

Backyard Astronomy Tips: Star Gazing Under a Starry Night Sky!

Good Preparation Tips:

1. Dress appropriately according to weather conditions – for winter observing, dress in layers to keep warm and bring gloves and a hat. Hand warmers are also recommended – you want to have a good experience while observing - not to stand around shivering and freezing!
2. Always observe with a partner – shared experience are more memorable and you can learn from each other. Always let a parent or scout leader know about your plans for safety.
3. Prepare ahead of time – do not run out under dark skies and hope to figure out what you are looking at – look up observable objects like planets, stars, constellations and star clusters or double stars ahead of time. Use a planisphere to see what constellations and star groupings will be visible at your dark sky location. (shielded from stray lighting)
4. Make a checklist to easily record what you find and realize you might not accomplish everything but this gives you more to do during your next observing session!
5. Never use an optical instrument to look directly at the Sun. You will damage your eyesight and nothing is precious than your eyesight! Contact an amateur astronomy group or a local observatory – they will have special filtered telescopes that will allow you to safely view the Sun. Always follow their instructions – solar observing can be fun but it requires adherence to strict observing protocol to ensure everyone will have a good and safe experience while looking at our closest star through the telescope eyepiece or by means of a projected image where everyone can look at the disk of the Sun at the same time!
6. Find out when the inner terrestrial planets will be easily observed either right after sunset or just before sun rise and plan accordingly. Venus can be found near the Pleiades right after sunset in the western sky.

Venus is brilliant right after sunset! Find out when sunset or sun rise is for any planned observing date and work with your scout leader to plan out an outdoor observing session. Make sure you keep good records of what you are observing and if you have the capability, take a timed

photograph of the night sky with a camera mounted on a tripod! This is good for record keeping. Do the same for Moon rise and Moon set – this will help you learn the phases of the Moon as it orbits the earth throughout the lunar cycle.

ASTRONOMY		
SUN	RISE	SET
Actual Time	6:17 AM	7:22 PM
Civil Twilight	5:49 AM	7:51 PM
Nautical Twilight	5:14 AM	8:25 PM
Astronomical Twilight	4:38 AM	9:01 PM
Length of Visible Light	14 h 1 m	
Length of Day	13 h 4 m	
Tomorrow will be 2 minutes 49 seconds longer		
Moon	8:15 PM	6:55 AM
 Waning Gibbous 99% of the Moon is Illuminated		
<div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  Apr 14 Waning Half Last Qtr </div> <div style="text-align: center;">  Apr 22 New Moon </div> <div style="text-align: center;">  Apr 30 Waxing Half First Qtr </div> <div style="text-align: center;">  May 7 Full Moon </div> </div>		

Figure 1: Details for Wednesday April 08, 2020 in Fitchburg, MA with Moon phases for the month of April!

to the local weather forecast for your observing area – many online sites tell details about sunset, sunrise, moon rise, moon set and talk about the time for astronomical twilight which will help you plan when to begin your observing session!

<https://www.wunderground.com/weather/us/ma/fitchburg>

Civil Twilight – sun has just set (not more than 6 degrees below the horizon!) and sky is still very bright. The Moon and Venus can be seen!

Nautical twilight – darker – sun is not more than 12 degrees below the horizon and sky is getting darker! Bright stars and planets can be seen with the Moon!

Astronomical Twilight – darkest – sun is now between 12 degrees and 18 degrees below the horizon and it is now dark enough to see most stars!

Check out this site for the National Weather Bureau for a clear definition of each phase!

<https://www.weather.gov/lmk/twilight-types>

Binoculars – Use binoculars to scan the sky to help locate objects you would like to see through a telescope. Binoculars allow people to use both eyes and can give a really impressive views of the Moon, Jupiter and its moons as well as star clusters, nebula and galaxies like the Andromeda galaxy.

Telescopes view the night sky using different wavelengths in the electromagnetic spectrum for us to learn more than we could by only observing using visual wavelengths!

Chandra – X-Ray Space Observatory – Massachusetts based control center!

