

A starry night sky with a colorful nebula on the right side. The nebula has shades of red, purple, and blue. The stars are scattered across the dark background.

Astronomy Essentials

*Essential information that every
beginning amateur astronomer
should know...*

Antelope Valley Astronomy Club
November, 2002

Antelope Valley Astronomy Club

Meetings:

- 2nd Friday of Every Month (Except December)
- SAGE Planetarium
North-East Corner of 20th East and Avenue R
Meetings start at 7:00, last until 9:00
Featured speaker each month at 7:45 pm
- FREE to attend meetings!

Monthly Public Star Parties: ** Free ** Dress Warm!

Visit <http://www.avac.av.org> for map and details!





Astronomy Essentials

- These rules are accurate for all practical purposes. They become inaccurate only over hundreds to thousands of years.

*Thank you to Ben Balmages, from the Starry Knights
Foothill High School Astronomy Club*

1. The stars never move in relation to each other. They are always the same distance apart (in degrees across the sky) and in the same patterns.

Reality (Over time)

2. The sun, moon, planets (and their moons), comets and asteroids do move - they change their positions among the stars



Comet Hyakutake 01/30/96



Predictable

3. Stars always rise and set in the same positions on the horizons (from the same viewing spot).
4. All stars rise in the east and set in the west.

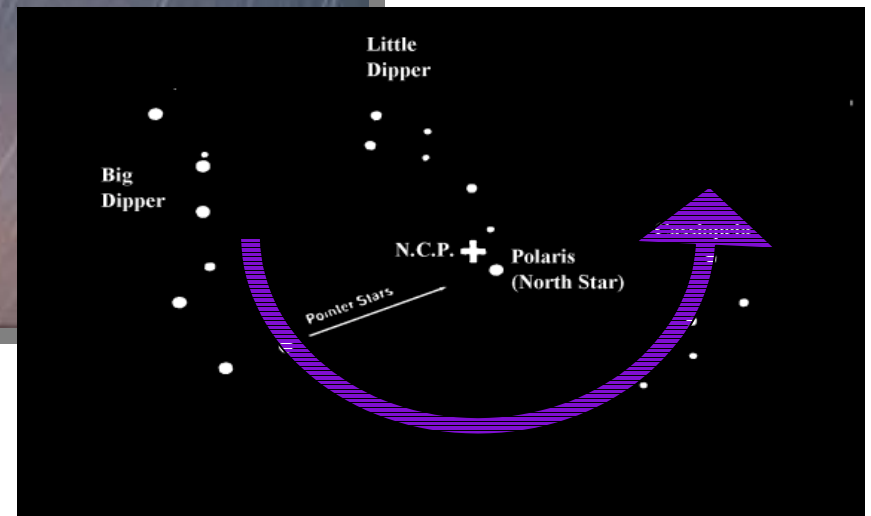
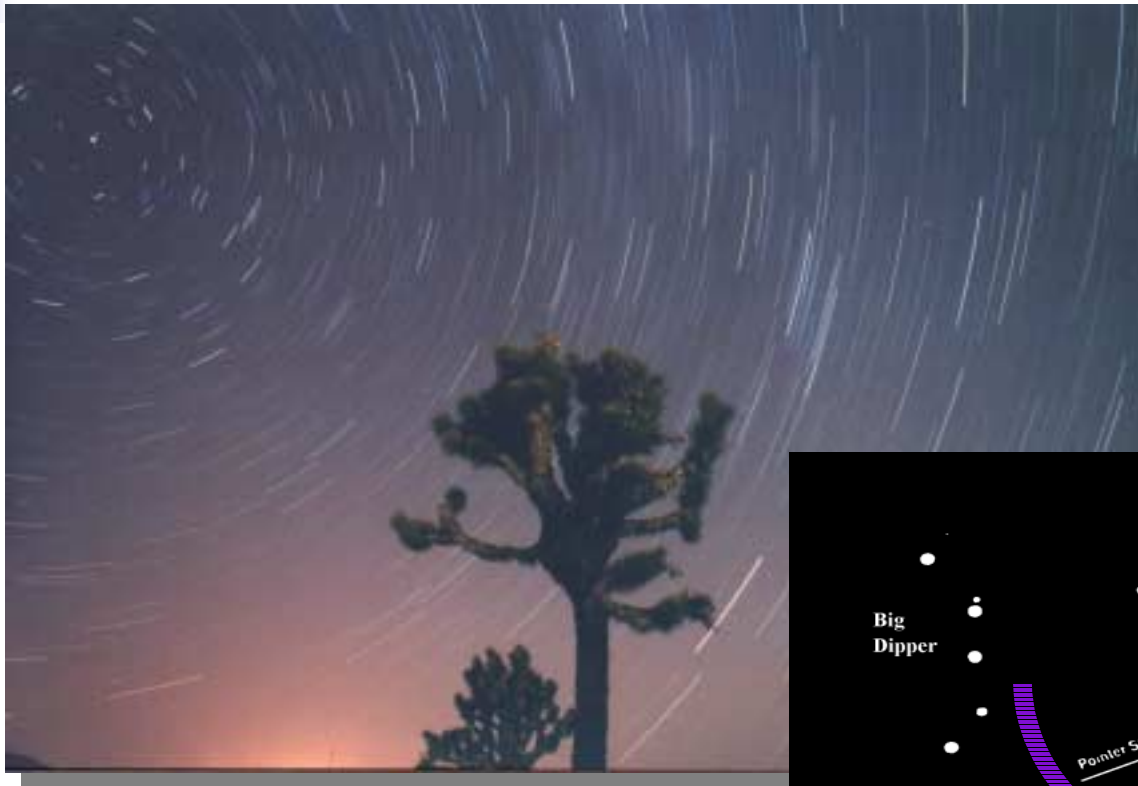
Circumpolar Stars

