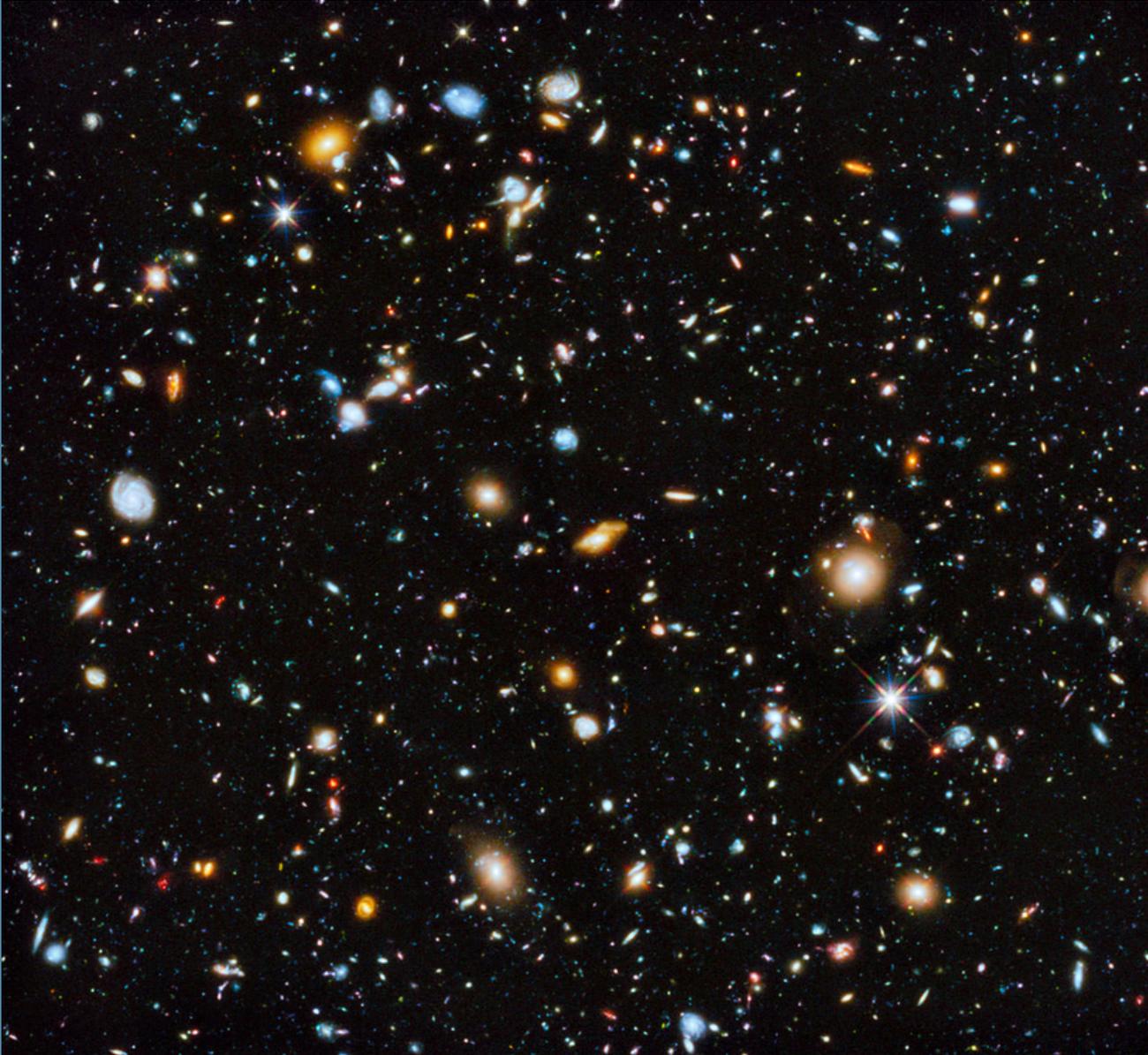


An Introduction to Astronomy



Our Universe is HUGE!



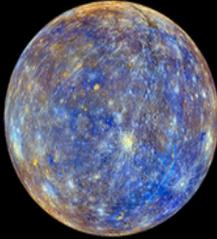
This picture is from the Hubble Telescope and shows over 10,000 Galaxies in just a small part of our skies. In fact it only shows 1/24,000,000th of the visible sky from Earth. You can't see them all due to having to shrink the image to fit this presentation, but they are there.

Our Universe is thought to be 92 billion light years across. *A light year is about 6 trillion miles!* So *92 billion X 6 trillion miles!* Almost beyond comprehension.

