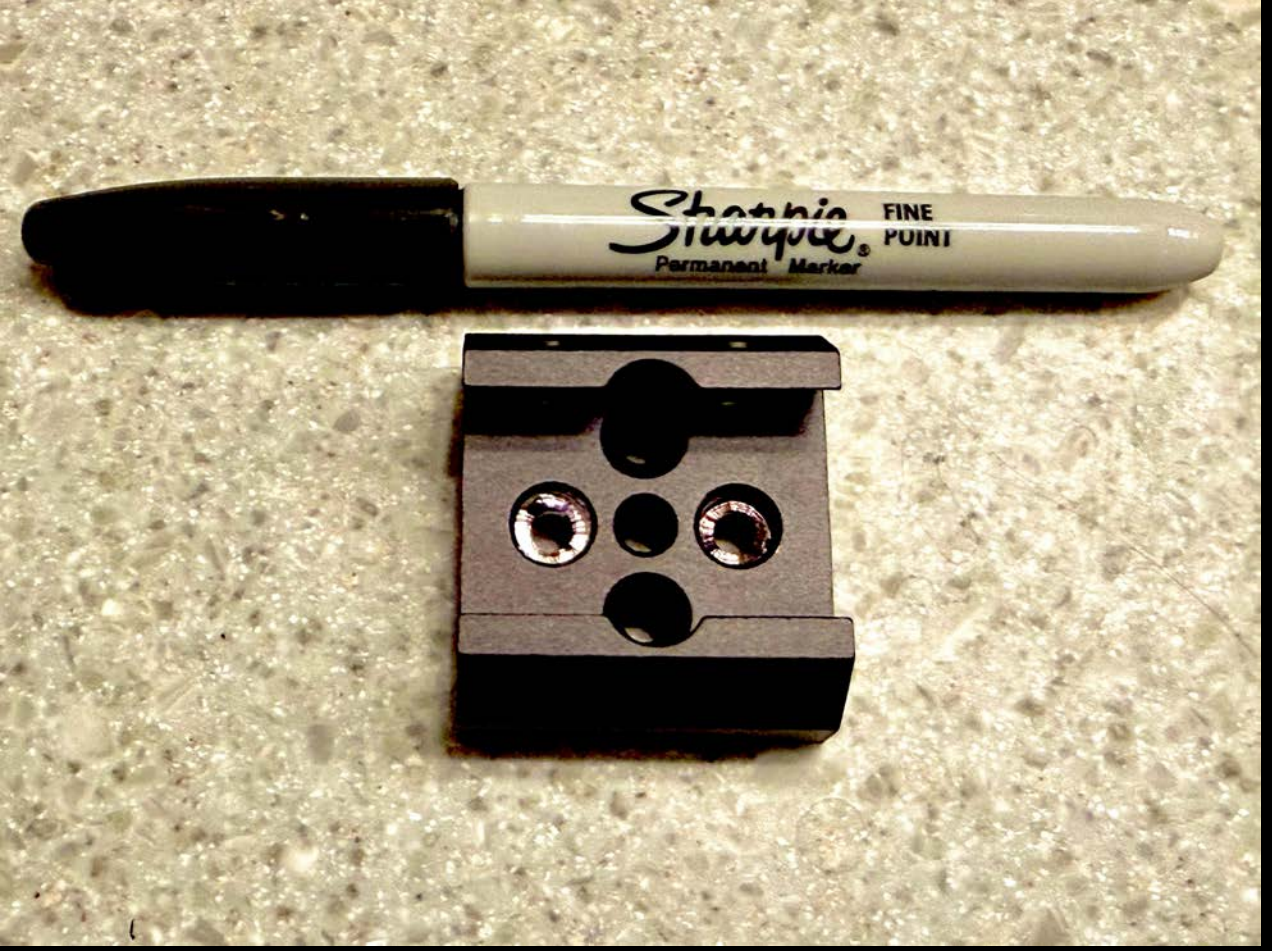
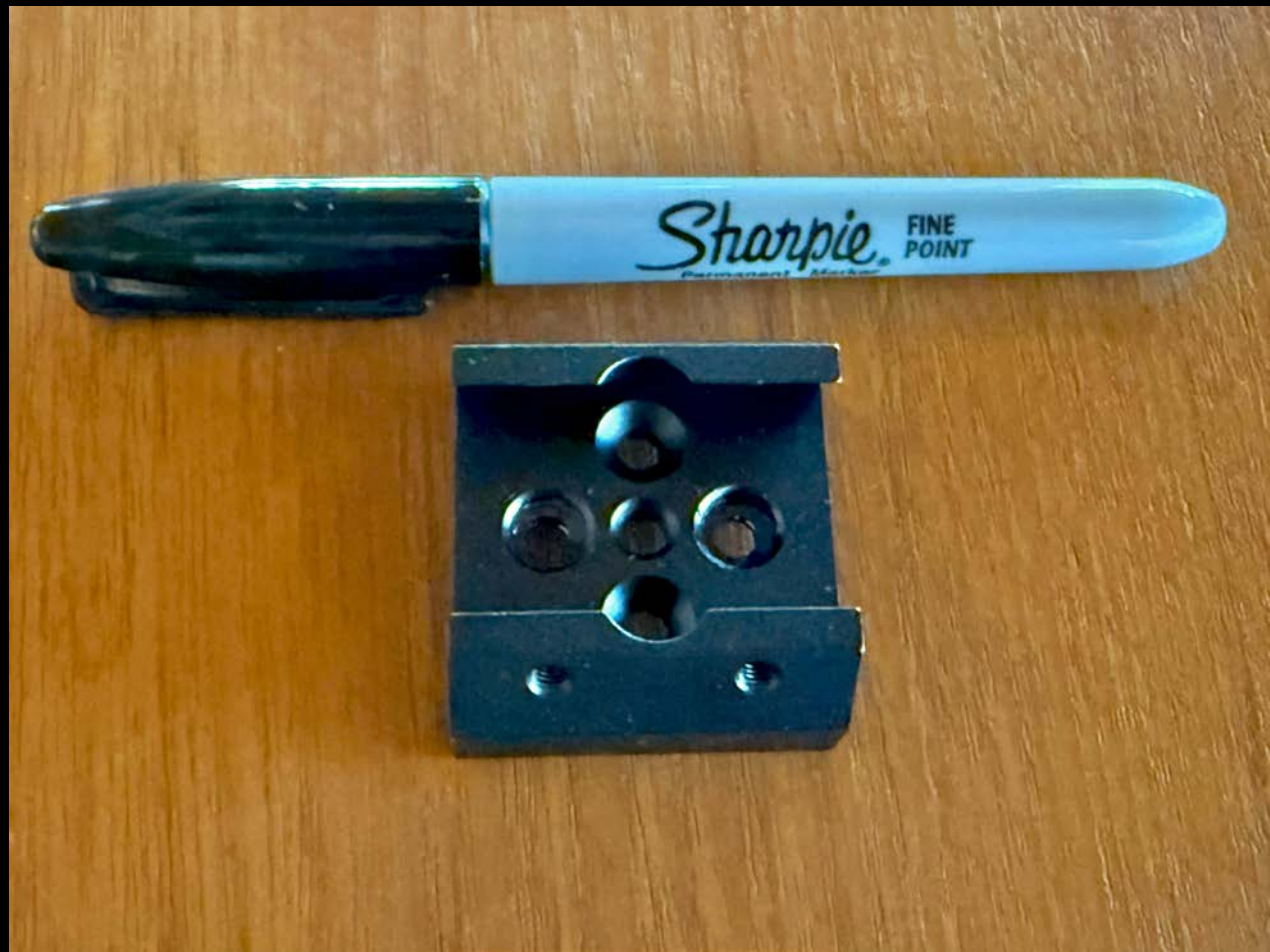

Sharpie
FINE
POINT
Permanent Marker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Finders

- I’m a BIG fan of red-dot finders!
- I’m going to be tarred and feathered for saying this, but I’m not a huge fan of the Telrad finder.
  - Why? Because I prefer a single dot in the sky over the concentric rings
  - Also, I find the Telrad’s weight and bulk an issue with my smaller telescopes
- Euclid goes mad in the night sky…