5. Some stars are visible every night of the year, all night long. This is due to their proximity to Polaris, the North Star. These are called "Circumpolar Stars." For example, the stars of the Little Dipper.

- Circumpolar stars rotate counter-clockwise around the North Star. Polaris is the only star that is always in the same spot.



Star Trails Around Polaris





Rise and Set Times

6. All stars rise (and set) approximately four minutes earlier each day. In a month the stars rise and set two hours earlier. Over the course of a year this amounts to 24 hours.

$$4 \text{ min/day earlier} \times 30 \text{ days/month} = 120 \text{ min} = 2 \text{ hr/month}$$
$$2 \text{ hr/month} \times 12 \text{ months/year} = 24 \text{ hours earlier/year}$$



Predictable

7. All stars are in the same positions at the same date and time each year.

Example

On November 15, 2002 at 10:30 p.m. the Little Dipper will be in the same position as on November 15, 2005 at 10:30 p.m.



Effect of Earth's Rotation

8. Each hour the stars move 15 degrees across the sky. During each 24 hours the stars all appear to make one revolution around the earth (as the earth spins on its axis).

15 degrees/hour X 24 hours = 360 degrees in 24 hours
[There are 360 degrees in a circle]

- If you stay up all night, you can see just about all of the stars that can be seen from your latitude. The only ones you would not see are those close in the sky where to the sun is.



