



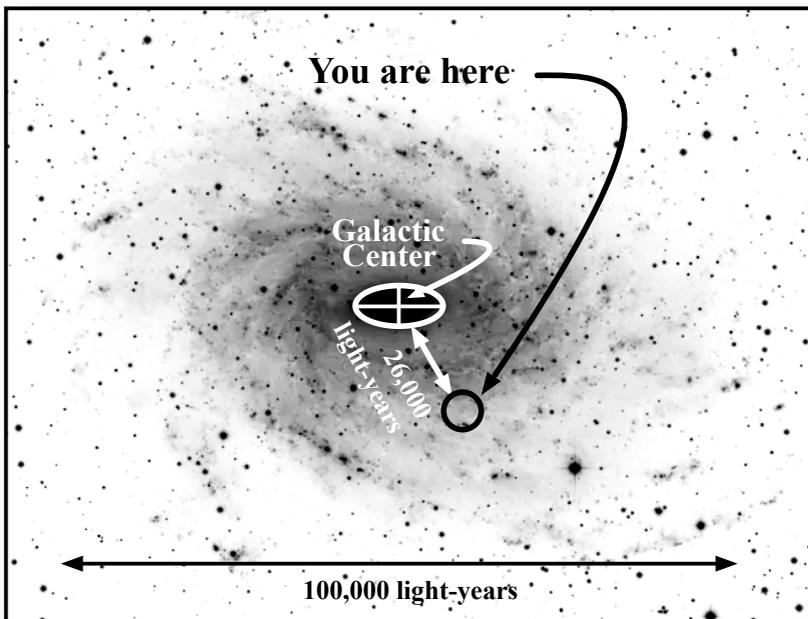
# ASTRONOMICAL LEAGUE

The nation's largest federation of astronomical societies

Take your first steps exploring the heavens!

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When beginning a journey, it is good to understand where you are ...



Negative image of galaxy NGC 6744, a galaxy very similar to the Milky Way.  
Original image: NASA

## Where is the Milky Way?

The galaxy contains you along with more than 200 billion stars and vast amounts of gas and dust. It is spread unevenly across a disk 100,000 light-years wide, and, in the spiral arms, 2000 light-years thick.

*No single word adequately conveys its immensity.*

From our earthbound viewpoint, the Milky Way is seen as a soft, glowing band with bright areas and dark regions that stretches across the sky. While portions of it can be distinguished from suburban areas, dark skies are needed to fully appreciate this marvelous sight.

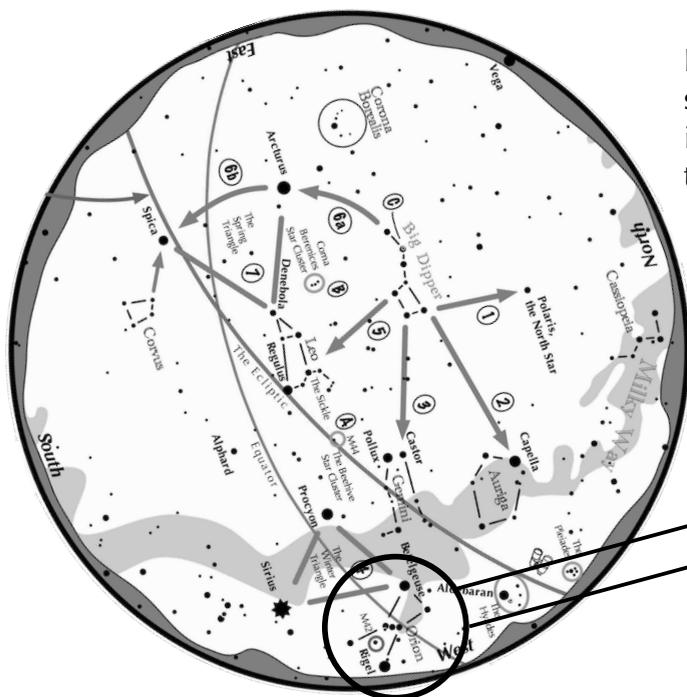
Since 1946, the ASTRONOMICAL LEAGUE has been helping stargazers explore the Milky Way and far beyond.

Let this well respected organization help you on your journey, and also help connect you to a community of stargazers through a local astronomy club or as a member of the AL. The League offers members its quarterly magazine, the *Reflector*; many Recognition & Youth awards; numerous and very popular Observing Programs and Observing Materials; plus much more!