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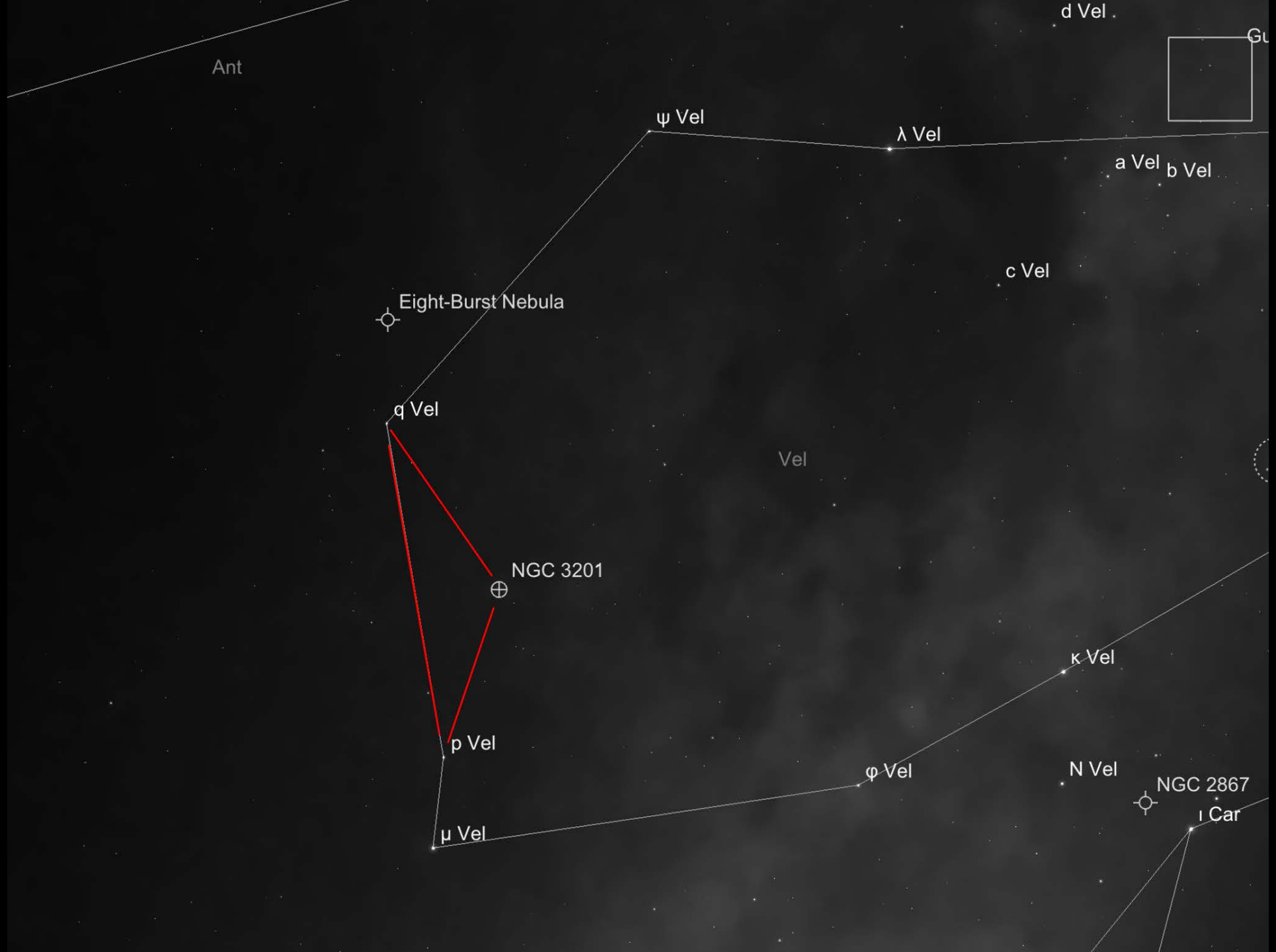
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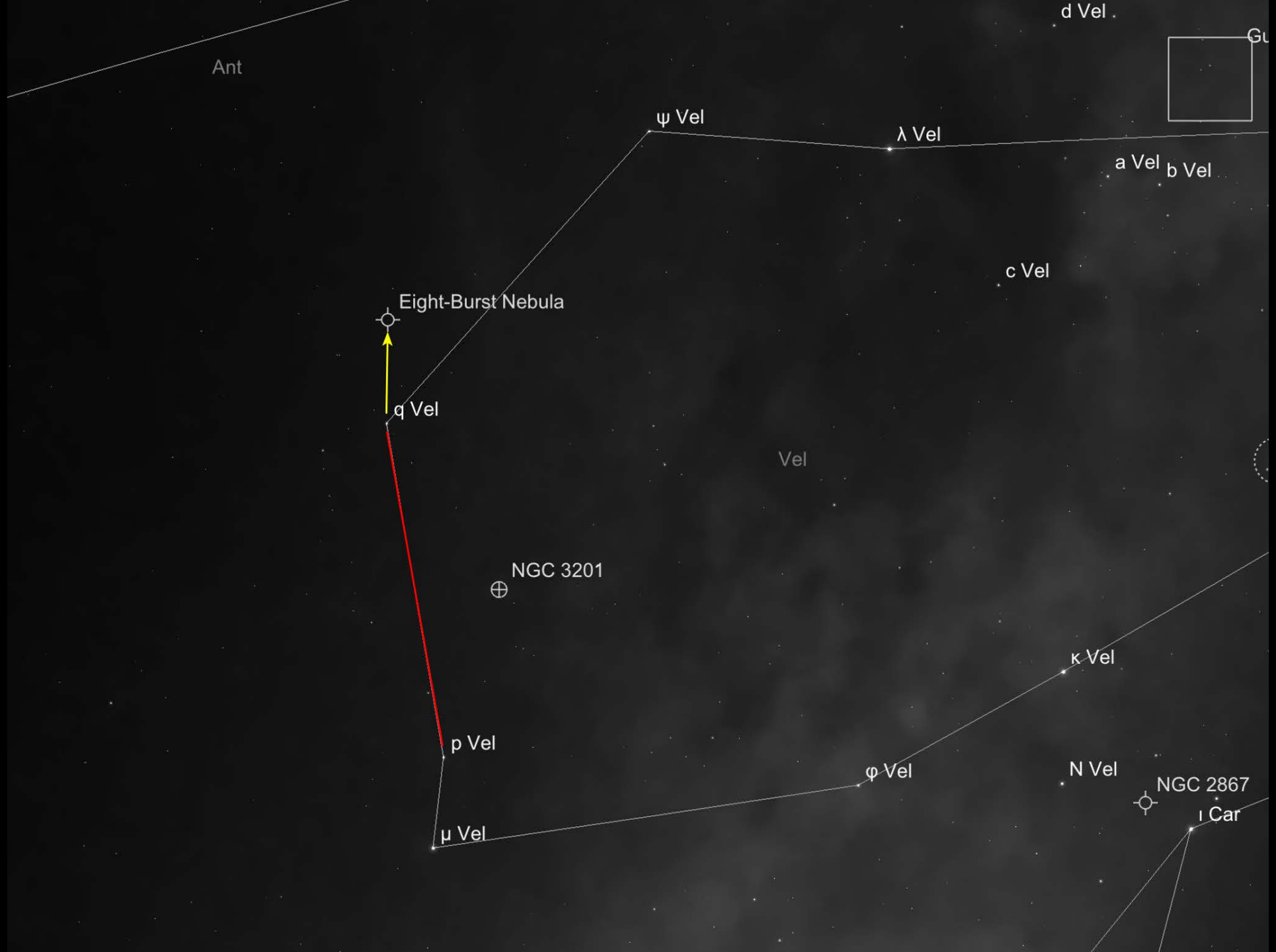
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NGC 2360