The Beginning of Astronomy

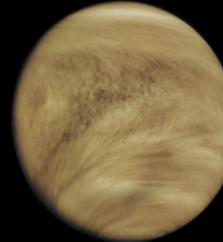
- Astronomy is the oldest of the natural sciences
- A 32,500 year old Mammoth Tusk is thought to show an engraving of the Constellation Orion
 - Ancient peoples used the night sky as a timer to determine when to plant crops. Knowing when it is safe to plant meant that they wouldn't lose their effort to frost, flood, or drought at either end of the growing season

Our Planets



Mercury

Mercury—the smallest planet in our solar system and closest to the Sun—is only slightly larger than Earth's Moon. Mercury is the fastest planet, zipping around the Sun every 88 Earth days.



Venus

Venus spins slowly in the opposite direction from most planets. A thick atmosphere traps heat in a runaway greenhouse effect, making it the hottest planet in our solar system.



Earth

Earth—our home planet—is the only place we know of so far that's inhabited by living things. It's also the only planet in our solar system with liquid water on the surface.



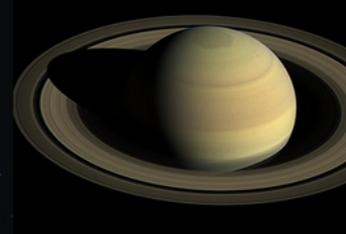
Mars

Mars is a dusty, cold, desert world with a very thin atmosphere. There is strong evidence Mars was—billions of years ago—wetter and warmer, with a thicker atmosphere.



Jupiter

Jupiter is more than twice as massive than the other planets of our solar system combined. The giant planet's Great Red spot is a centuries-old storm bigger than Earth.



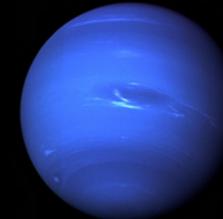
Saturn

Adorned with a dazzling, complex system of icy rings, Saturn is unique in our solar system. The other giant planets have rings, but none are as spectacular as Saturn's.



Uranus

Uranus—seventh planet from the Sun—rotates at a nearly 90-degree angle from the plane of its orbit. This unique tilt makes Uranus appear to spin on its side.



Neptune

Neptune—the eighth and most distant major planet orbiting our Sun—is dark, cold and whipped by supersonic winds. It was the first planet located through mathematical calculations.

Pluto is now considered a dwarf Planet

The night sky

- What is there to see in the night sky?
 - Our Moon
 - Planets & their moons
 - Stars
 - Globular Clusters
 - Bright Nebulae
 - Dark Nebulae
 - Galaxies
 - Meteor Showers & Comets

Our Moon



The Moon has fascinated all people for 10s of thousands of years. You don't need a telescope to see that the surface is rough, and varies in brightness across the face of it's disk.

We all have seen the various phases of the Moon and many calendars show the phases of the Moon.

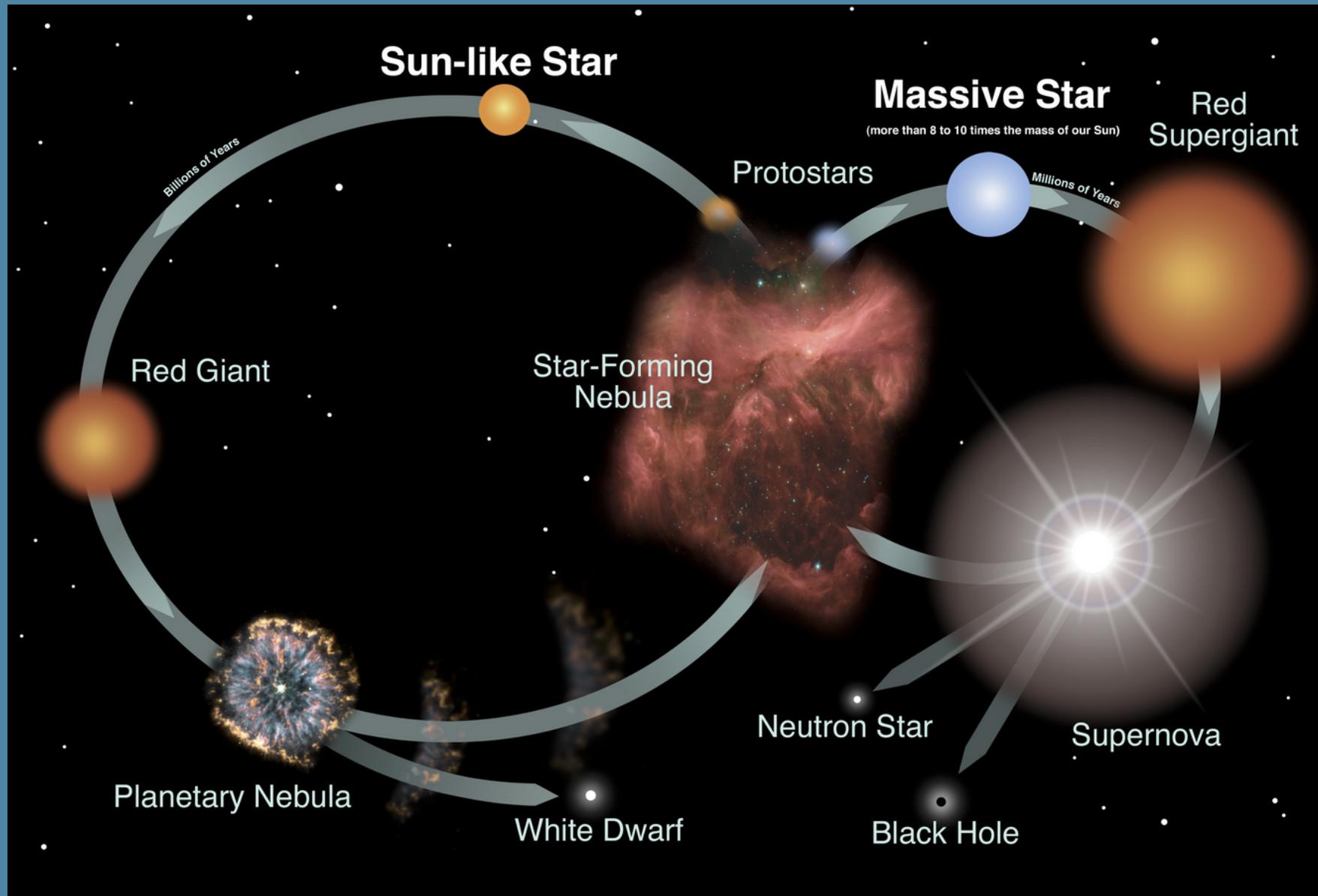
A small telescope will show the observer craters, lava flows, mountains, and impact craters with lighter rays of ejected material across the Moons face. Less than full Moon is the best time to observe.