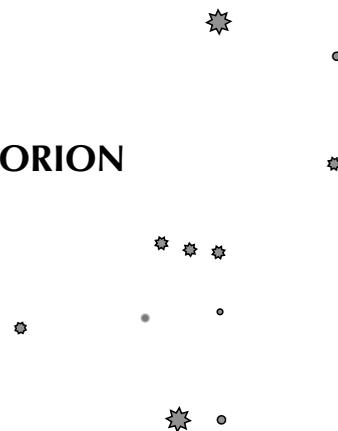
# Take your first steps exploring the heavens



Learn to judge distances and sizes on the map with those in the sky. The map is small, the sky is huge!

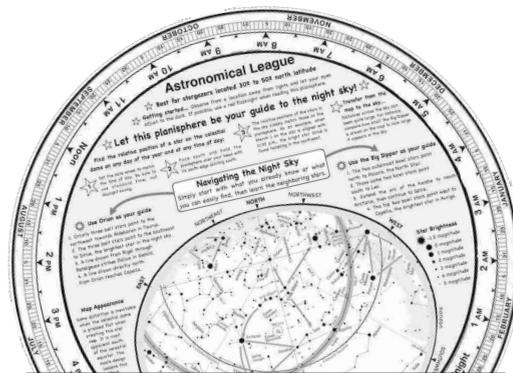
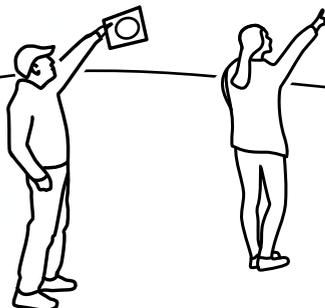


## ORION



Monthly sky maps and activities can be found at:  
[www.astroleague.org/navigating-the-night-sky-guides](http://www.astroleague.org/navigating-the-night-sky-guides)

Do you see fewer stars in the sky than are plotted on your map? This is likely due the negative effects of light pollution.



A **planisphere** is a rotatable dial that shows star positions in the sky at any time of the year.

## Nothing beats time spent under the stars

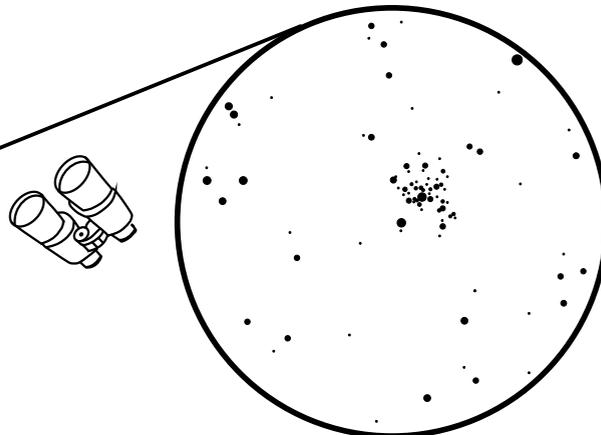
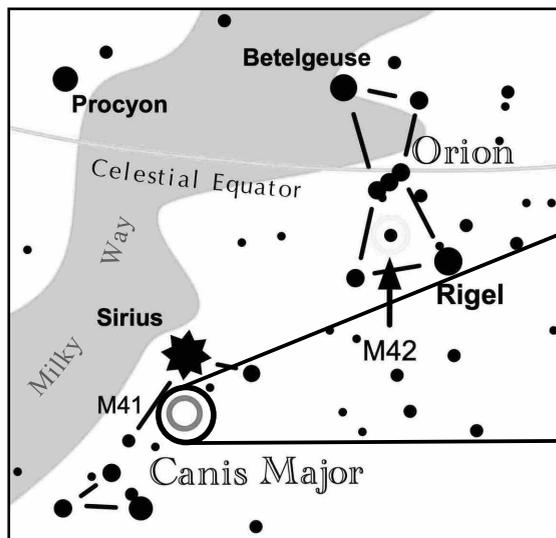
- ★ Use a red flashlight and a basic star map – such as the ones produced by the Astronomical League – or a planisphere. Situate yourself away from direct outdoor lights. A bright moon will make it more difficult to see stars.
- ★ Find North, South, West, and East in the sky and on the map. Rotate the map so that it matches the direction that you are facing. Match the overhead position on the map (called the zenith) with that same position in the sky.
- ★ Learn the constellations and bright stars by starting with a star pattern that you already know and can find – perhaps the Big Dipper or Orion.
- ★ Then, estimate the distances and directions to other nearby constellations and bright stars. You will quickly learn how the relative sizes and spacings of constellations and stars on your map compare with those in the sky.