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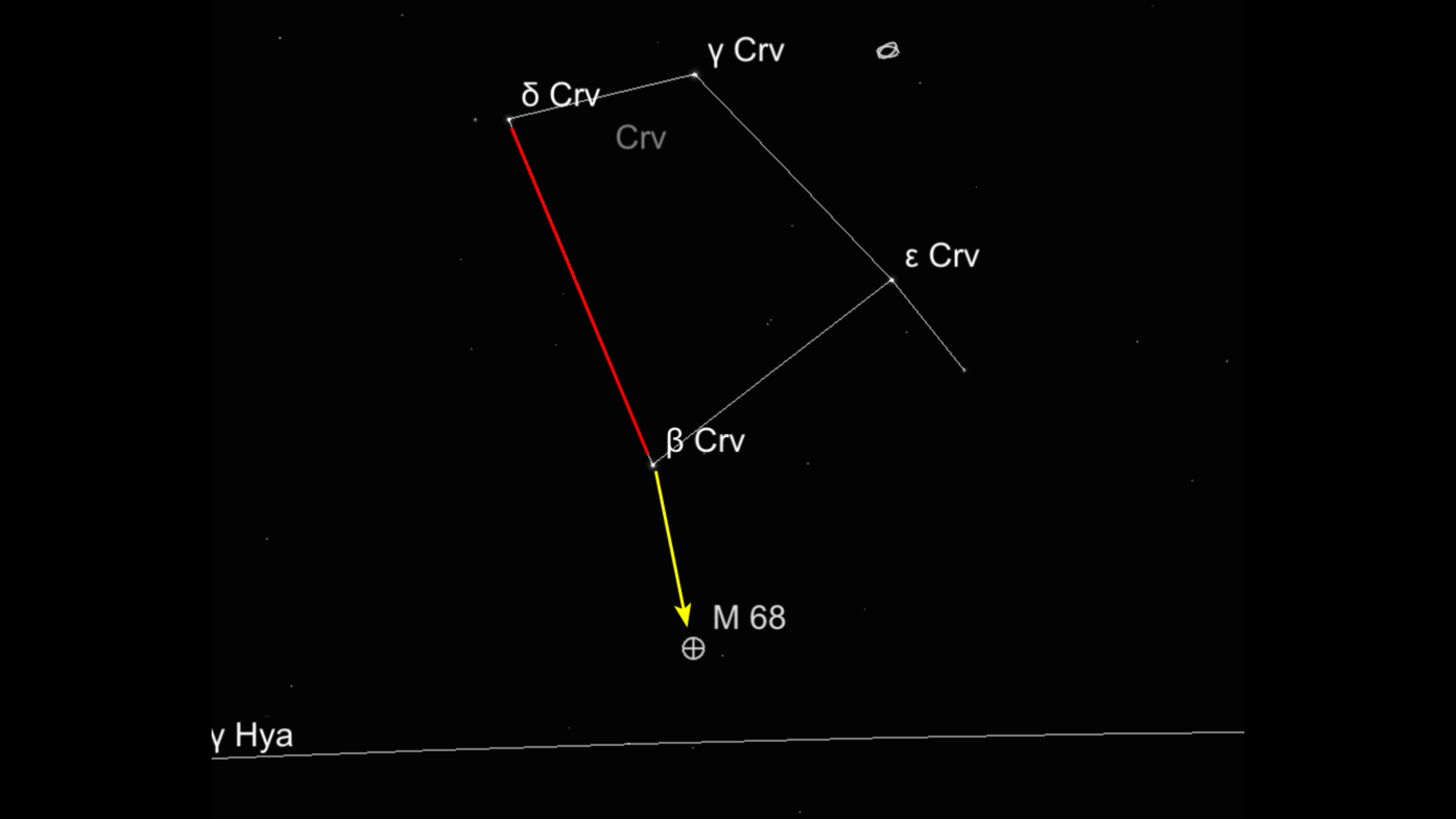
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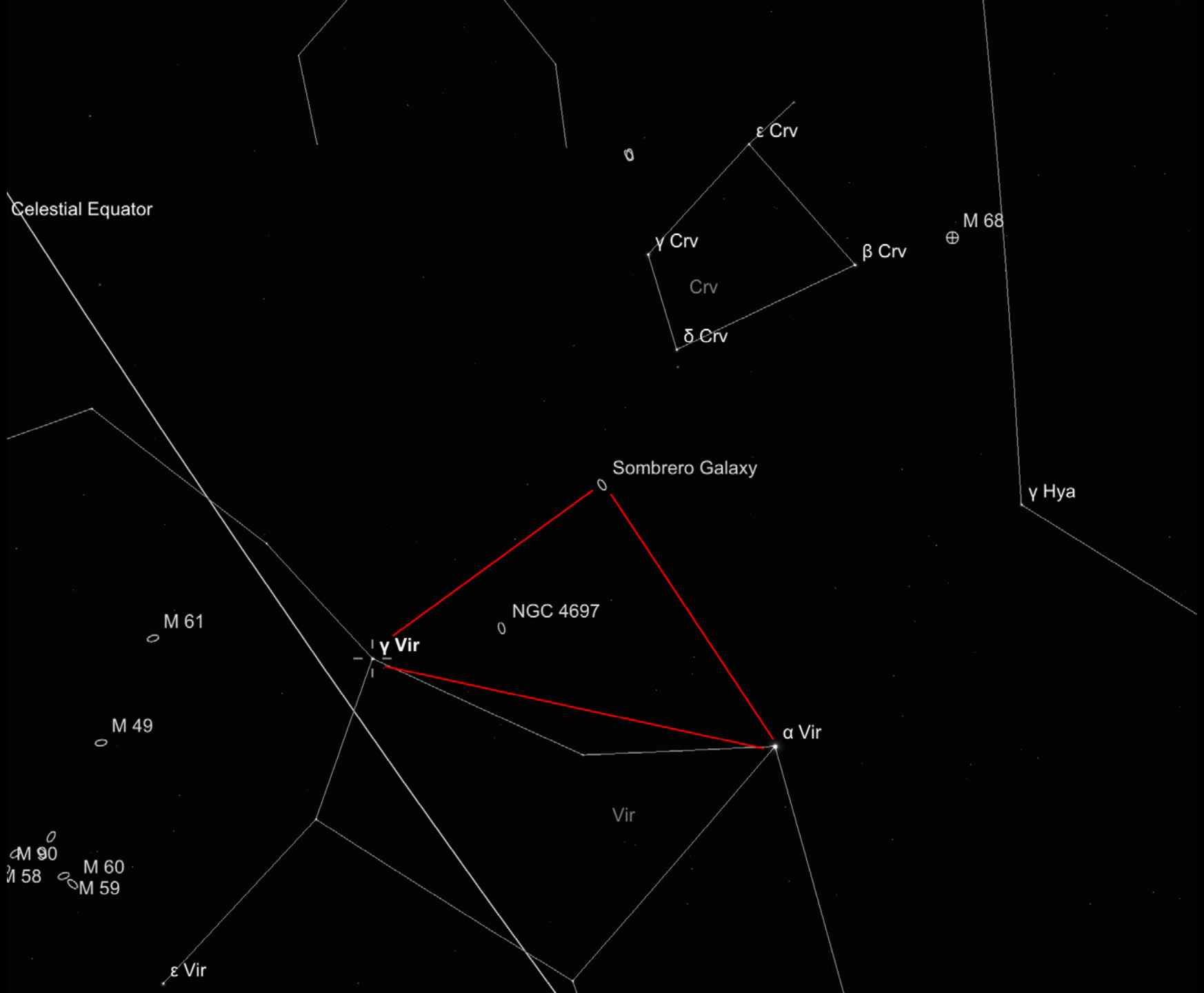
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Optical Finders