Observing Planets



Here are two images I took. Of course Saturn is the one with rings, and the other is of Jupiter. The moons Io and Europa are barely visible in this scaled down picture. I haven't gotten Mars, Venus, Mercury Uranus or Neptune yet, but I'm looking forward to trying even though they will be tiny in comparison to Jupiter and Saturn. Over a bit of time, you can watch the moons of Jupiter orbit the planet, and even see their shadows on the face of Jupiter when the moons pass between the Sun and Jupiter. When you see this, you have to realize that what you see in the eyepiece took place about 41 minutes ago. Jupiter is that far away.

A Star's Life Cycle



Star Sizes

A comparison of star sizes

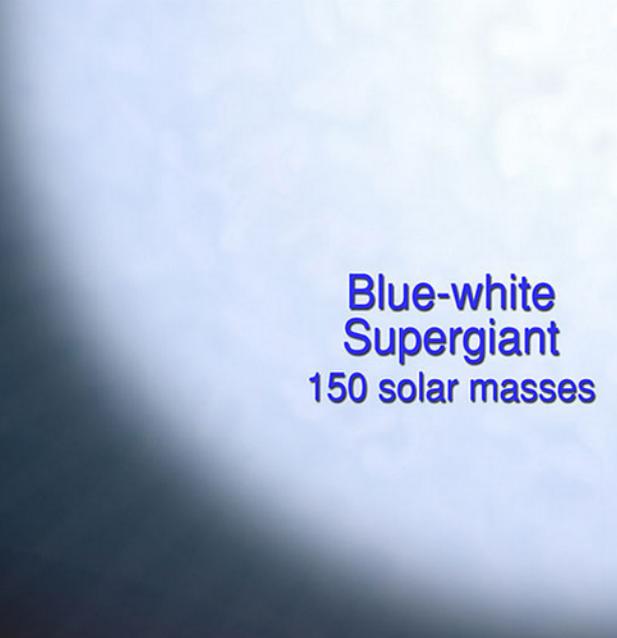
Red Dwarf
Lower limit:
0.08 solar
masses