Before you consider purchasing a telescope ...



## Binoculars *The little instrument that can!*

- ✧ Easy to use, easy to store, and ultra-portable.
- ✧ Image – right side up and not mirrored.
- ✧ Can see large sections of the sky at once.
- ✧ Can use them for daytime activities, too.
- ✧ A tripod or other mount helps steady the image.
- ✧ Be sure to sharply focus them.
- ✧ Relax on a comfortable lawn chair.



Binocular view of the star cluster M41

Binoculars reveal wide double stars, brighter star clusters, wispy nebulae, and even a few incredibly distant galaxies!

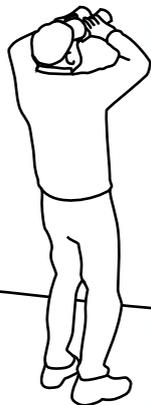
### Once you learn a few constellations and bright stars ...

- ✧ Look for celestial objects plotted on your basic star chart. These will be the brighter ones – bright enough to be spotted through binoculars.
- ✧ Simply estimate the object's distance and direction from two reference stars, then aim the binoculars to that point in the sky. This technique is called "Triangulation."
- ✧ 8x42, and 7x35 binoculars are fine for casual stargazing. 10x50 binoculars are even better!

**Binoculars are perfect for scanning the Milky Way – its bright regions, its dark bays, and its misty glows.**

### Binocular size designation:

- ✧ The first number given is the magnification.
- ✧ The second number is the diameter (in millimeters) of the front lens. The larger the lens is, the fainter the objects revealed – but the heavier the binoculars are.
- ✧ Example: 10x50 (pronounced "10 by 50"); 10 magnification, front lens diameter of 50 millimeters (2 inches).





# Are you ready for a telescope?

*Telescopes can split double stars, show twinkling star clusters, unveil wispy nebulae, reveal incredibly distant galaxies, and give tantalizing hints at the nature of our universe.*

## Before you purchase a telescope, ask yourself these questions...

- ✧ How well do you know the night sky? Finding objects is not easy without practice. A quality "go-to" computerized telescope is costly and its operation must be mastered.
- ✧ How hard is the scope to assemble? If it is too complicated, you won't use it.
- ✧ Where will you do most of your observing? A city resident will likely need to cart it to a dark site.
- ✧ If you really like astronomy, you'll outgrow too small a scope in six months.
- ✧ Will you eventually pursue astrophotography? You'll need a sturdy, motor driven mount that tracks accurately.

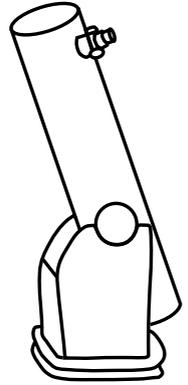
## Observing tips:

- ✧ Magnification – low power is used for most objects.
- ✧ Finder scope – a small one is nearly useless.
- ✧ The larger the telescope's diameter, the better views it gives, but the less portable it is.
- ✧ If the scope has poor optics or a wobbly mount, it will be frustrating to use.
- ✧ Never point the telescope at the sun without the proper filter installed ON FRONT of the scope.
- ✧ Don't expect what you see in the eyepiece to closely resemble what you see in photographs.

**Finding celestial wonders requires practice, patience, and perseverance.  
It is well worth the time and effort!**

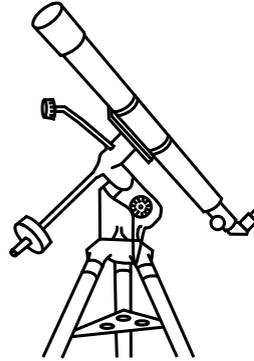
## Reflector

- ✧ Easy to use.
- ✧ Least expensive scope design.
- ✧ Great for star clusters, nebulae, and galaxies.
- ✧ Can be bulky.
- ✧ Generally, not suitable for astro-imaging.