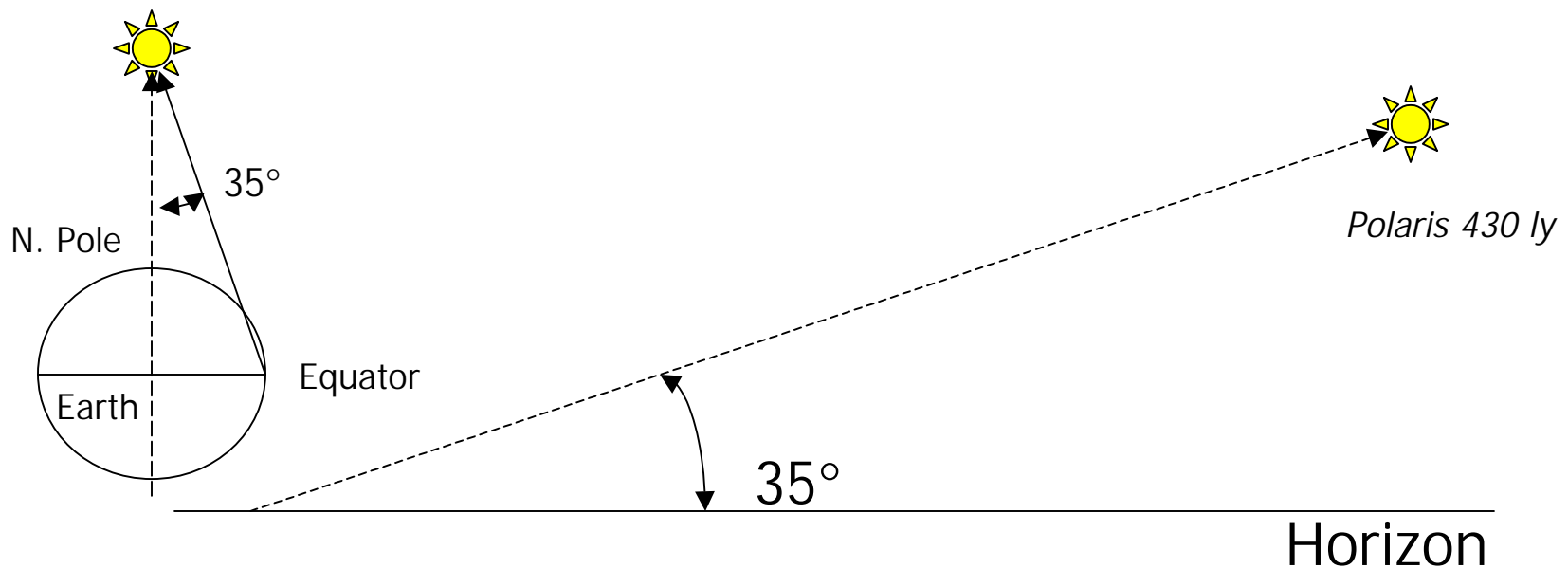
Stars and Latitude

9. The stars are there during the daytime but we cannot see them because of the light of the Sun.
10. The stars you can see change with your latitude. (Longitude is irrelevant.) People at the same latitude see the same stars, no matter what country they are in. People in Los Angeles see the same stars as people in Tokyo and Beirut.

The North Star (The Pole Star)

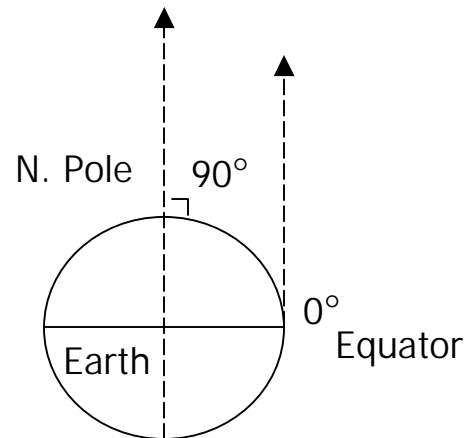
11. Polaris is almost directly above the Earth's North Pole. The height Polaris is above your horizon (in degrees) is equal to your latitude.

- In Palmdale, Polaris is about 35° above the horizon.



The Pole Star

- At the North Pole, Polaris is 90° above the horizon (straight overhead).
- At the equator Polaris is 0° above the horizon. At the North Pole, all visible stars are circumpolar, none of them rise or set but they all travel in lines parallel to the horizon.





Constellations

12. There are 88 official constellations. We can see about 60 of them from our latitude over the course of a year, or a full night of stargazing.



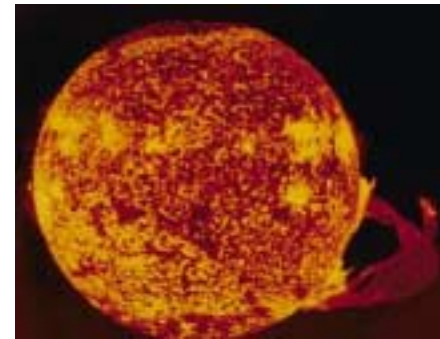
*The
constellation
of Orion.
Visible in the
winter sky.
1400 ly*



Stars & Meteorites

13. The sun is a star. It is bright, because it is much, much closer to us. Unless you are properly equipped with special filters and trained in their use, **do not look at the sun with a telescope or binoculars!**

View of the Sun and a Solar Prominence through a Special Hydrogen-Alpha Filter



- 'Shooting stars' are not stars. They are small grains of dirt entering the earth's atmosphere at high speed and burning up due to friction.