Our Sun
1 solar mass



Blue-white
Supergiant
150 solar masses



Red Giant
Very old stars that
evolve from stars of
<5 solar masses



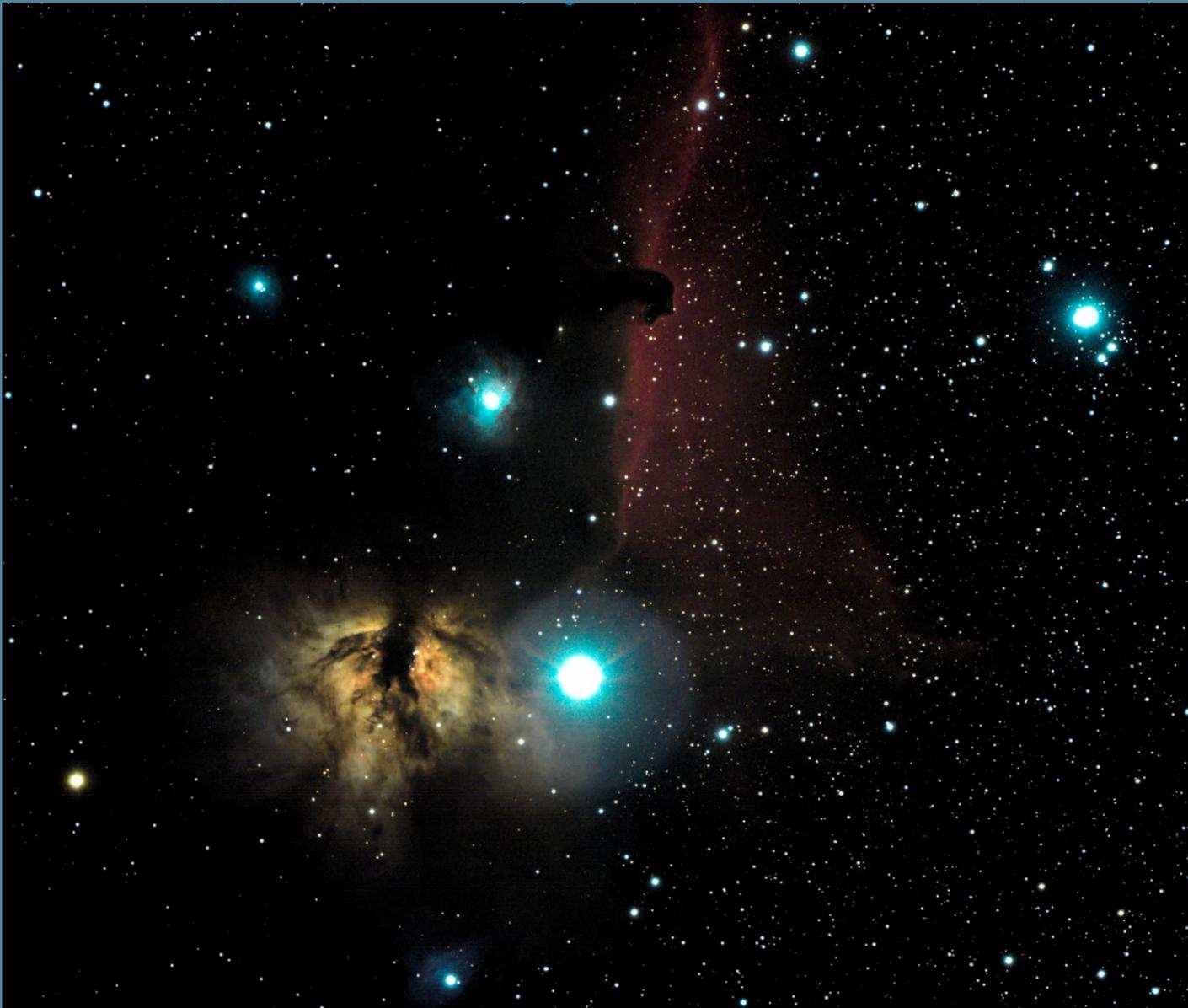
Globular Clusters

Globular clusters are groups of stars very close to one another in astronomical terms.

The image to the right is named M13 and consists of several hundred thousand stars in the shape of a globe. Thus the name Globular cluster. There are many of these clusters which appear in small telescopes as a fuzzy ball of light. Yes you can see them, but not like the Hubble Cameras record them. Note the various colors of the stars. From blue to reds. This is caused by the star's temperature.



Bright & Dark Nebulae



This image taken by me contains both Bright and Dark Nebulae. The red, yellow, and blue glow around the stars are all nebulae.

What looks like a Horse's head is an example of a dark nebula, caused by dust in space.

This hobby requires an investment. In time & equipment. We'll talk about equipment later.

Galaxies



This is the great Andromeda Galaxy.

Image taken by me at my Observatory.

If you know where to look, you can see this as a faint fuzzy patch with your naked eye. It contains about 1 trillion stars, and is scheduled to collide with our Milky Way home in about 4.5 billion years. Relax, we'll be gone!

