

Introduction to Telescopes

Notes from the
Smoky Mountain Astronomical Society
aka the SMAS

Telescope Rules

- Never look directly at the sun.
- Never touch the glass surfaces of a telescope or eyepiece.
- Always ask permission before looking through or touching someone else's telescope.



What is a telescope?

- An optical telescope is a device that gathers and focuses light.
- We can see much dimmer objects using a telescope than we can using our eyes alone. This is because telescopes gather and focus light into a beam small enough to **fit through the pupil of our eye**.
- The bigger the telescope, the more light it catches and the sharper the image it forms.

Parts of the telescope

- The main lens or mirror is called the *primary objective*.
- Any other lenses or mirrors are called *secondary objectives*.
- The framework that holds the lenses and mirrors in place is called the *tube*.
- The stand that holds the telescope is called the *mount*.
- The *finder scope* helps point the telescope at the right place in the sky.
- The *focuser* adjusts the length of the telescope to bring objects in to focus.
- The *diagonal* and *eyepiece* are what you look through.

How does a telescope work?

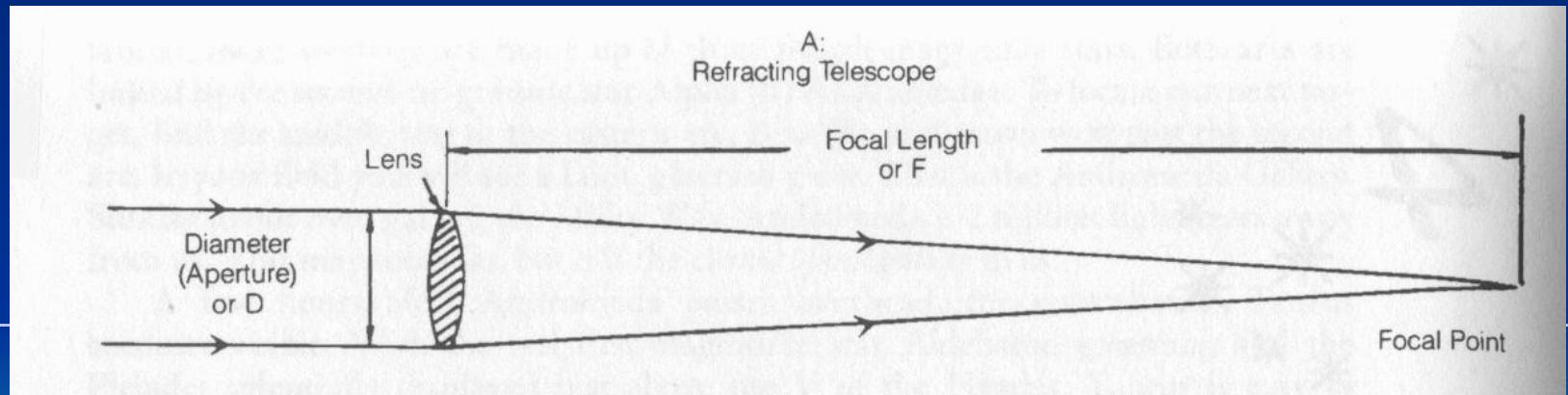
There are three basic types of telescopes:

- Refractors
 - Reflectors
 - Compound telescopes
-



The Refractor

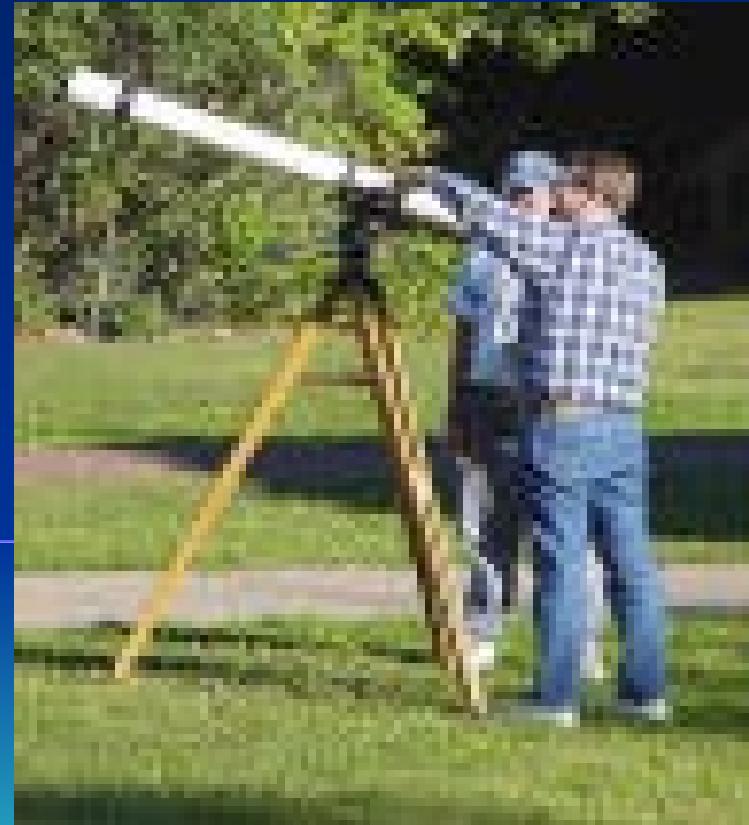
- A refractor uses glass lenses to bend, or refract, light to form an image.