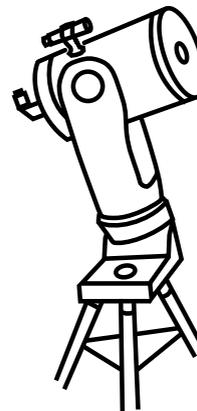
## Refractor

- ✧ Easy to use.
- ✧ Tend to be costly.
- ✧ Smaller aperture than Reflectors; showing fewer targets.
- ✧ Many can be configured for astro-imaging.
- ✧ Great for the moon and planets.



## Catadioptric

- ✧ Portable, but heavy.
- ✧ Tend to be costly.
- ✧ Good for astro-imaging.
- ✧ General purpose scope.



Learn more about telescopes, and the fascinating field of amateur astronomy by visiting your local amateur astronomy club!

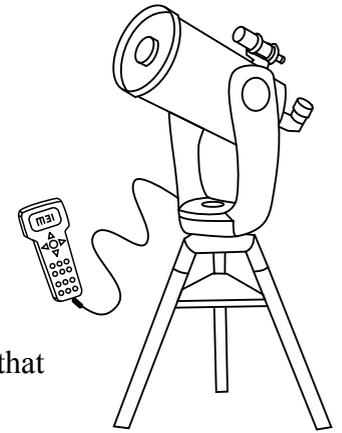


# How do you find the celestial wonders that you want to see?

## Finding celestial targets the modern way

Computerized "GoTo" style telescopes ... the quick and easy method:

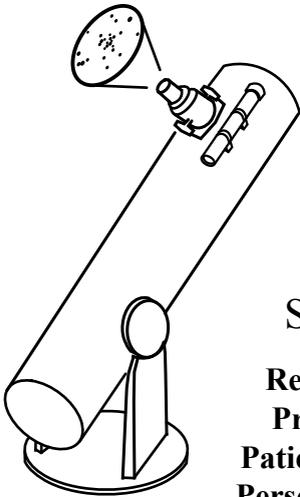
- ★ The telescope's computer operation must first be mastered.
- ★ Except for the newest generation of telescopes, you still need to have some knowledge of the brightest stars.
- ★ These instruments tend to be costly.
- ★ Once the battery power is depleted, the telescope must be used manually.
- ★ Data base typically contains over 1000 celestial objects. But that doesn't mean that all objects will give meaningful views.



## As when using Binoculars, try Triangulation

**Brighter objects are directly visible in binoculars and the finderscope**

On a star chart, locate the position of the object with respect to nearby recognizable objects, such as bright stars. Judge the relative distances and angles from the guide objects to the target and mentally project them onto the sky. Then, carefully aim the telescope to that spot.

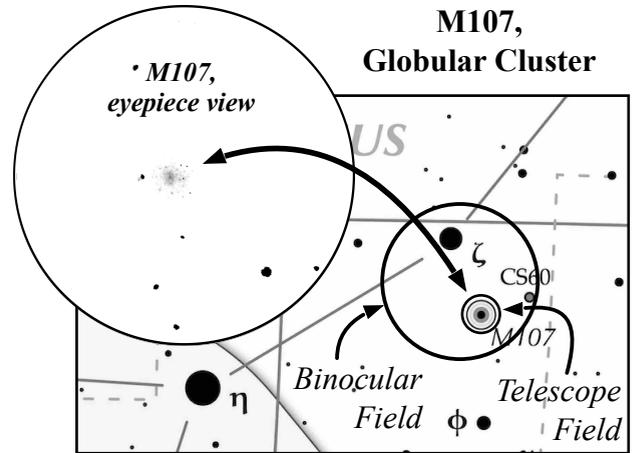


## Star Hopping is an Art

**Requires:  
Practice,  
Patience, and  
Perseverance!**

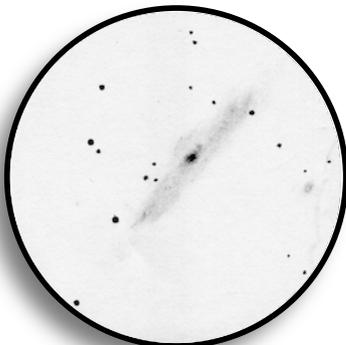
**It is well worth the  
time and effort.  
Your reward?  
A personal view  
of the Universe.**

- ★ Must have a **detailed** star map.
- ★ Begin at a reference star that you can find.
- ★ Match the stars on the map with those in the eyepiece.
- ★ Hop among the stars in each subsequent field of view until the correct field is reached.