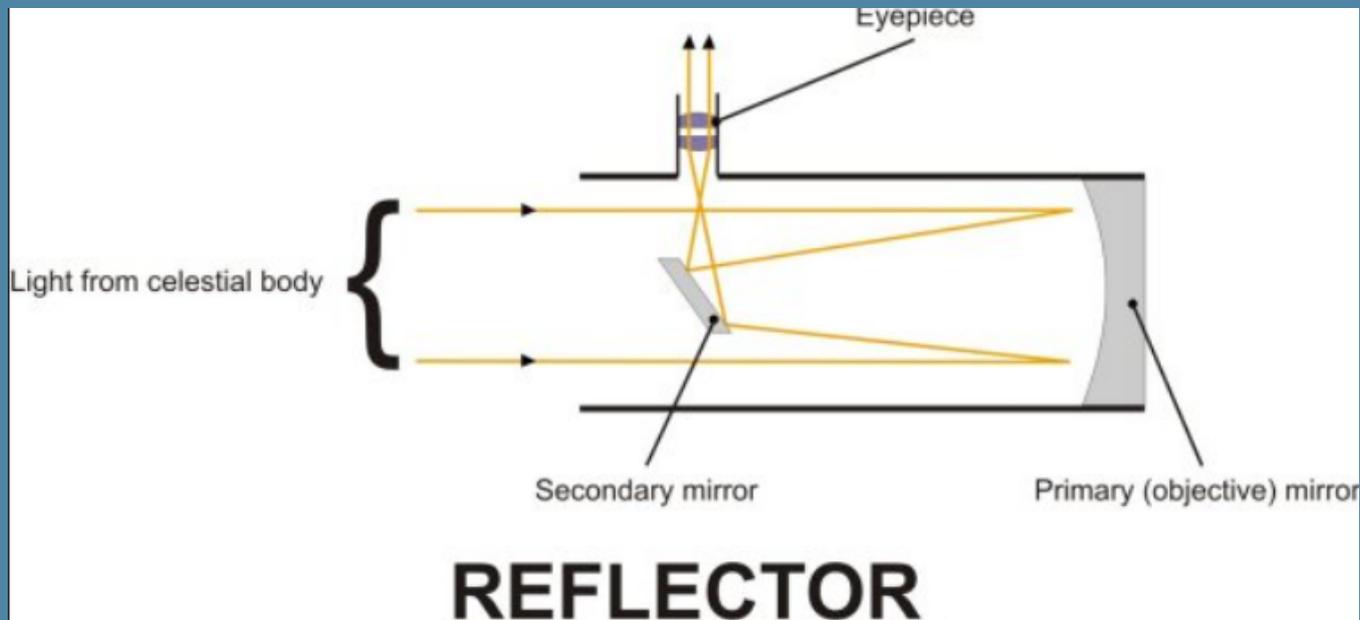
What do you need?

- The easy way to begin Astronomy is with your eyes.
- Another easy way is to use Binoculars
- A step up to a telescope allows you to see more
 - The smallest telescope I would recommend is 4 inches. If you are only going to observe the Moon, you could get away with a 3 inch telescope.
 - Department Store telescopes are rarely worth the investment.
 - Just as important as the telescope is the tripod it sits on, you can't see much if it is vibrating while you try to focus, you seldom can enjoy observing if the image is moving due to a poorly engineered tripod.

Types of Telescopes

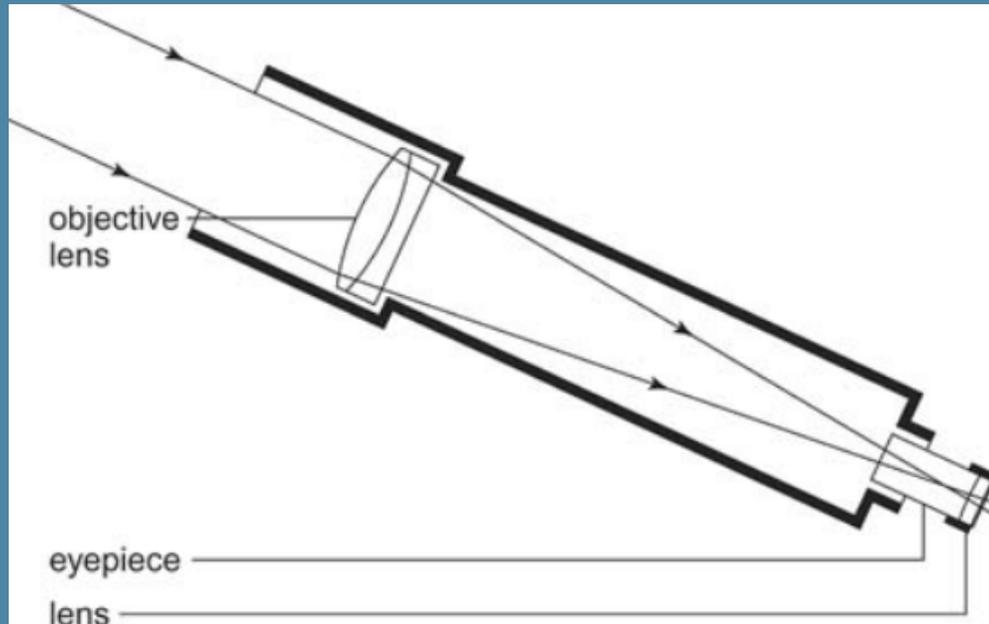
- There are two major types of optical telescopes
 - Reflectors
 - Uses a mirror to collect light and focus it into an eyepiece
 - May or may not have a front corrector lens
 - Refractors
 - Uses lenses to focus light into an eyepiece not mirrors