Parts of the telescope - refractor

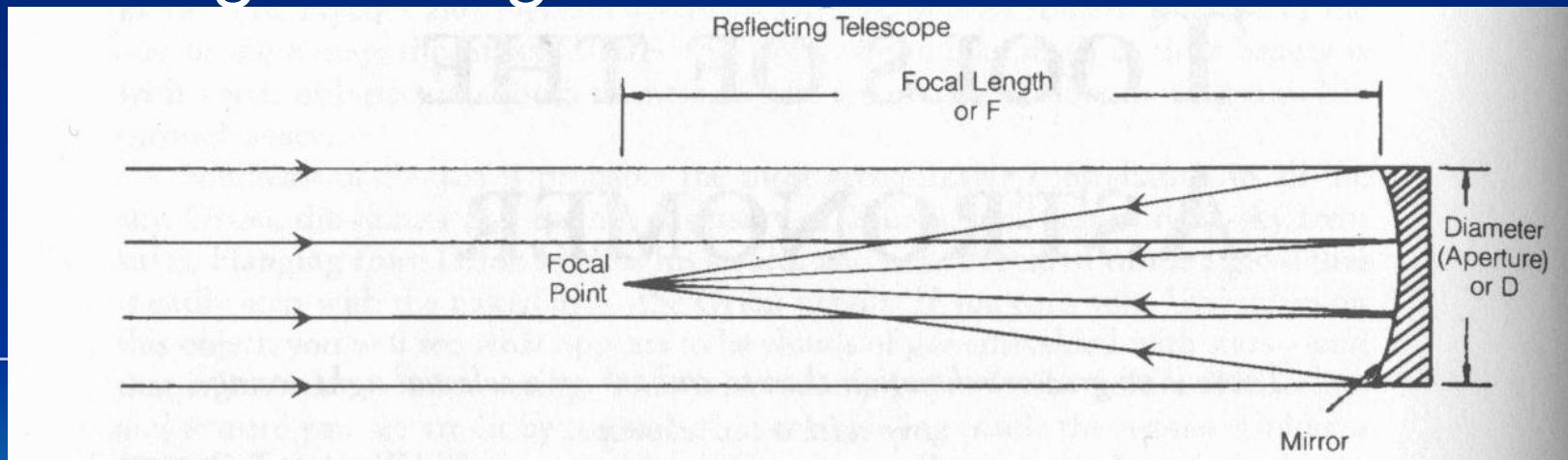


Refractors



The reflector

- A reflector uses curved mirrors to gather light and reflect it to form an