- Bigger is better!
- Higher magnification is better!
- Using a 60-80mm finder at a magnification of 20-40x allows me to directly see *all* of the Messier, and a large portion of the NGC catalog
- The exceptions are fainter galaxies and tiny planetary nebulae
- The greater light-gathering ability of the large finder makes it easier for me to see fainter stars, which helps guide me to even the faintest of targets.

Tip - Tripod Hammocks

- These little gizmos have saved me from dropping eyepieces, eyepiece bolt cases, lens caps, flashlights, etc. onto the ground.
- A nice place to lay your phone, the Pocket Sky Atlas, or an observing list temporarily rather than going back to your observing table.
- They are inexpensive and readily available online. I now have them on every one of my tripods.


WETMAN

Eyepieces

- Eyepieces should be personally matched to the observer.
- There is no “one size fits all”.
- Apparent field-of-view is as much a personal preference as someone’s favorite color.
- The aging eye directly affects the choice of the ideal eyepiece
  - Exit pupil size needs to match your entrance pupil size which declines with age.
  - Eye relief (if you need to wear eyeglasses for astigmatism)
  - Effective eye relief!
- Consider the resale value of eyepieces.

Eyepieces

- Entrance pupil of your eye…
- Can be measured at night under dark adaptation using metric Allen wrenches while observing a bright star.
- Calculating the exit pupil of your optics
  - Focal Length of eyepiece in mm / F-ratio of the telescope
  - Telescope Aperture in mm / Magnification
- Example:
  - For my 60mm, 700mm FL Sears refractor (F/11.7)
  - The 20mm Keller eyepiece has an exit pupil of: 20mm / F11.7 = 1.7 mm
  - Can also be calculated as: 60mm / 35x = 1.7 mm

Exit Pupil

- **4–7 mm EXIT PUPIL (Low Magnification)**
- *Advantages:*
- Delivers the widest true field of view — ideal for sweeping large star fields, open clusters, and extended objects like the Milky Way, large nebulae, and nearby galaxies such as the Magellanic Clouds
- Provides the brightest possible image for extended objects, maximizing surface brightness
- Best for rich-field viewing

Exit Pupil

- *Disadvantages:*
- If the exit pupil exceeds your dark-adapted pupil diameter, light is wasted and the effective aperture of your telescope is reduced — a 7mm exit pupil is wasting aperture for an older observer whose pupil only opens to 4-5mm
- Sky background appears brighter, reducing contrast on faint extended nebulae under light-polluted skies
- Minimal magnification means minimal resolution — fine detail in planets, globular clusters, and small nebulae is lost
- Central obstruction in reflecting telescopes creates a small central shadow in the exit pupil at low powers, reducing contrast

Exit Pupil

- **2–4 mm EXIT PUPIL (Medium Magnification)**
- *Advantages:*
- The sweet spot for most deep-sky observing — the optimal balance between image brightness, contrast, and resolution
- Sky background darkens relative to objects, improving contrast on nebulae, galaxies, and globular clusters
- Less affected by atmospheric seeing than higher magnifications
- Generally, the most comfortable range for extended observing sessions
- Optimal for detecting faint extended objects — the classic *"2mm exit pupil rule"* is a reliable guideline many experienced observers use as a starting point for any new object

Exit Pupil

- *Disadvantages:*
- Insufficient magnification for fine planetary detail or for splitting close double stars
- Some extended objects (like very large nearby galaxies or big open clusters) may become too magnified to fit comfortably in the field of view

Exit Pupil

- **1 mm or less EXIT PUPIL (High to Very High Magnification)**
- *Advantages:*
- Maximum resolution — fine planetary detail, lunar features, tight double stars, and the cores of globular clusters can be properly examined
- Sky background becomes very dark, which can actually improve contrast on small, high-surface-brightness objects like planetary nebulae, which pop dramatically against a darkened sky
- Excellent for splitting close double stars near the Dawes or Rayleigh limit of the aperture

Exit Pupil

- *Disadvantages:*
- Sensitive to the atmospheric seeing — on all but the best nights, the image simply falls apart at these magnifications, becoming a blurry, boiling mess. On most nights from most sites, exit pupils below 0.5mm are effectively unusable
- Faint extended objects become dim and washed out — surface brightness drops dramatically as magnification increases, making large nebulae and galaxies nearly invisible

Exit Pupil

- *Disadvantages:*
- Less forgiving of eye placement — the observer must hold their eye very precisely at the eye point, making viewing more tiring and uncomfortable over long sessions
- “Floaters” in your vision become quite bothersome, especially with bright planets and the moon.
- Mechanical imperfections in the mount and tracking are greatly amplified
- Thermal air currents within the telescope tube (tube currents) become apparent and problematic

Exit Pupil

- An experienced observer carries eyepieces covering all three ranges and selects the exit pupil dictated by the object, the sky conditions, and the night's atmospheric seeing — rather than defaulting to any single magnification.

Tip - Focusers for Catadioptrics

- An add-on 10:1 reduction focuser which mounts to the visual back of your SCT makes focusing these fussy telescopes a joy.
- Gets rid of image shift.
- Allows very precise control of focus position.
- Moves the focal point further to the rear, so there is less tendency to bump the mirror cell with your head.


TELE VUE
2010 5 12

Observing comfort

- Observing chairs
- If you aren’t using an observing chair, you are missing out on one of the best accessories which will make you a better observer.
  - A comfortable seated position lets you remain longer at the eyepiece, allowing you to discern more detail and fainter objects.
  - Being seated improves your ability to steady your gaze into the exit pupil (less swaying means less blackout, and less kidney-beaning of your view).
  - Being comfortable increases your total observing time before becoming fatigued.
- Be sure to purchase an observing chair made for your telescope type, and with enough vertical range to accommodate all eyepiece positions.

Tip - Eyepiece Turrets

- When I first bought my TEC 140 APO refractor in 2003, I was intrigued by the TEC 5-eyepiece turret. I decided to buy it after reading reviews and it's one of the best purchases I've ever made. Unfortunately, TEC no longer makes these turrets, but Takahashi manufactures a very nice 4-eyepiece turret.
- Eyepiece turrets are only for use on refractors and catadioptrics
- All of your eyepieces are immediately available, are parfocal, and only a click-turn away.
- No more dropped eyepieces!