Dobsonian type telescope



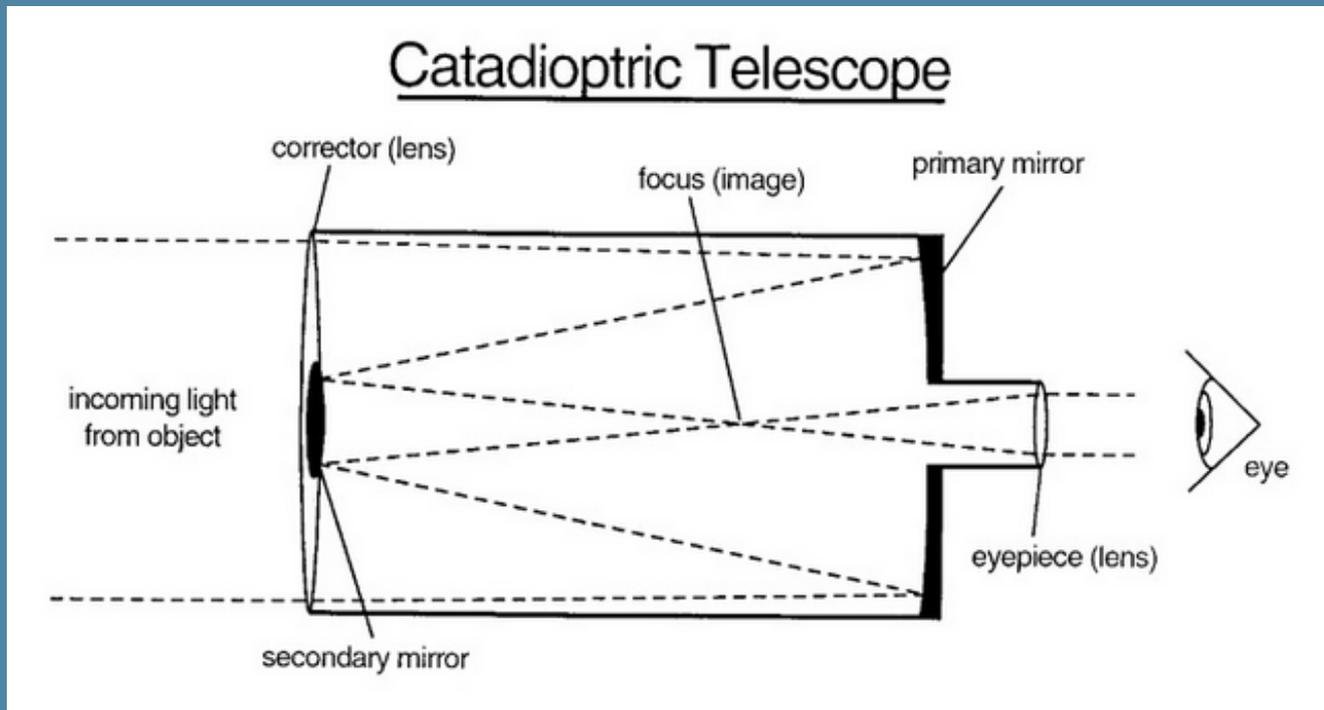
- Advantages reasonably priced, still capable of great views
- Disadvantage totally manual operation, you push it to a target by hand

Refractor



- Advantages – smaller and lighter than a Dobsonian or Newtonian Telescope
- Disadvantage – More costly than a Dobsonian, a 4 inch refractor will normally cost more than a 6 inch Dobsonian, needs a good tripod to be functional, less light gathering than Dobsonian telescopes.

Catadioptric Telescope



- Advantages – Compact, reasonably priced, though more than Dobs/Newts
- Disadvantages – generally requires an equatorial mount that tracks the sky automatically, but is still a favorite of many Amateur Astronomers.

Types of Mounts (tripods)

- German Equatorial Mount (GEM mounts)
 - Computer Controlled
 - Non Computer Controlled
 - Manual
 - Electronic
- Altitude & Azimuth Mounts
 - Computer Controlled
 - Manual Controlled

GEM vs Alt-Az Mount

- If you plan to use a camera for time shots, you need a GEM mount
- If you plan to only observe visually, an Alt-Az mount is satisfactory
- There are exceptions to most rules and choice of mounts is one of those exceptions. If you are interested in taking up this hobby, talk with me personally.