Spitzer – Infrared (heat energy) Space Observatory (no longer working)

Hubble – Mostly Visual with limited UV and narrow Infrared capability
Space Observatory

National Radio Astronomy Observatory (NRAO) – Earth Based radio telescopes includes Atacama millimeter/submillimeter array, Very Long Baseline Array (VLBA), Very Large Array (VLA)

Galex Ultraviolet Space Telescope – Earth Orbiting (no longer working)

Astronomical Telescopes: **Three Types**

All telescopes need to be acclimated or brought to the air temperature outdoors before using them.

Most have a carry case with lens caps and aperture covers

Never point any telescope at the Sun or use it to look at the Sun – this will result in damage to your eyesight! Only telescopes with specialized filters can be safely used to view the Sun – contact your local amateur astronomical society for information!

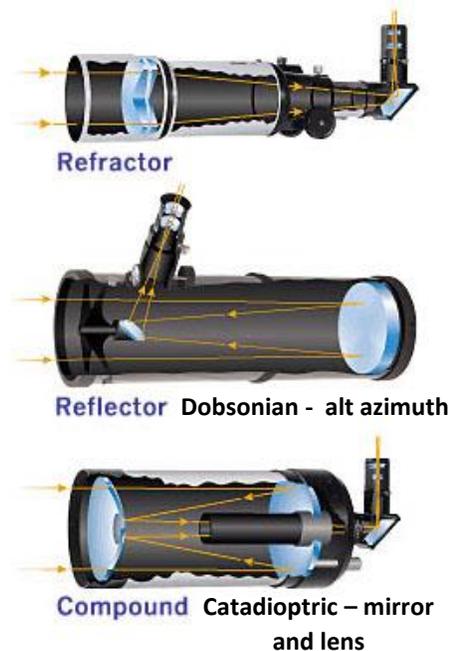
Carefully handle any telescope or binocular – they all have delicate optics that can be shifted out of alignment if mishandled or dropped.

Do not use any cleaning fluids to clean eyepieces – only knowledgeable people should clean optical surfaces of a telescope. You can blow dust off eyepieces using canned CO2 aerosol cans. Check with your scout leader!

Telrads are non-magnifying finders that are mounted on optical instruments to allow users to sight objects in the night sky through the main telescope.

Planispheres – small star and constellation locator that can be used throughout the year – you can set the month, date and time using this locator.

Small Finder Scope – a small finder scope that allows the main telescope to be pointed at night sky objects



Constellations Observable in November/December 2019 skies

Ursa Major with asterism Big Dipper

Ursa Minor with asterism Little Dipper

Cassiopeia – the W, M or Kite asterism in the night sky

Heading toward the western skies – Summer Triangle Asterism – the

Constellation of Cygnus, Aquila and Lyra

Perseus

Auriga

Gemini – Zodiacal constellation

Taurus - (The Bull) Zodiacal constellation - with the Pleiades star cluster (also known as Subaru or the seven sisters)

Andromeda – location of the magnificent Andromeda galaxy

Orion – the Hunter

Canis Major

Star Colors – check Albireo and Gamma Andromeda!

Zodiacal constellations

Aries

Taurus

Gemini

Cancer

Leo

Virgo

Libra

Scorpius

Sagittarius

Capricornus

Aquarius

Pisces

Bright Stars

Sirius – brightest star in the night sky also called the dog star – located next to Orion the Hunter

Betelgeuse – Orion the Hunter

Rigel – Orion the Hunter

Summer Triangle stars - **Vega** from Lyra; **Deneb** from Cygnus the Swan; and **Altair** from Aquila the Eagle

Albireo – a beautiful double star in Cygnus with a secret!

Capella from Auriga

Aldebaran from Taurus the Bull

Castor and **Pollux** from Gemini the Twins

Polaris – Ursa Minor – the little bear

Alcor and Mizar – beautiful double star in the handle of the asterism of the Big Dipper

Algol – a winking demon star in Perseus – an eclipsing binary star!

First Magnitude Stars – Vega, Betelgeuse, Rigel, Sirius, Capella, Pollux

The **Milky Way** – a band of stars unresolved to the unaided eye that is what we see when we look in the direction of the center of the Milky Way Galaxy!

Planets:

Mercury, Venus, Mars, Jupiter and Saturn.