Parts of the telescope – reflector

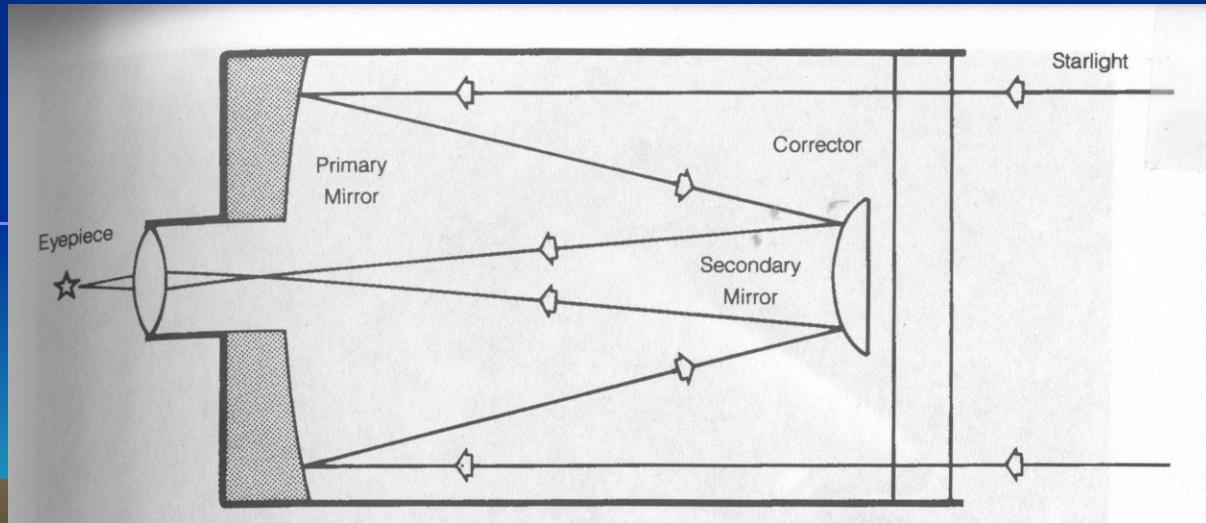


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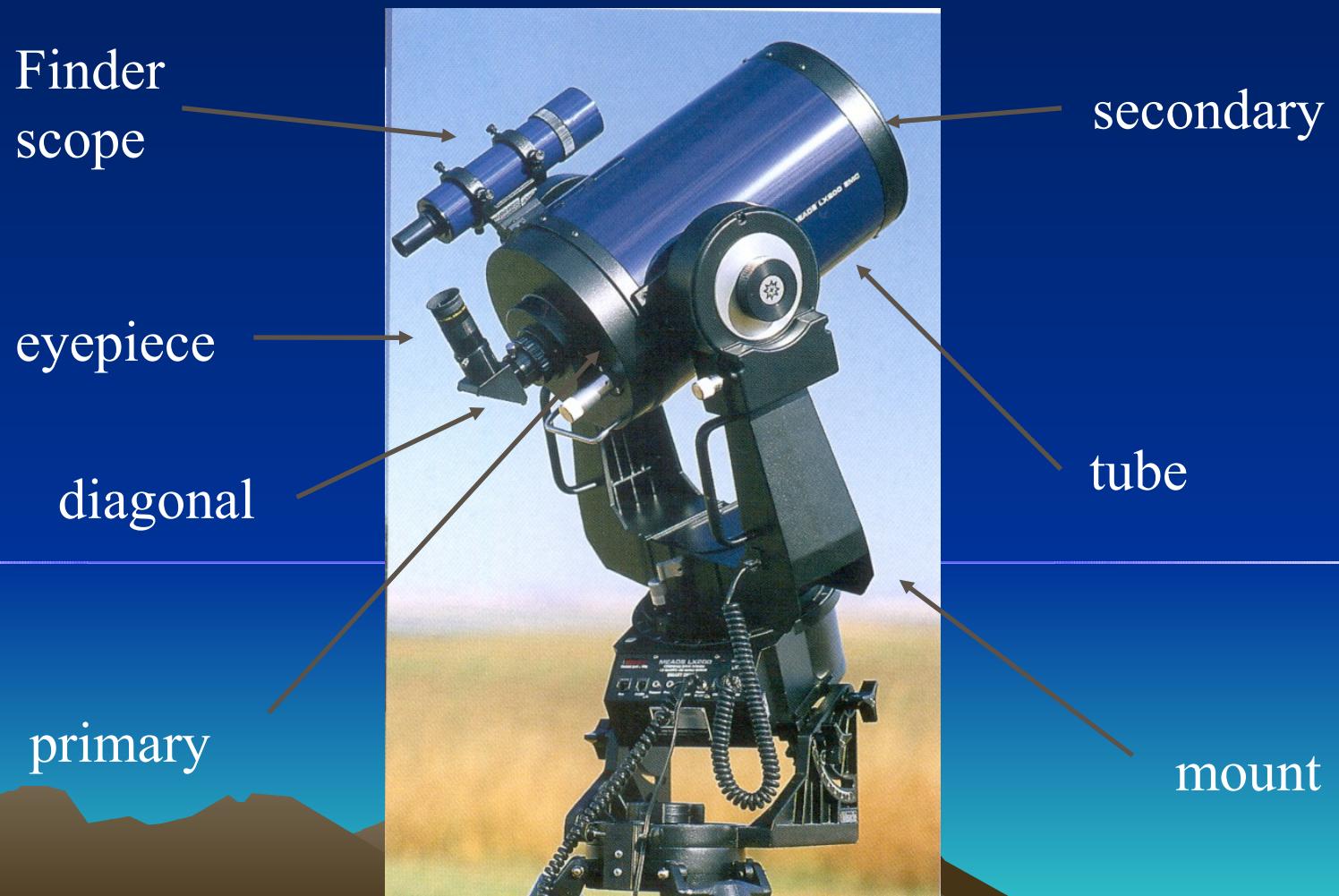