Things you should know

- What you see won't look like the Hubble images you may have seen on TV or the Web
- The only colors seen are on the Planets, and the Stars an exception will be discussed on the next slide
- If you look at the Whirlpool Galaxy for instance, it will appear as a small comma shaped object in your eyepiece, the magic to me is that the photons hitting your eye have been traveling thru Space for 25 million years, other objects you observe can be much, much farther away, and those photons have traveled much longer to reach the Earth and your eye.

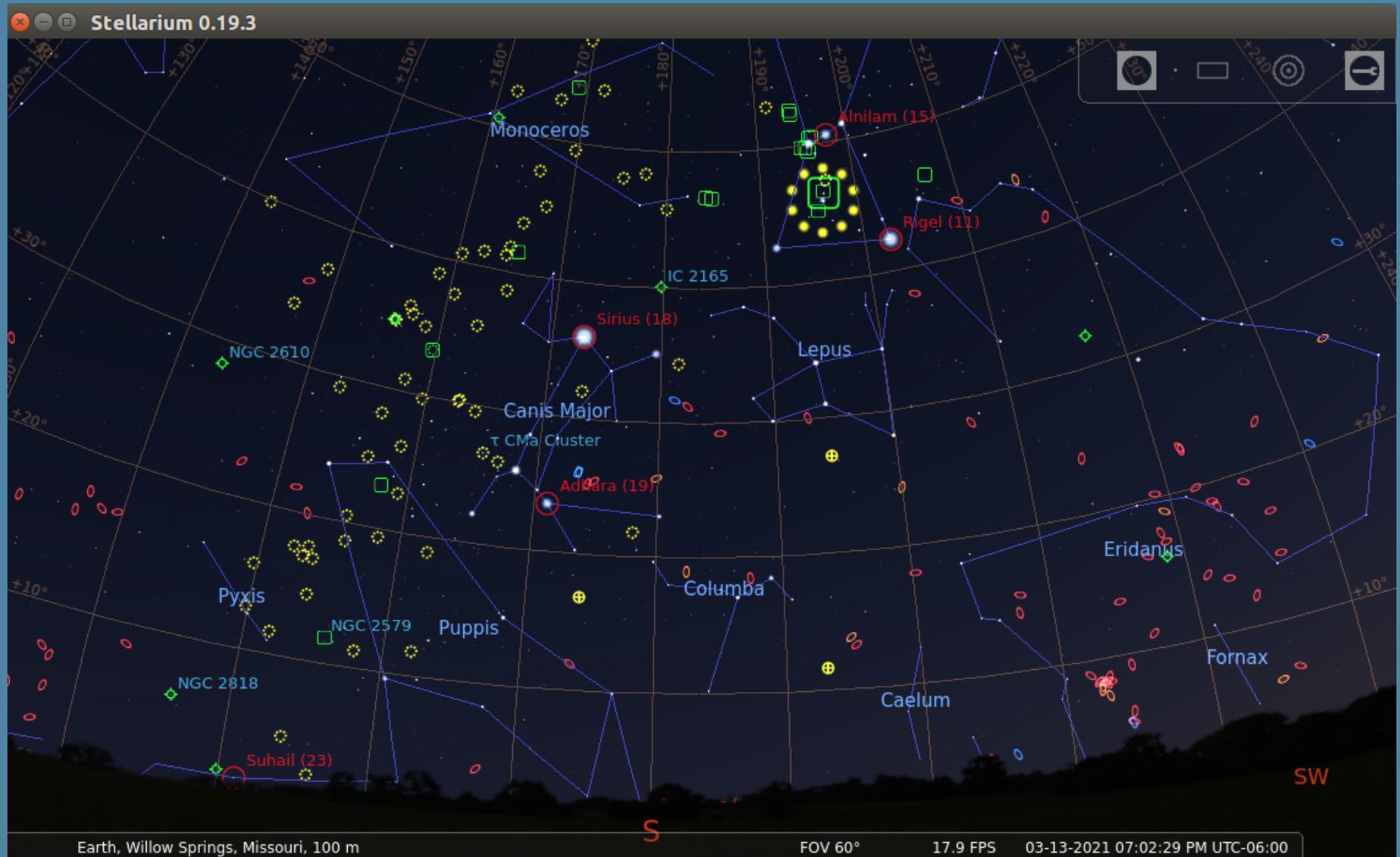
How to Observe in Color

- One way to observe colors even using a four inch telescope is to use Electronic Assisted Astronomy often called EAA
 - Special Cameras are available which replace your eyepiece, and then feed the signal to a Windows Computer. There are many brands of these cameras, I use one by Mallincam who also makes an entry level camera at a reasonable cost. Here is a link to this product <https://www.mallincam.net/micro-series.html>
 - There is a solution for those without a computer, a product called the Revolution Video Imager. Check their product out on YouTube, Consider it the minimum you need to see color, it works even with small telescopes, though a tracking mount is likely needed at a minimum. Their website is <https://www.revolutionimager.com/>
 -