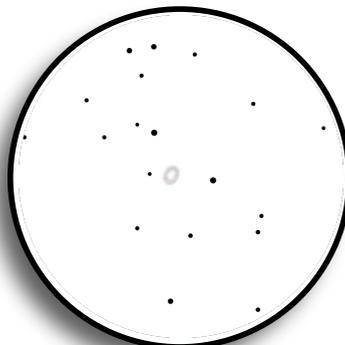


**What will a telescope reveal?** The wonders you see will be with your own eyes. You will see the universe as it truly is, not computer-enhanced, electronically obtained images.

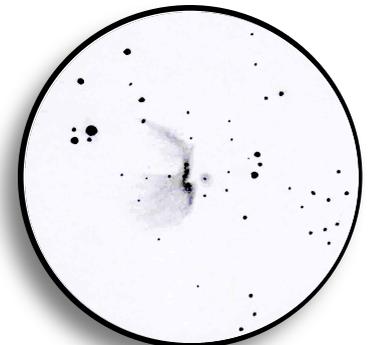
Andromeda Galaxy



Ring Nebula



Orion Nebula

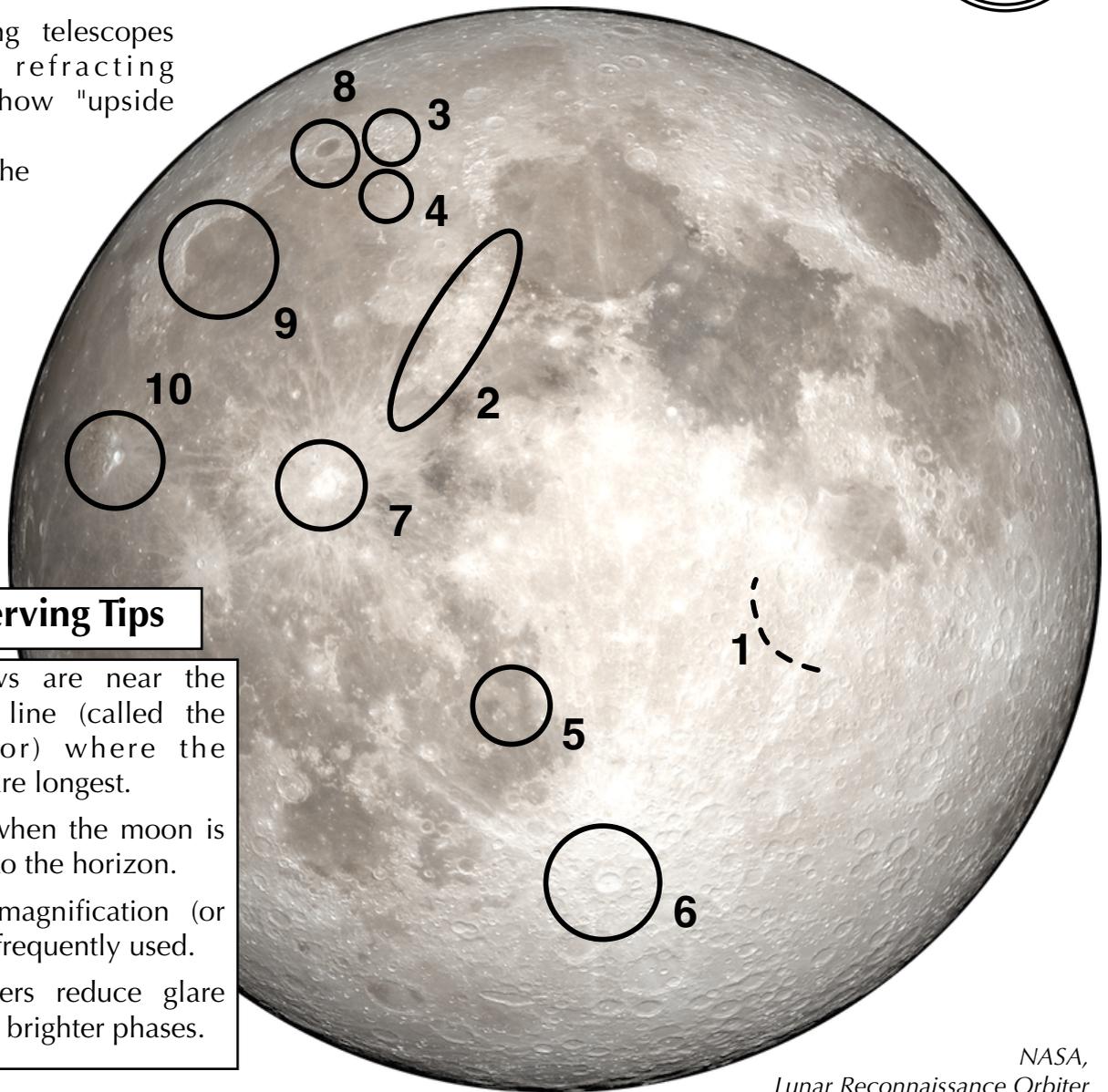


# Discover the Moon – A Great Place to Start!

*Being bright and large, the moon is a great target showing much detail. Telescopes of all sizes reveal craters, mountains, faults, and rays.*



Most reflecting telescopes (and some refracting telescopes) show "upside down" images. Simply rotate the chart 180°.



## Observing Tips

- Best views are near the night/day line (called the terminator) where the shadows are longest.
- Observe when the moon is not close to the horizon.
- Medium magnification (or higher) is frequently used.
- Moon filters reduce glare during the brighter phases.

NASA,  
Lunar Reconnaissance Orbiter

Many lunar features are suitable for examination through a small telescope. Here are a few:

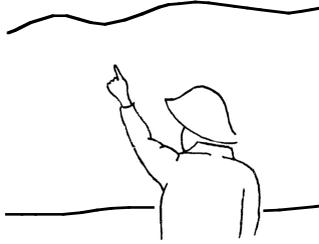
Number	Name	Type	Best seen
1	Altai Scarp	Cliffs	5 days
2	Apennine Mountains	Mtn range	1st Quarter
3	Alpine Valley	Fault	1st Quarter
4	Mons Piton	Massif	8 days
5	Straight Wall	Fault	8 days
6	Tycho	Complex crater	9 days
7	Copernicus	Complex crater	10 days