TEC APO 140
ADVANCED TELESCOPE SYSTEMS

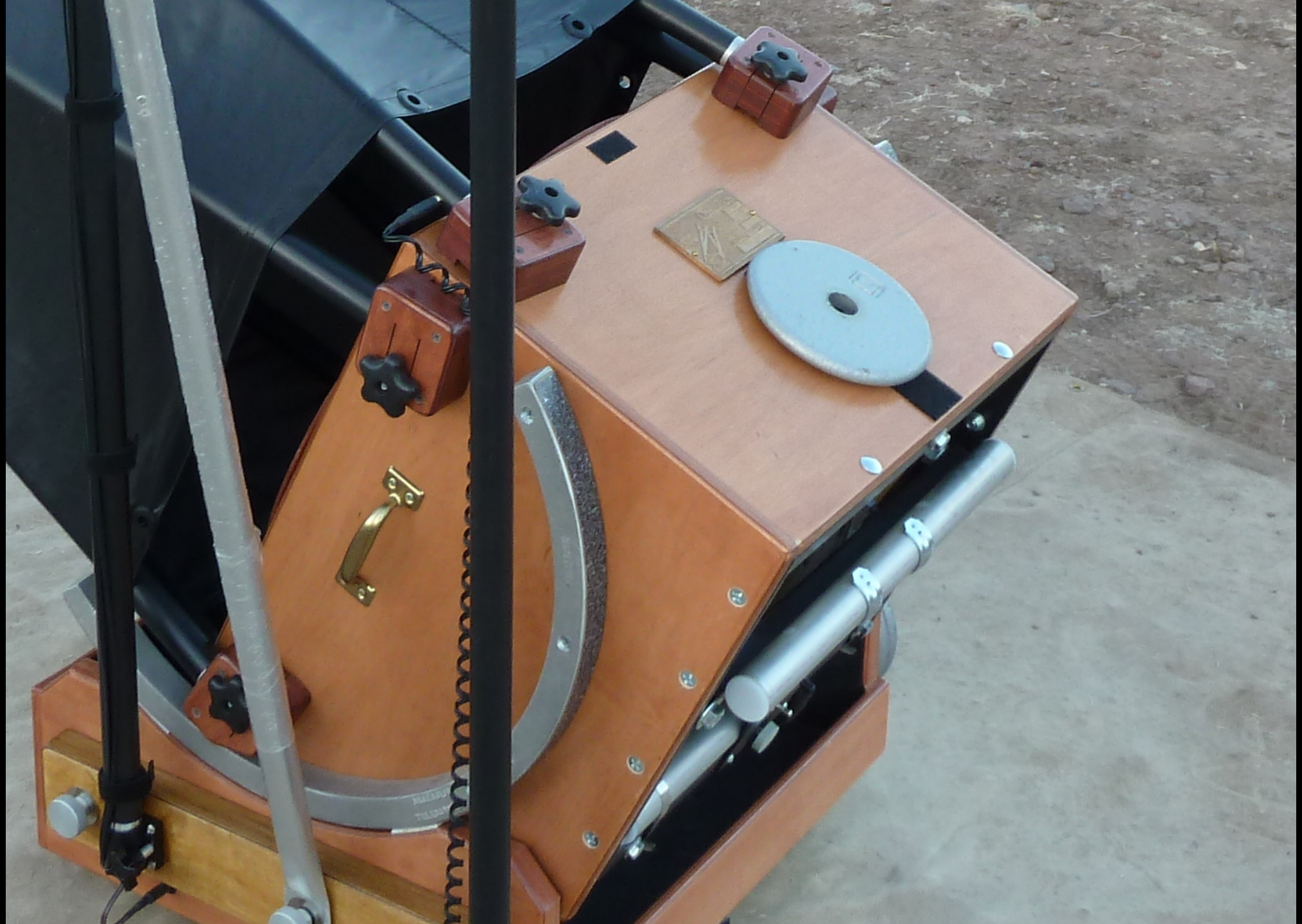

CELESTRON

Observational planning

- Having a plan on what you wish to observe helps make the best of your limited time under the stars.
- I check for transient events on most nights I observe: comets, new novae and supernovae, bright asteroids, (eclipses, transits, conjunctions, and occultations of the moons of Jupiter and Saturn).
- I make a note of any new and interesting objects I may have read about online or in an astronomy magazine, with the plan to observe that object in the future.
- There is a joy and sense of accomplishment when working through established published observing lists, or a list you have created yourself. The Astronomical League's observing club lists are outstanding.

Tip – OTA weights for Dobs

- Eyepieces of differing weights can cause problems with Dobsonian telescopes either popping up, or nose-diving.
- Attaching a weight to the mirror box of a Dob can counterbalance any weight inequities.
- I find that using a round, flat, iron 5# or 10# weight-lifting plate with attached adhesive Velcro allows me to move the plate up and down the middle of the mirror box on my Dob for balance.
- It's very simple to shift the position of the weight to perfectly balance the eyepiece weight.
- There is a ***big*** weight difference between a 31mm Type 5 Nagler and an 11mm Type 6 Nagler!

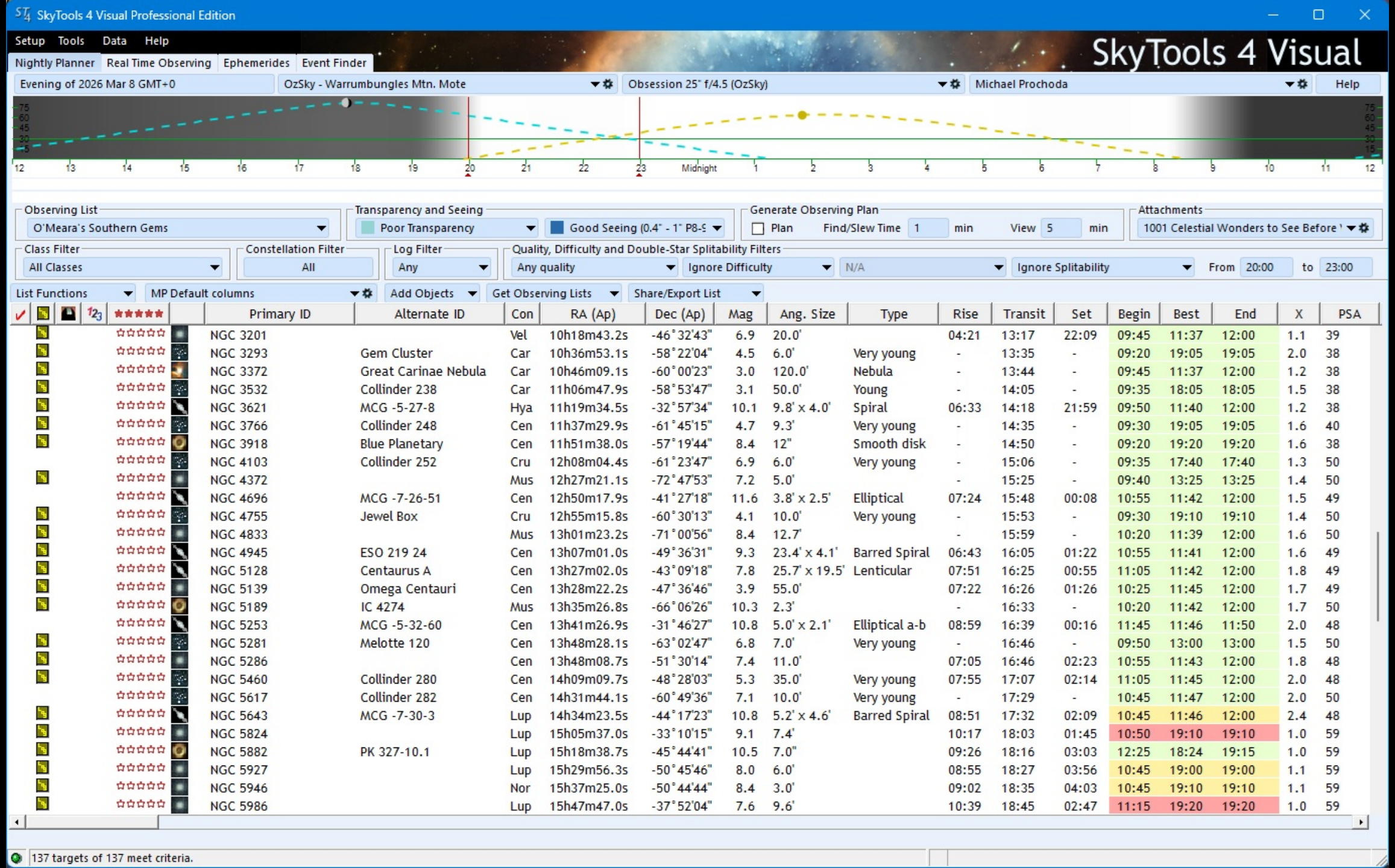


Recording observations

- Recording your observations has many benefits:
  - Documenting forces you to focus on the details of your observations, making you a better observer.
  - Creates a record of a night's conditions and observations for later review.
  - Allows you to follow the progress of transient objects over time.
  - Allows a comparison of the appearance of objects through different instruments and apertures, as well as on different nights.
- Sketching objects will hone your observational skills even further.
- Recording your observations electronically allows you to search the database for specific objects, instruments, locations, etc.

Electronic recording of observations

- I use a program called SkyTools4 to record my observations.
- This creates a fully searchable database of my observations, but the program also includes observing lists and a very deep star atlas with outstanding features.
- SkyTools4 is limited to the Windows OS, so it requires a laptop.