The compound (catadioptric) telescope

- All other telescopes use some combination of lenses and mirrors to form an image. The lens is usually at the front of the tube, while the primary mirror is usually at the back.



Parts of the telescope – compound



Compound telescopes



What can you see through a telescope?

- Earth's moon
- *With proper filters*, features of our sun
- Planets of our solar system
- Stars
- Deep Space Objects
 - Open clusters
 - Globular clusters
 - Galaxies
 - Nebulae



Managing expectations.

- What will you not see through a telescope?
- Color, Visually, generally Deep Space Objects show no color.
 - Open clusters
 - Globular clusters
 - Galaxies
 - Nebulae
- Stars have color, some quite a lot.
- For color, you need photography.



Earth's Moon



Photo by SMAS member Shawn Harrison

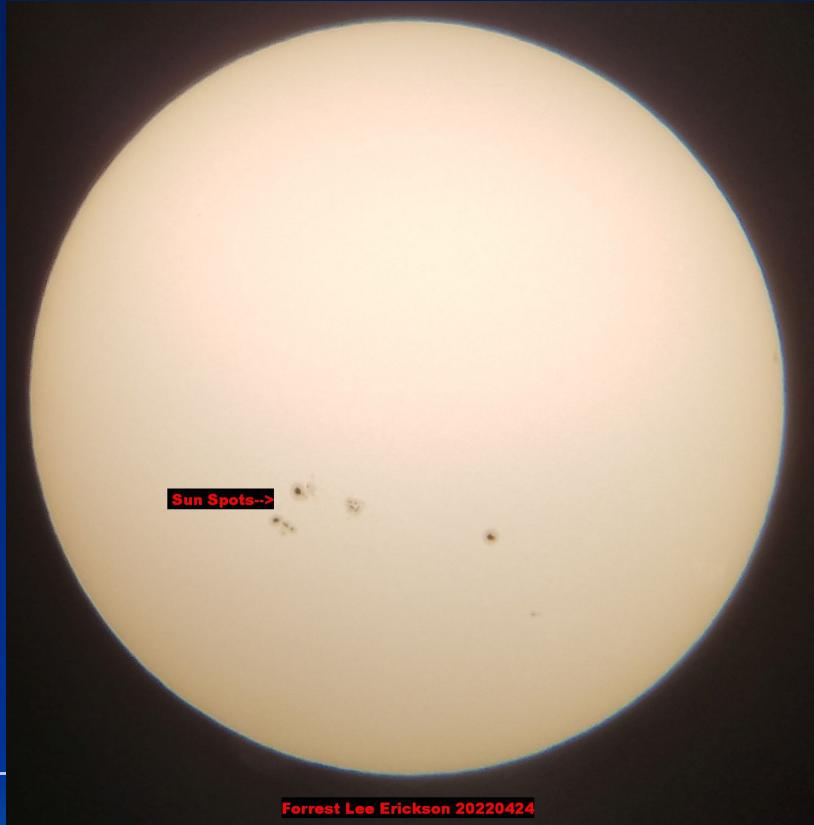
Lunar Features



Lunar Eclipse



Sun Spots or Transits of Mercury

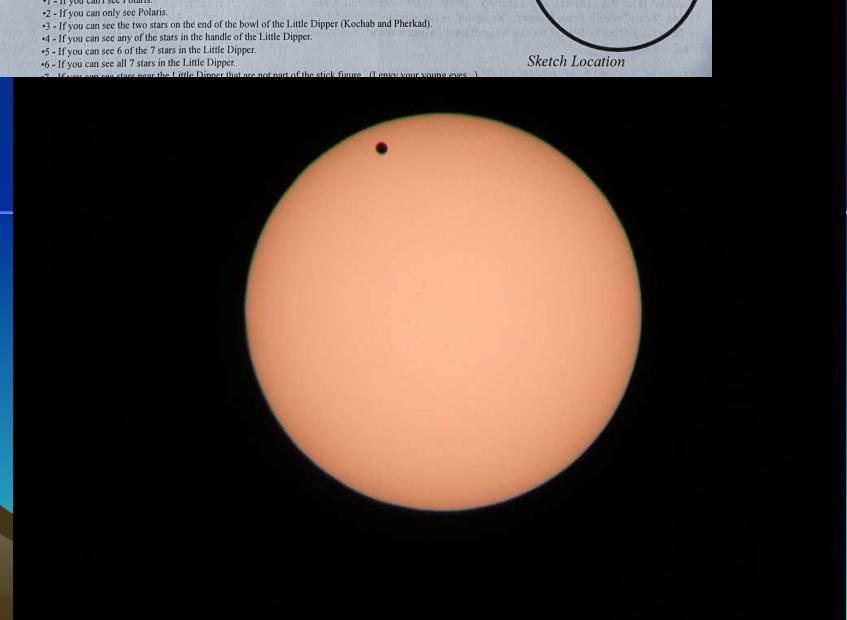


or EDT for Eastern Daylight Time. Better yet, learn how to convert and use UT (or GPS) time.

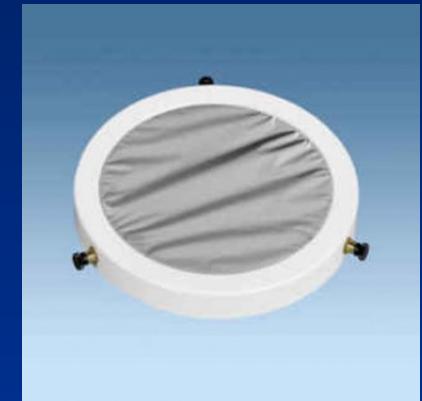
Object Drawing Notes
Object Name: Jule Say
Drawn by: Lee Erickson
Date: April 25 Time: 1150 EDT
Telescope Description
Model: X710
Objective diameter= 254 mm
Focal Length (f)= 1000 mm
Eye piece (e)= 26 mm
Magnification=f/e= 46
Observing Description
Transparency (1-7): 100% Haze
Seeing: Very Good
Location: BCPL
Limiting Mag: -26
Lat: 35.7 N Long: 84.0 W
Object Description:
Say with spots
5 groups with very small t + large
Group near center
WEST

Seeing: How stable is the sky?
-E (excellent) - The brighter stars are not twinkling at all.
-VG (very good) - The stars are twinkling slightly, but the brighter planets are not twinkling.
-G (good) - The brighter planets are twinkling slightly.
-F (fair) - The stars are obviously twinkling.
-P (poor) - The atmosphere is turbulent: all objects are twinkling to the point where observation is not practical.
Transparency: How clear is the sky?
Transparency is a measure of what you can see in the nighttime sky in spite of dust, smoke, haze, humidity, or light pollution. An easy way to measure this is to use the magnitude of the faintest star you can see. Ideally, this would be looking straight up at zenith. But, to make life simpler, you can use the Little Dipper (Ursa Minor) if you can see it. Here is the scale:
1 - If you can't see Polaris.
2 - If you can only see Polaris.
3 - If you can see the two stars on the end of the bowl of the Little Dipper (Kochab and Pherkad).
4 - If you can see any of the stars in the handle of the Little Dipper.
5 - If you can see 6 of the 7 stars in the Little Dipper.
6 - If you can see all 7 stars in the Little Dipper.
7 - If you can see stars near the Little Dipper that are not part of the stick figure. (Lousy young eyes...)