Useful Websites and Programs

- Here is a program I highly recommend, even if you only use your eyes to observe the night sky, but it is almost a necessity for users of telescopes or Binoculars.
 - Stellarium, a detailed planetarium program showing all the objects an amateur telescope can observe. For Windows, Macs, Linux
 - stellarium.org
 - Demo if possible

Stellarium Screen Shot



Useful Websites and Programs

- Virtual Moon Atlas is especially useful for small telescope users and Binoculars. It is very useful for 4 to 8 inch telescope users as well.
 - <https://sourceforge.net/projects/virtualmoon/>

I have this program on my Linux machine, but it appears that it is only available for Windows 10 at this point. More details may be found at the link above. You can explore the Moon for a whole lifetime and always see something new.

This program shows the Moon on a given date and time from your location, and can zoom in on features on its face. Craters are named, and the photos shown on your screen are from various moon landers, and even the manned Moon landings of the past. An alternative is to get a Moon map from Orion Telescopes, it isn't as detailed, but it will do the job of helping you identify features you observe on the Lunar face.

Demo if possible

Virtual Moon Atlas Screen Shot

The screenshot displays the Virtual Moon Atlas software interface. The main window shows a detailed grayscale image of the Moon's surface with several regions labeled: Mare Imbrium, Mare Serenitatis, Oceanus Procellarum, Mare Insularum, Mare Tranquillitatis, Mare Crisium, Mare Fecunditatis, and Mare Nubium. The interface includes a menu bar (File, Configuration, Help), a zoom slider set to 1:1, and a toolbar with various navigation and tool icons. On the right side, there is an 'Ephemeris' panel with tabs for 'Information', 'Notes', and 'Ephemeris'. The 'Ephemeris' tab is active, showing a date selection interface (Date: 2021-03-02, Time: 14:01) and a 'Compute' button. Below the date selection is a table of ephemeris data for DE421.

Ephemeris:	
Observatory:	+36°32' +92°00'
Date:	2021-03-02 14:01
Date (TT):	2021-03-02 20:02
(J2000) Right Ascension	13h53m10.61s
(J2000) Declination:	-08°20'02.3"
(Date) Right Ascension:	13h54m17.52s
(Date) Declination:	-08°26'16.8"
Distance:	370964Km
Apparent diameter:	32.21'
Colongitude:	136.9°
Phase:	313.2°
Lunation:	19.04 days
Illumination:	84.2%
Sub-solar latitude:	-1.5°
Libration in Latitude:	-04°11'
Libration in Longitude:	-00°08'
Position angle:	19.5°
Azimuth	+323°05'
Altitude	-56°35'
Rise:	22h07m
Transit:	2h57m
Set:	8h49m
Rise azimuth:	+102°26'
Transit Altitude:	+45°

Longitude: Latitude: Date: 2021-03-02 Time: 1... Field:34' Zoom:1.8 Level:1 WAC

Useful Websites and Programs

- Sky maps
 - <http://www.skymaps.com/> Lots of maps and charts for the observer. Geared more towards naked eye viewers or Binoculars. Check this one out, because it is full of all kinds of useful documents. Some free.

Telescopes and tools to help determine what type of telescope you should buy may be found at the Orion Telescope site. <https://www.telescope.com/>

The two major telescope manufacturers are Celestron, and Meade
Celestron's site is at <https://www.celestron.com/>

Meade's site is at <https://www.meade.com/>

My Images



Ring Nebula



Moon



Rosette Nebula



North America Nebula



Globular Cluster M13



Jupiter



ES127 Refractor



Horsehead Nebula

The best telescope for those on a budget who don't know if their aspiring astronomer will stick with it!

Quick View Close X



FREE SHIPPING!

Orion SkyQuest XT6 Classic Dobsonian Telescope

★★★★★ [Read 69 reviews](#) | [Write a review](#)

\$349.99	Add to Cart
Expected Ship Date: 04/13/2021 Email Me When In Stock	Quantity: <input type="text" value="1"/>

- Perhaps the best beginner Dobsonian reflector telescope you can buy - big 6" aperture at an amazing price
- A beginner may use a 60mm telescope for a few months or years before deciding they need to upgrade to a better telescope - a 6" Dobsonian will give you a lifetime of wonderful views
- Simple navigation and no need to polar align makes this Dobsonian reflector telescope extremely ease to use for the whole family
- The 6" diameter f/8 parabolic mirror is fantastic for Moon and planetary views, and also has enough light grasp for deep-sky viewing of nebulas, galaxies, and star clusters
- The stable Dobsonian base provides a vibration free image even when viewing at a high powers, and features smooth enough motions to make tracking of celestial objects a breeze