SkyTools 4 Visual Professional Edition
Setup Tools Data Help
SkyTools 4 Visual
Nightly Planner Real Time Observing Ephemerides Event Finder
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OzSky - Warrumbungles Mtn. Mote
Obsession 25" f/4.5 (OzSky)
Michael Prochoda
Help
Observing List
O'Meara's Southern Gems
Transparency and Seeing
Poor Transparency
Good Seeing (0.4" - 1" P8-9
Generate Observing Plan
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Find/Slew Time 1 min
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1001 Celestial Wonders to See Before
Class Filter
All Classes
Constellation Filter
All
Log Filter
Any
Quality, Difficulty and Double-Star Splitability Filters
Any quality
Ignore Difficulty
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From 20:00 to 23:00
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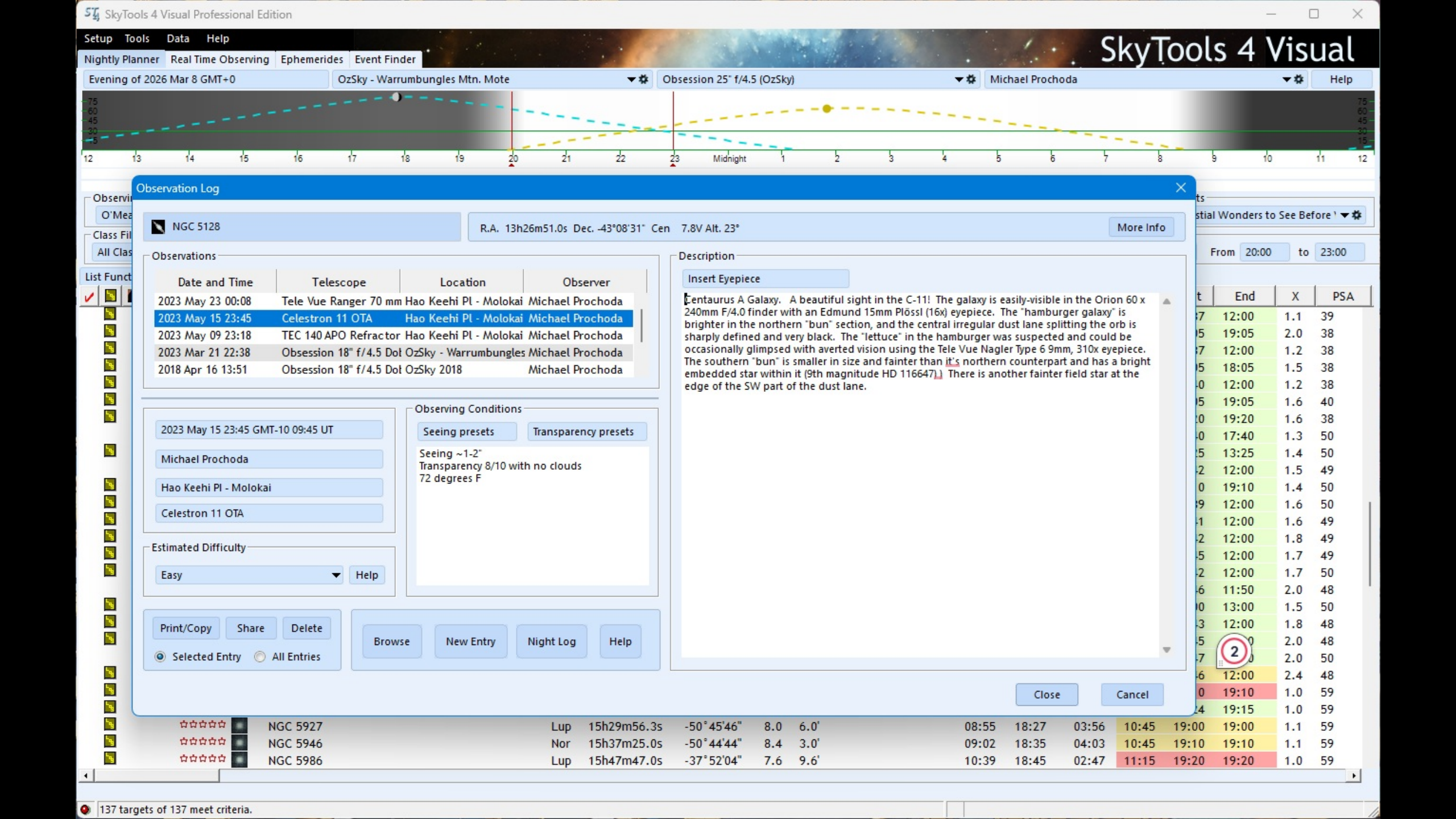
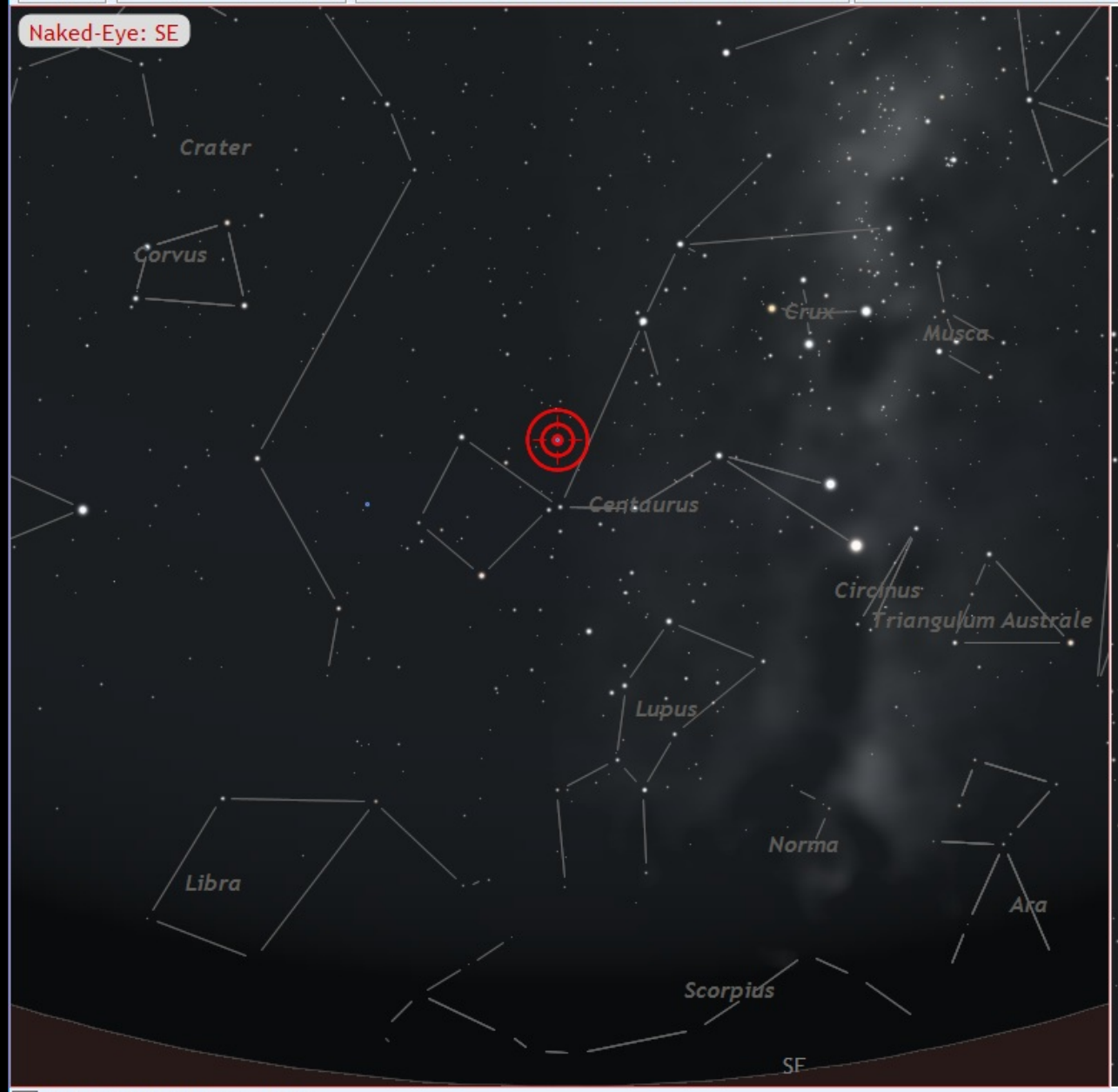
Get Observing Lists
Share/Export List
Primary ID Alternate ID Con RA (Ap) Dec (Ap) Mag Ang. Size Type Rise Transit Set Begin Best End X PSA
NGC 3201 Vel 10h18m43.2s -46°32'43" 6.9 20.0' 04:21 13:17 22:09 09:45 11:37 12:00 1.1 39
NGC 3293 Gem Cluster Car 10h36m53.1s -58°22'04" 4.5 6.0' Very young - 13:35 - 09:20 19:05 19:05 2.0 38
NGC 3372 Great Carinae Nebula Car 10h46m09.1s -60°00'23" 3.0 120.0' Nebula - 13:44 - 09:45 11:37 12:00 1.2 38
NGC 3532 Collinder 238 Car 11h06m47.9s -58°53'47" 3.1 50.0' Young - 14:05 - 09:35 18:05 18:05 1.5 38
NGC 3621 MCG -5-27-8 Hya 11h19m34.5s -32°57'34" 10.1 9.8' x 4.0' Spiral 06:33 14:18 21:59 09:50 11:40 12:00 1.2 38
NGC 3766 Collinder 248 Cen 11h37m29.9s -61°45'15" 4.7 9.3' Very young - 14:35 - 09:30 19:05 19:05 1.6 40
NGC 3918 Blue Planetary Cen 11h51m38.0s -57°19'44" 8.4 12" Smooth disk - 14:50 - 09:20 19:20 19:20 1.6 38
NGC 4103 Collinder 252 Cru 12h08m04.4s -61°23'47" 6.9 6.0' Very young - 15:06 - 09:35 17:40 17:40 1.3 50