Movement of the Sun

14. As the Earth rotates on its axis, the Sun appears to travel from east to west around the Earth.
 - On each day, the Sun is "in" a particular constellation, which means that if you could see the stars during daylight, the Sun would appear to be part of a constellation. As the year progresses and the Earth revolves around the Sun, the Sun appears to be "in" different constellations.



Ecliptic Constellations

15. The path the Sun appears to travel through the constellations is called the **Ecliptic** and the constellations it passes through are known as the constellations of the Ecliptic or the Zodiac.
 - Traditionally, there were thought to be 12 constellations of the Zodiac but, in reality, the Sun passes through 13 constellations.



Ecliptic Constellations

- These constellations are Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpius, Ophiuchus, Sagittarius, Capricornus, Aquarius and Pisces.
- The Sun is always in one of these constellations and moves completely through them slowly over the course of a year.

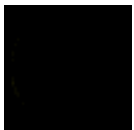


Moon Essentials

16. The Moon rises an average of about 50 minutes later each day.



- The Full Moon always rises at about sunset and sets at about sunrise.



- The New Moon always rises and sets approximately with the sun, which is why we cannot see it.



- The first quarter Moon, is straight overhead at sunset and sets at midnight.



- The third quarter Moon rises at about midnight and is straight overhead at sunrise.

Moon Essentials

- A waxing Moon is in the shape of a "D", that is, it bulges to the right. A waning Moon is shaped like a "C", it bulges to the left.

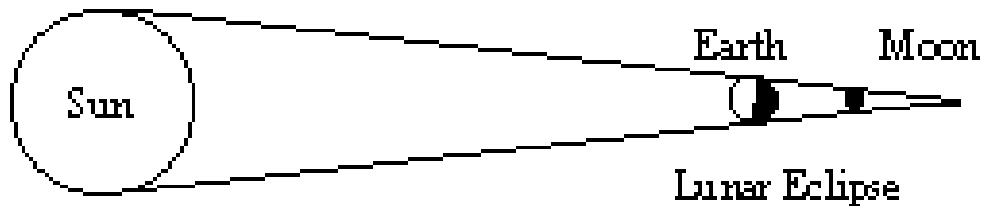
Waxing Crescent



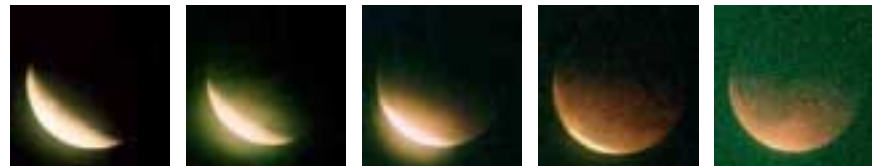
Waning Crescent

Lunar Eclipse (Common)

- Lunar Eclipses happen when the Moon passes into the Earth's shadow. (Once or twice a year)
- Anyone on the night side of Earth can see the Lunar Eclipse.

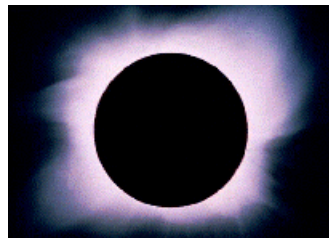
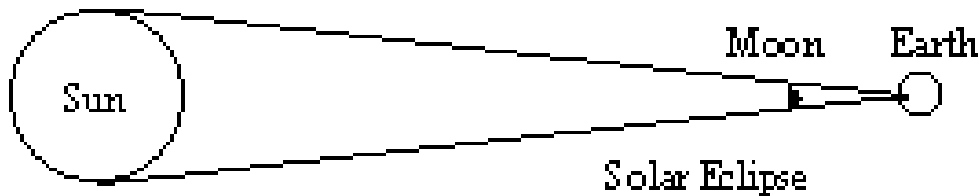


Lunar Eclipse Sequence



Solar Eclipse (Rare)

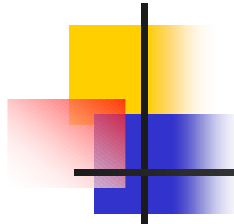
- A Solar eclipse happens when the Moon lines up exactly between the Earth and Sun. For any given spot on the earth, a total Solar eclipse happens about once in 300 years.