8	Plato	Flooded crater	9 days
9	Sinus Iridum	Flooded plain	11 days
10	Aristarchus region	Crater and rille	12 days



# Observing the Bright Planets



## Is that a planet or a star?

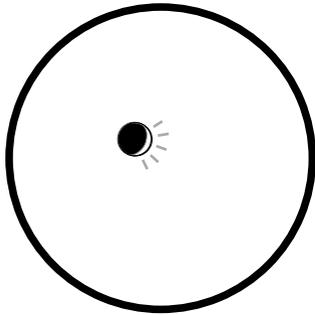


- A planet shines with a steady light. Stars tend to "twinkle."
- A planet is always located near the ecliptic, which is the sun's annual path across the heavens.
- A planet slowly shifts its position nightly with respect to the background stars.

## Planets appear small – even at high magnification!

### Mercury

When it doesn't appear too near the sun, it lies either low above the western horizon just after sunset, or low above the eastern horizon just before sunrise. Oftentimes, a challenge to spot.

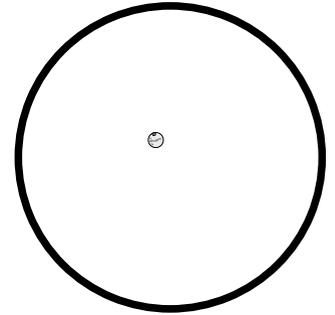


### Venus

- Either above the western horizon in the evening, or above the eastern horizon in the early morning depending on where it lies in its orbit with respect to Earth.
- When it is near Earth, it presents a brilliant crescent phase.
- Dazzling bright object.

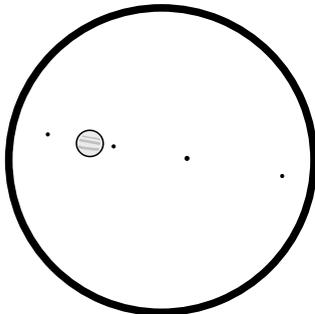
### Mars

- When close to Earth, Mars is a bright red-orange object in the east after sunset, high in the south near midnight, and in the west before sunrise.
- A small telescope barely reveals its white southern polar ice cap, and strange, indistinct gray surface markings.