NGC 4372 Mus 12h27m21.1s -72°47'53" 7.2 5.0' - 15:25 - 09:40 13:25 13:25 1.4 50
NGC 4696 MCG -7-26-51 Cen 12h50m17.9s -41°27'18" 11.6 3.8' x 2.5' Elliptical 07:24 15:48 00:08 10:55 11:42 12:00 1.5 49
NGC 4755 Jewel Box Cru 12h55m15.8s -60°30'13" 4.1 10.0' Very young - 15:53 - 09:30 19:10 19:10 1.4 50
NGC 4833 Mus 13h01m23.2s -71°00'56" 8.4 12.7' - 15:59 - 10:20 11:39 12:00 1.6 50
NGC 4945 ESO 219 24 Cen 13h07m01.0s -49°36'31" 9.3 23.4' x 4.1' Barred Spiral 06:43 16:05 01:22 10:55 11:41 12:00 1.6 49
NGC 5128 Centaurus A Cen 13h27m02.0s -43°09'18" 7.8 25.7' x 19.5' Lenticular 07:51 16:25 00:55 11:05 11:42 12:00 1.8 49
NGC 5139 Omega Centauri Cen 13h28m22.2s -47°36'46" 3.9 55.0' 07:22 16:26 01:26 10:25 11:45 12:00 1.7 49
NGC 5189 IC 4274 Mus 13h35m26.8s -66°06'26" 10.3 2.3' - 16:33 - 10:20 11:42 12:00 1.7 50
NGC 5253 MCG -5-32-60 Cen 13h41m26.9s -31°46'27" 10.8 5.0' x 2.1' Elliptical a-b 08:59 16:39 00:16 11:45 11:46 11:50 2.0 48
NGC 5281 Melotte 120 Cen 13h48m28.1s -63°02'47" 6.8 7.0' Very young - 16:46 - 09:50 13:00 13:00 1.5 50
NGC 5286 Cen 13h48m08.7s -51°30'14" 7.4 11.0' 07:05 16:46 02:23 10:55 11:43 12:00 1.8 48
NGC 5460 Collinder 280 Cen 14h09m09.7s -48°28'03" 5.3 35.0' Very young 07:55 17:07 02:14 11:05 11:45 12:00 2.0 48
NGC 5617 Collinder 282 Cen 14h31m44.1s -60°49'36" 7.1 10.0' Very young - 17:29 - 10:45 11:47 12:00 2.0 50
NGC 5643 MCG -7-30-3 Lup 14h34m23.5s -44°17'23" 10.8 5.2' x 4.6' Barred Spiral 08:51 17:32 02:09 10:45 11:46 12:00 2.4 48
NGC 5824 Lup 15h05m37.0s -33°10'15" 9.1 7.4' 10:17 18:03 01:45 10:50 19:10 19:10 1.0 59
NGC 5882 PK 327-10.1 Lup 15h18m38.7s -45°44'41" 10.5 7.0" 09:26 18:16 03:03 12:25 18:24 19:15 1.0 59
NGC 5927 Lup 15h29m56.3s -50°45'46" 8.0 6.0' 08:55 18:27 03:56 10:45 19:00 19:00 1.1 59
NGC 5946 Nor 15h37m25.0s -50°44'44" 8.4 3.0' 09:02 18:35 04:03 10:45 19:10 19:10 1.1 59
NGC 5986 Lup 15h47m47.0s -37°52'04" 7.6 9.6' 10:39 18:45 02:47 11:15 19:20 19:20 1.0 59
137 targets of 137 meet criteria.