The Moon in Front of the Sun, a Total Solar Eclipse



View from the Mir Space Station of the Moon's shadow on the Earth



Light

17. Nearly everything scientists know about the universe comes from studying the light that reaches their telescopes.
- Light travels at a speed that can be measured. 186,000 miles in a second.
 - The light you see from Sun left the surface of the Sun about 8 1/2 minutes earlier, and light takes 1.3 seconds to travel from the Moon to the Earth.

You Can See 2,300,000 Light Years!

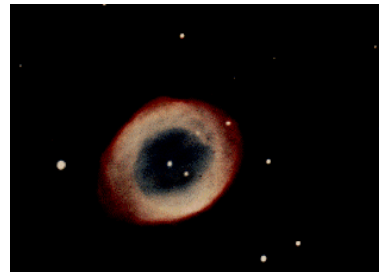
- The light from the Andromeda Galaxy that you can see with your naked eye is nearly 2.3 million years old!



Objects For Amateur Telescopes



Veil Nebula in Cygnus 1300 ly



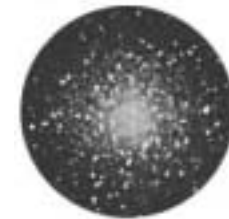
*Ring Nebula (M57)
in Lyra 1500 ly*



*Dumbbell Nebula (M27) in
Vulpecula 1250 ly*



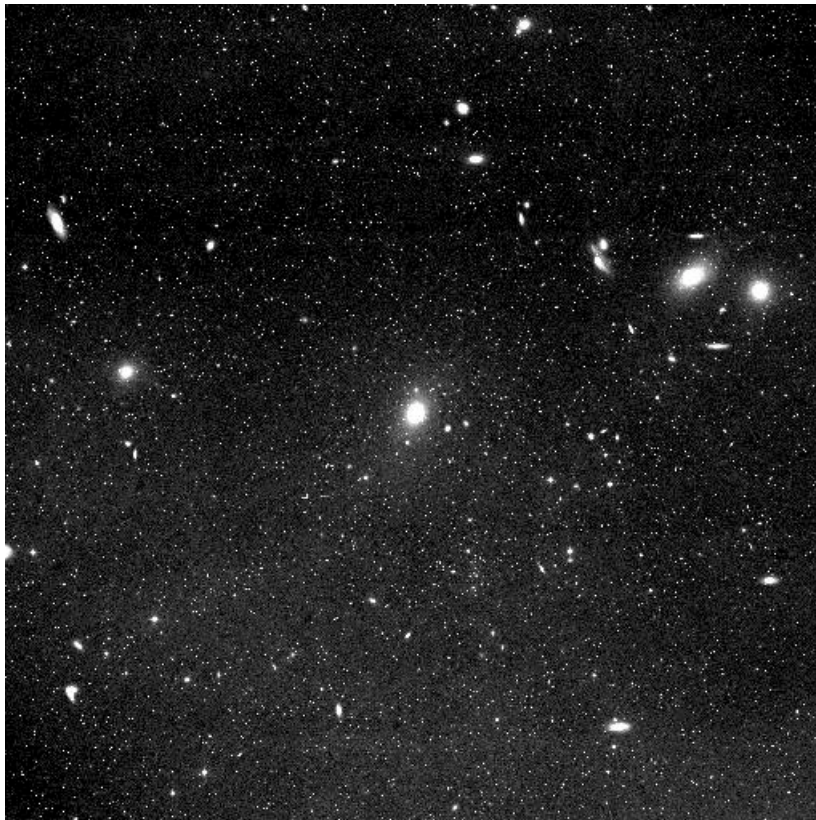
Whirlpool Galaxy (M51) 37M ly



*Hercules
Cluster (M13)
35,000 ly*



"Deep Sky" Galaxies



*Virgo
Galaxy
Cluster
60M ly*



*Sunflower
Galaxy
(M63)
37M ly*