Sketch Location



With a proper filter, Sun Spots and Partial Solar Eclipse.



or EDT for Eastern Daylight Time. Better yet, learn how to convert and use UT (or UTC) for Central Time.

Object Drawing Notes

Object Name: 3 Sun Spots

Drawn by: Lee Licksey

Date: 31 May 25 Time: 11:50 EDT

Telescope Description

Model: X710

Objective diameter = 254 mm

Focal Length (f) = 1200 mm

Eye piece (e) = 26 mm

Magnification = f/e = 46

Observing Description

Transparency (1-7): Poor Seeing: Very Good

Location: B.C.P.L.

Limiting Mag: -26

Lat: 35.7 N Long: 89.0 W

Object Description:

Sun with spots

5 groups with very prominent + large

Group near center

West

Sketch Location

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 6 - If you can see all 7 stars in the Little Dipper.
 7 - If you can see stars near the Little Dipper that are not part of the stick figure. (envy your young eyes.)

If you travel, Total Solar Eclipse



TOTAL ECLIPSE IMAGE BY BRANDON SANDERS

PARTIAL ECLIPSE IMAGES BY JIM SANDERS

Planets in our Solar System



By SMAS member

Duane Dunlap



By SMAS member Vicente Diaz



Open Clusters



Open Clusters are
loosely packed
young stars.



Photo by SMAS member Duane
Dunlap

Globular Clusters

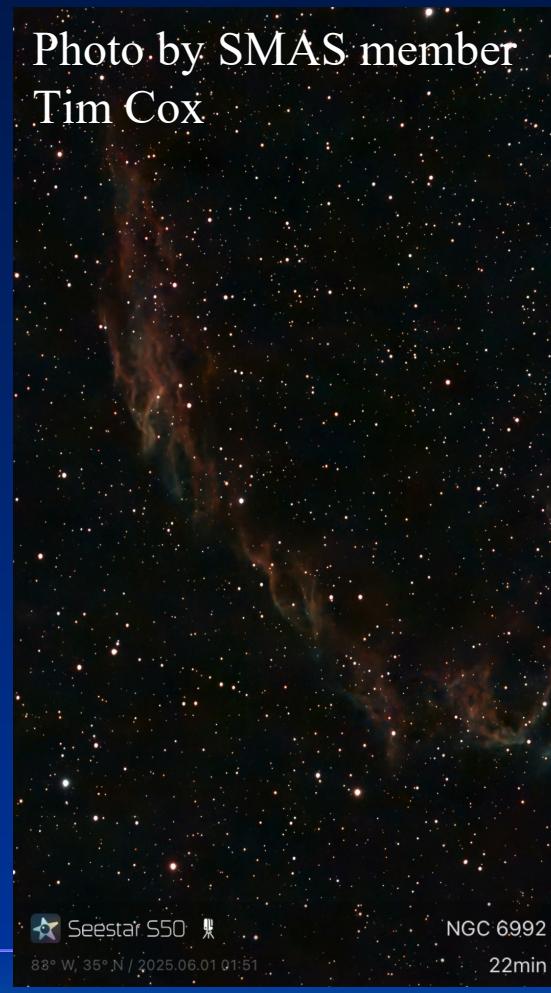
Photo by SMAS member
Tim Cox



Globular Clusters
Packed tighter and
higher at the center
old stars.



Nebulae



- However, no color visually
- Use a camera (and special mount) for color

Galaxies are large collections (hundreds of billions) of stars.

These galaxies are near Leo and Virgo and best seen and photographed in the winter and spring.

Galaxies

Photo by SMAS member
Peggy Burkman



Photo by SMAS member
Tim Cox



- The Sombrero galaxy, M104
- The Leo triplet of galaxies, M65, M66 and NGC3628

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