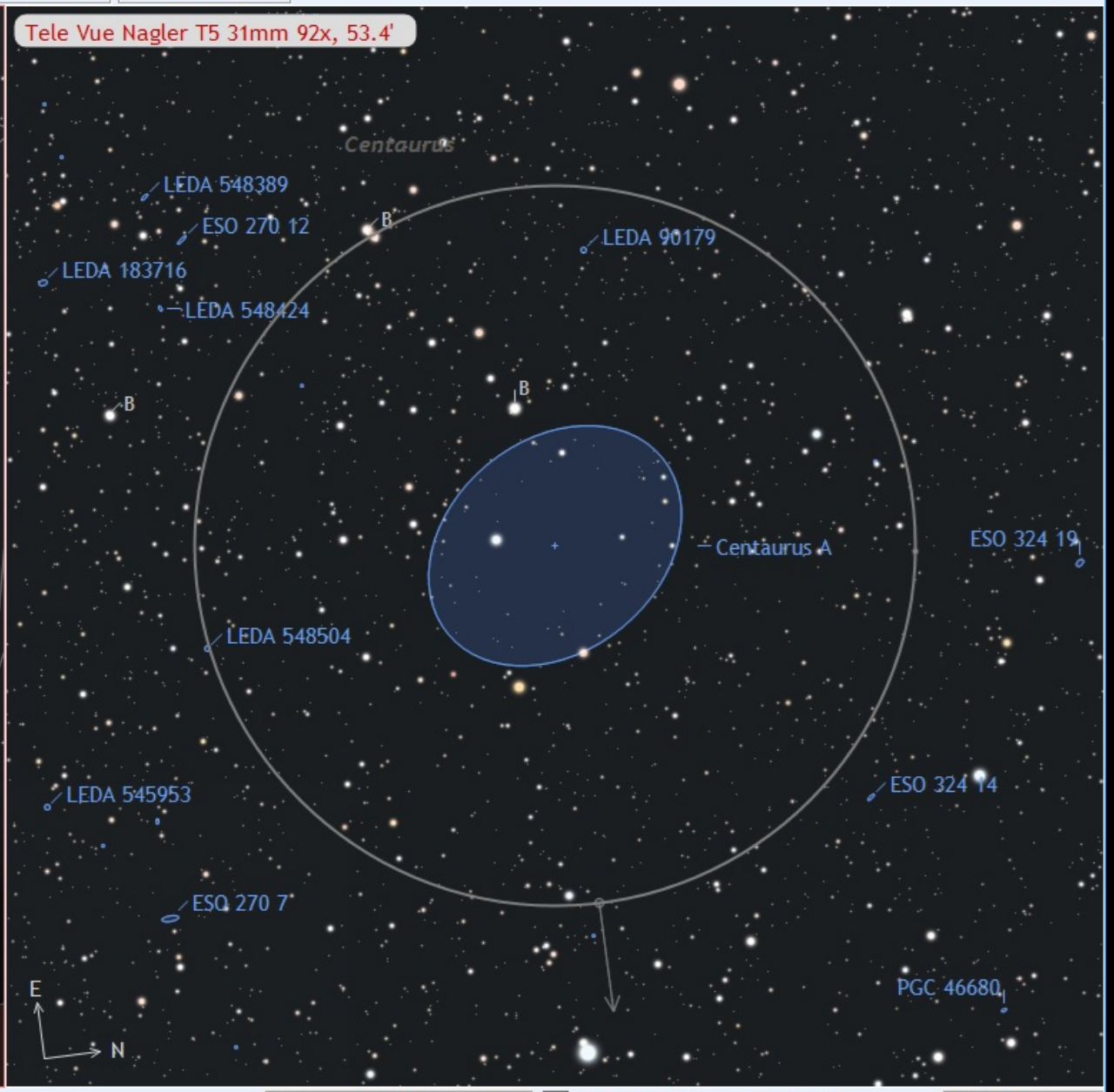

SkyTools 4 Visual Professional Edition
Setup Tools Data Help
SkyTools 4 Visual
Nightly Planner Real Time Observing Ephemerides Event Finder
Evening of 2026 Mar 8 GMT+0
OzSky - Warrumbungles Mtn. Mote
Obsession 25" f/4.5 (OzSky)
Michael Prochoda
Help
Observation Log
NGC 5128
R.A. 13h26m51.0s Dec. -43°08'31" Cen 7.8V Alt. 23°
More Info
Observations
Date and Time
Telescope
Location
Observer
2023 May 23 00:08 Tele Vue Ranger 70 mm Hao Keehi Pl - Molokai Michael Prochoda
2023 May 15 23:45 Celestron 11 OTA Hao Keehi Pl - Molokai Michael Prochoda
2023 May 09 23:18 TEC 140 APO Refractor Hao Keehi Pl - Molokai Michael Prochoda
2023 Mar 21 22:38 Obsession 18" f/4.5 Dob OzSky - Warrumbungles Michael Prochoda
2018 Apr 16 13:51 Obsession 18" f/4.5 Dob OzSky 2018 Michael Prochoda
Description
Insert Eyepiece
Centaurus A Galaxy. A beautiful sight in the C-11! The galaxy is easily-visible in the Orion 60 x 240mm F/4.0 finder with an Edmund 15mm Plössl (16x) eyepiece. The "hamburger galaxy" is brighter in the northern "bun" section, and the central irregular dust lane splitting the orb is sharply defined and very black. The "lettuce" in the hamburger was suspected and could be occasionally glimpsed with averted vision using the Tele Vue Nagler Type 6 9mm, 310x eyepiece. The southern "bun" is smaller in size and fainter than it's northern counterpart and has a bright embedded star within it (9th magnitude HD 116647). There is another fainter field star at the edge of the SW part of the dust lane.
2023 May 15 23:45 GMT-10 09:45 UT
Michael Prochoda
Hao Keehi Pl - Molokai
Celestron 11 OTA
Observing Conditions
Seeing presets
Transparency presets
Seeing ~1-2"
Transparency 8/10 with no clouds
72 degrees F
Estimated Difficulty
Easy
Help
Print/Copy
Share
Delete
Selected Entry
All Entries
Browse
New Entry
Night Log
Help
Close
Cancel
NGC 5927 Lup 15h29m56.3s -50°45'46" 8.0 6.0' 08:55 18:27 03:56 10:45 19:00 19:00 1.1 59
NGC 5946 Nor 15h37m25.0s -50°44'44" 8.4 3.0' 09:02 18:35 04:03 10:45 19:10 19:10 1.1 59
NGC 5986 Lup 15h47m47.0s -37°52'04" 7.6 9.6' 10:39 18:45 02:47 11:15 19:20 19:20 1.0 59
137 targets of 137 meet criteria.

Finder Chart

NGC 5128 | 2026 Mar 14 | 12:00 | GMT+0 | OzSky - Warrumbungles Mtn. M | Michael Prochoda | Poor Transparency | Obsession 25" f/4.5 (OzSky) Telesco | Tele Vue Nagler T5 31mm

Zoom + - | Time Stepping 1 hr | Scenario | View | Prefs | Trails | Trace | Print | Copy | ? | View on/off: Naked Eye | Finder | Eyepiece | Single View





J132848.8-423437 (star) in Cen, V15.0 | 43 minor planets at this epoch | Fully dark ML 7.0 target undetectable | 73° x 72°

Plate-solving for pointing accuracy

- Use of a simple inexpensive imaging camera through a small guide scope (20-40mm aperture) along with a small computer allows for “plate-solving” the exact point in the sky in which the telescope is pointed.
- I use a dedicated ZWO ASIair imaging computer along with my ZWO AM5 mount (in alt-az configuration) as my plate-solving goto setup.
- I use a ZWO 30mm guide scope with a ZWO ASI120 Mini monochrome camera as my plate-solve imaging system.


ASIair
mini


AM5
ASTRO-TECH
AT90CFT

Plate Solving

- Plate solving allows for dead-center pointing accuracy of the telescope.
- Allows the use of high magnifications during goto slews, making it unnecessary to start with a low-power telescopic view in order to ensure the target is within the field-of-view of the telescope.
- The “PiFinder” system is available for Dobsonians, and does not even require any axis encoders. It uses plate solving and accelerometers to assure “push-to” accuracy.
- I have no personal experience with the PiFinder, but have heard good reviews.


PiFinder
PiFinder by BBLabs

Tip – Bungees for scope covers

- Using rope to tie down a telescope, a tarp, or a telescope cover can lead to torn grommets, damage to the scope cover, or damage to the telescope.
- Strong wind gusts can cause “parachuting” of covers, imposing tremendous forces to the cover or anything it’s attached to.
- Bungees provide “give” allowing even strong forces to be mitigated (For example: never try bungee jumping using a simple rope versus a dedicated bungee – the outcome would “lack grace”).
- Wrapping a long and thin bungee cord (1/8”) several times around your scope cover will prevent “parachuting” and tightly secure the cover without causing any damage.


2006 9 17


2006 9 21


2006 9 21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2006 9 21


Eureka!
2007 8 9

Sky Quality Meter (SQM)

- The Sky Quality Meter (SQM) from Unihedron is a dedicated device for measuring the darkness of the night sky.
- Measures the brightness of the night sky in magnitudes per square arcsecond.
- Correlates to the Bortle Scale of sky darkness:
  - Bortle 1 - 21.76 – 22.0 mag/arcsec^2
  - Bortle 2 - 21.6 – 21.75
  - Bortle 3 - 21.3 – 21.6
  - Bortle 4 - 20.6 – 21.3
  - Bortle 5 - 19.25 – 20.6

SQM

- The Sky Quality Meter (SQM) from Unihedron has different models.
- The SQM-L (with lens) is the best model for astronomers since it has a narrower FOV and therefore works more like a “spot-meter”.
- It has a FOV of about 15-20 degrees.
- You point it away from light domes and away from the bright parts of the Milky Way during measurements to get a good impression of your sky’s darkness.
- I take 4-6 measurements in different parts of the sky and average them to judge the overall sky darkness.
- I record the SQM measurement in my observing journal for the night.


Unihedron
Sky Quality Meter
19.66
mags
arcsec²
Start
16 17 18 19 20 21
www.unihedron.com

Additional Tips

- Hockey pucks for replacement feet of Dobsonian ground boards.
- Gooseneck red light holders for use at the telescope or for reading star charts.
- An astronomers “toolbox”.


2009 7 25


2009 7 25


Colorado
Estes Park's Newspaper Since 1912
October 12, 2007
water
the rise
Fee increase
plant u
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expansion t
purification te
increase the plant
to 4 million. Water treatm
sand-based filtration to a more efficient membrane system.
Utilities director Bob Goehring said evaluations of the plant showed that it was facing increasing demands on its capacity and water quality standards. He said the water treatment plant reached 85 percent of its capacity in 2002.
"A good red flag is to look at the demand placed on a
See Water: Page A 2
Hikers make
grisly find
Insert
Jack Klipstein
Estes Park trie
helmet (left) d
library's pre-sc
time at the fire
on Thursday.
Alexis Spear, 3,
Park watches as
Park Volunteer
Scott Dorman (
demonstrate his
for the Estes Par
Library's pre-sch
story time on Th


SKY COMMANDER VHA FLASH

Thank You!

Philosophy

- **Night's Claim**
- She spreads her velvet darkness wide, pins stars like diamonds to her gown— and I, forsaking warmth inside, step out when the sun goes down.
- What are the arms of earth and flesh to one who wears the Milky Way? She calls, and I am hers afresh, a willing captive to her sway.
- All daylight loves grow pale and small beneath her vast, consuming art— the night sky takes me, takes me all, and I surrender every part.