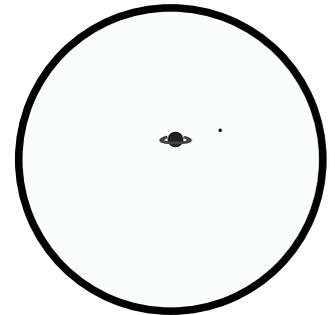
### Jupiter

- When it is not near the sun in the sky, Jupiter is seen as a very bright pale white object.
- Notice that it is not round, but slightly oval.
- Cloud bands can be discerned at moderate magnification.
- Jupiter's four large moons are easily visible.



### Saturn

- When it does not appear close to the sun, Saturn is seen as a bright creamy starlike object.
- Its famous ring system, though appearing quite small, can be seen in a small telescope using moderate magnification.
- Saturn's big moon, Titan, is frequently spotted off one side of the planet.



**Astronomical League**  
[www.astroleague.org](http://www.astroleague.org)

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### Uranus and Neptune

Uranus is only visible to the unaided eye under excellent conditions, while Neptune requires at least binoculars, again under excellent conditions, to spot. In a telescope, they present very small disks and show little detail.



# The ABCs of Stargazing

How would you describe to a friend the size of a sky object, its distance from a particular star, its brightness, or its location on the celestial dome?

## The ABCs of stargazing allow you to do just that!

### "A" is for angular size and distance

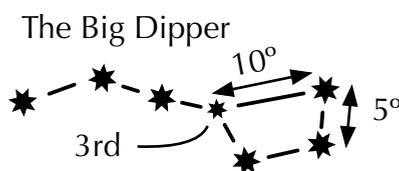
Remember these handy references when discussing size or distance in the sky:

- ★ The moon spans  $1/2^\circ$ . It would take 360 "full moons" to reach from horizon to horizon!
- ★ The apparent width of the tip of your index finger on your extended arm is less than  $2^\circ$ .
- ★ The width of the bowl of the Big Dipper is  $5^\circ$  and its length is  $10^\circ$ .
- ★ Your clenched fist on your fully extended arm is  $10^\circ$  from side to side.



Width of the Full Moon  
 $1/2^\circ$

Moon's apparent size relative to your clenched fist

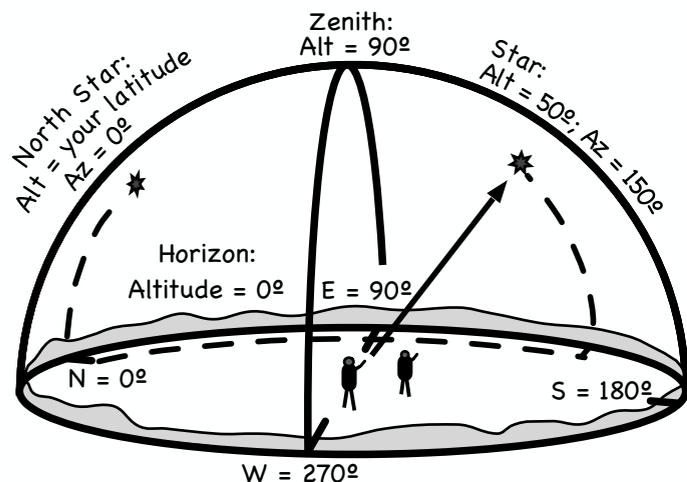


Six of the seven stars of the Big Dipper are of the 2nd magnitude.

### "B" is for brightness

Skywatchers use the "magnitude" scale to describe an object's brightness. Don't be confused by the reverse nature of the scale: The brighter the object, the smaller is its magnitude. Objects with negative magnitudes are very bright, indeed!

Mag:	Object
-26	Sun (never look at the sun!)
-12	Full moon
-4	Venus
-2.5	Jupiter at its brightest
-1.5	Sirius, the brightest star in the night
0	Arcturus, Vega, Capella, Saturn
+2	Six stars of the Big Dipper, North Star
+6	The faintest star seen by unaided eyes



### "C" is for coordinates

Stargazers often use the simple, but descriptive altitude-azimuth (alt-az) system to locate objects in the sky.

Altitude coordinate:	Azimuth coordinate:
Horizon is $0^\circ$	North is $0^\circ$
Zenith is $90^\circ$	East is $90^\circ$
	South is $180^\circ$
	West is $270^\circ$