Phases – **Mercury** and **Venus** go through phases as inferior planets meaning ones that orbit inside the orbit of the Earth. Galileo immediately proved that the Earth orbits the Sun when he observed Venus going through phases as it orbited the Sun!

Mars does exhibit a gibbous phase but only because of the interference of Earth's shadow with the appearance of the planet when it is close to Earth!

Finding Planets:

All planets will be found along the center line of the solar system which is called the ecliptic. When looking for a planet, the easiest solution is to find the Moon and then look for bright objects east of west of the Moon which most likely will be planets! You will always find the planets Mercury and Venus very close to the horizon after an evening sunset or before sunrise in the morning skies! Venus will be higher up and away from the Sun and will be visible as a bright -4.3 magnitude object that always attracts attention when seen after sunset or before sunrise.

You can also use the internet and go to the Astronomy Magazine or Sky and Telescope Website or Earth and Sky to find charts which will show what planets will be visible through the month. Free skymaps below:

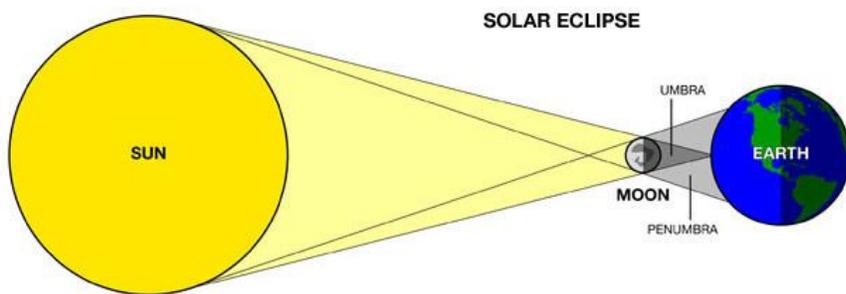
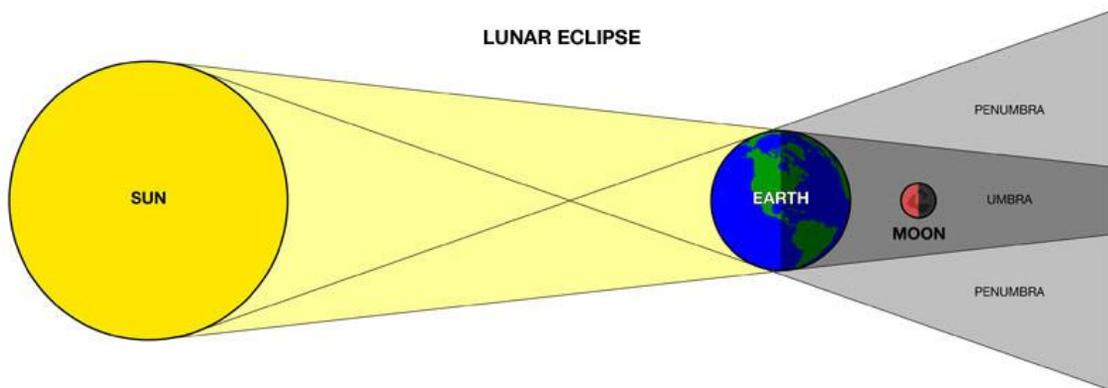
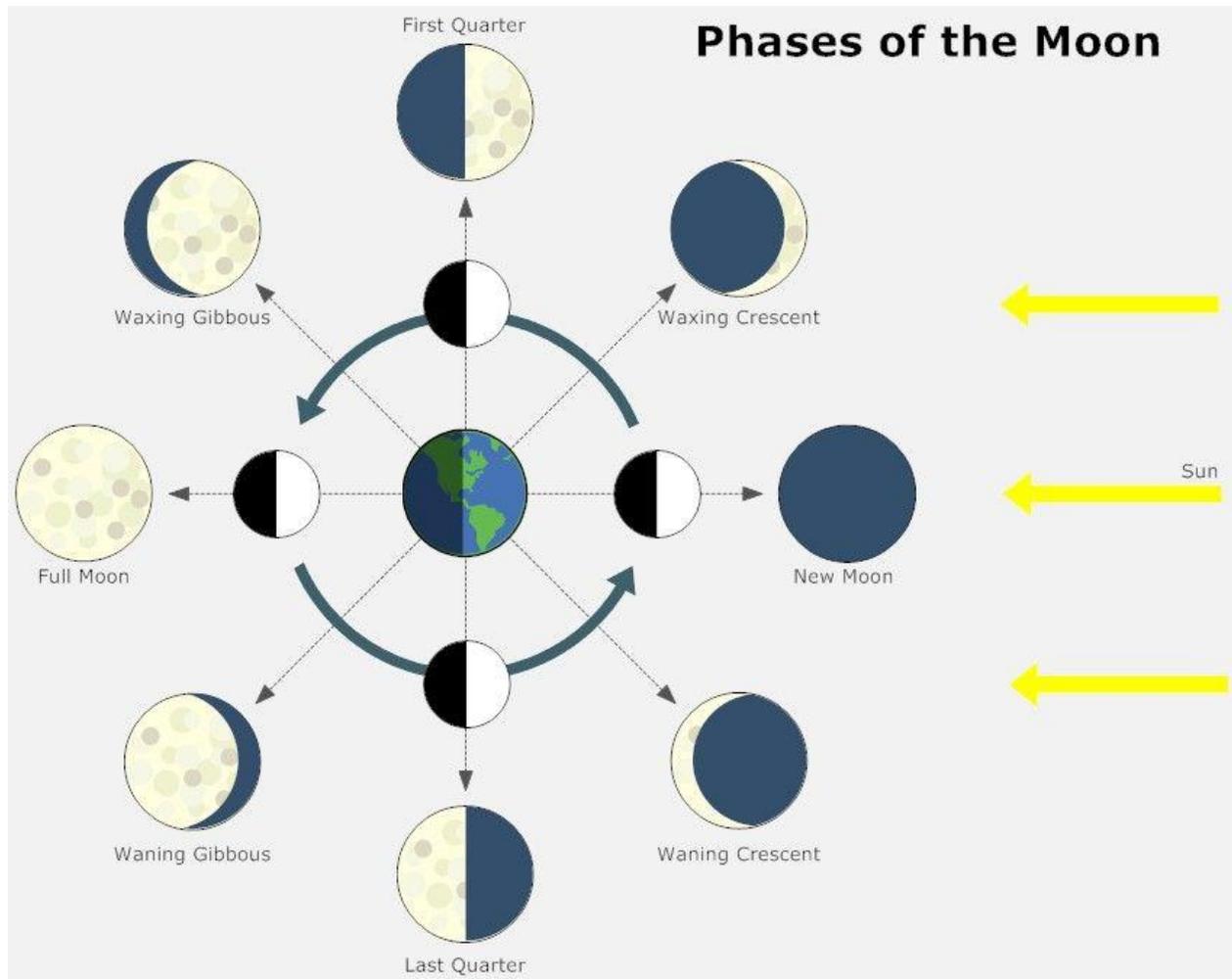
<http://www.skymaps.com/downloads.html>

You can also purchase a guide to the evening sky from Sky and Telescope or from the Astronomical League that will list what can be seen through any year.

Moon Phases

The Moon is always 50% illuminated by the Sun as it orbits the Earth but we only see a portion of the illumination from our perspective on Earth as we view the Moon! These are what we call the phases of the Moon with new Moon referring to the point in the lunar orbit when the Moon is directly in front of the Sun, and the full Moon when the Moon is directly opposite the sun at Sunset.

The Sun rotates and revolves around Earth but we only see one side of the moon. This is because the lunar rotation is synchronous meaning it rotates at the same rate that it revolves around the Earth allowing us to only see one hemisphere of the Moon! This phenomena was caused by the action of the tides over the millennia since the Moon formed.



The Sun

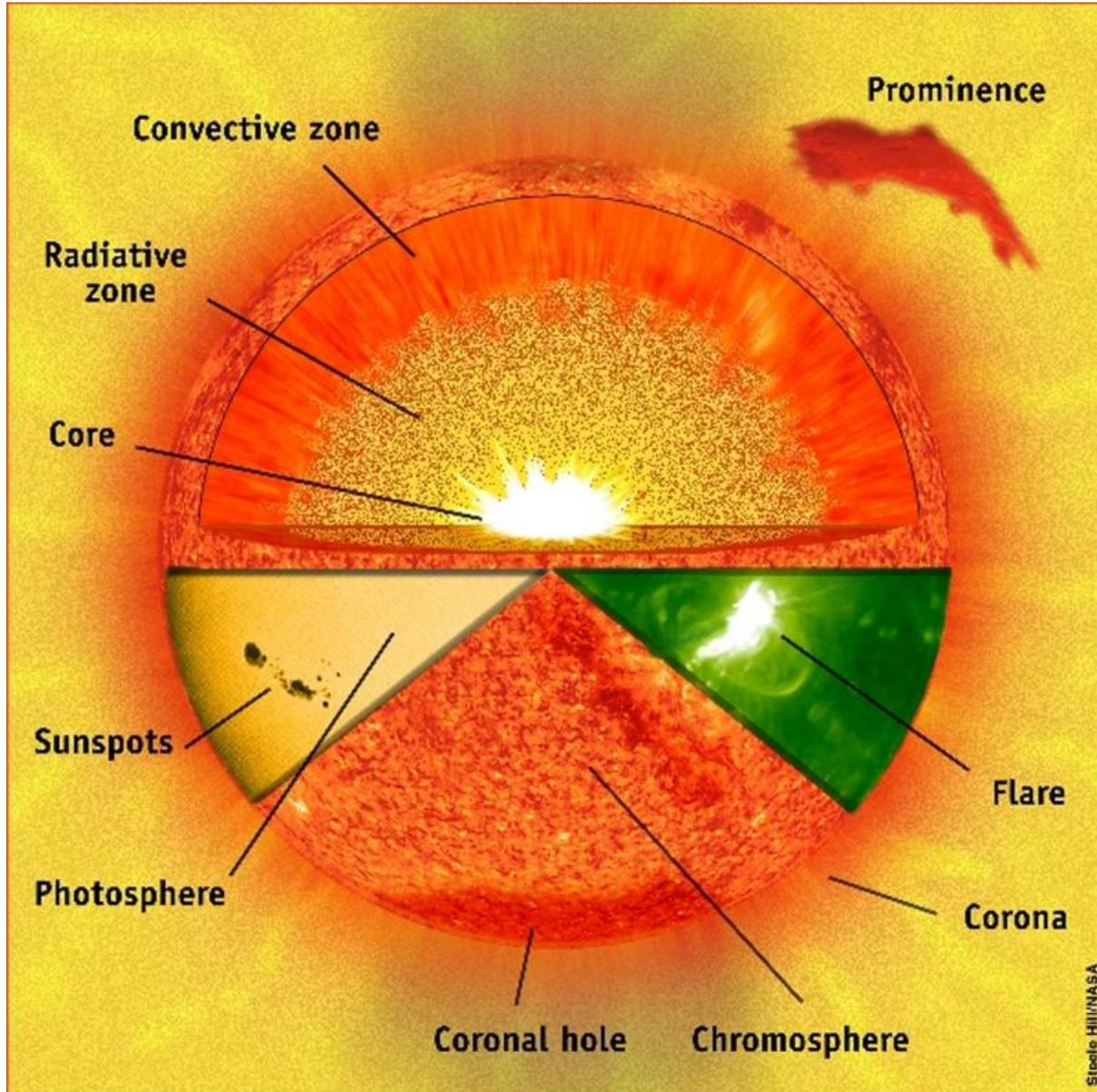


Figure 2: NASA – Composition of the Sun

Outbursts from the Sun can interfere with weather and communication satellites and also lead to outbreaks of the Northern Lights or Aurora Borealis. We are currently in a solar minima which means a quiet phase of the solar cycle which has a minimum of sunspots visible of the Sun's surface or photosphere.

Even during this quiet phase, the Sun can have coronal mass ejections that can hurl billions of tons of charged particles called the solar wind in the direction of Earth which can cause an Aurora to form!



Figure 3: Aurora with Venus next to the Pleiades Rayann Elzein on April 1, 2020 @ Utsjoki, Finland