



Celestial Objects:

A Menu For Day And Night Sky Observing



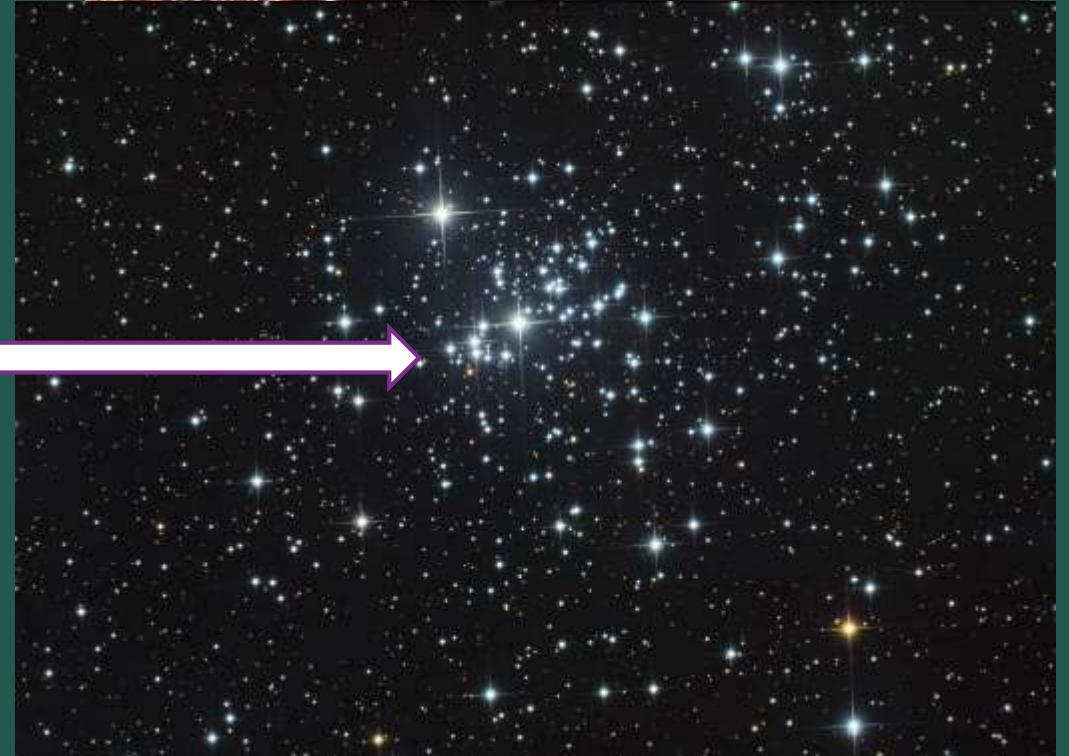
Culpeper Astronomy Club
27 January 2020

Overview

- Introductions
- Special Topics
- Celestial Observing
- Some Constellations
- Observing Session

Observation Sessions

- December 11/12 - Geminid Meteor Shower:
 - Observed about 10 meteors, some sporadic
- January 5
 - Open star clusters in Cassiopeia, Perseus and Auriga
 - Bright (76% illuminated) Moon

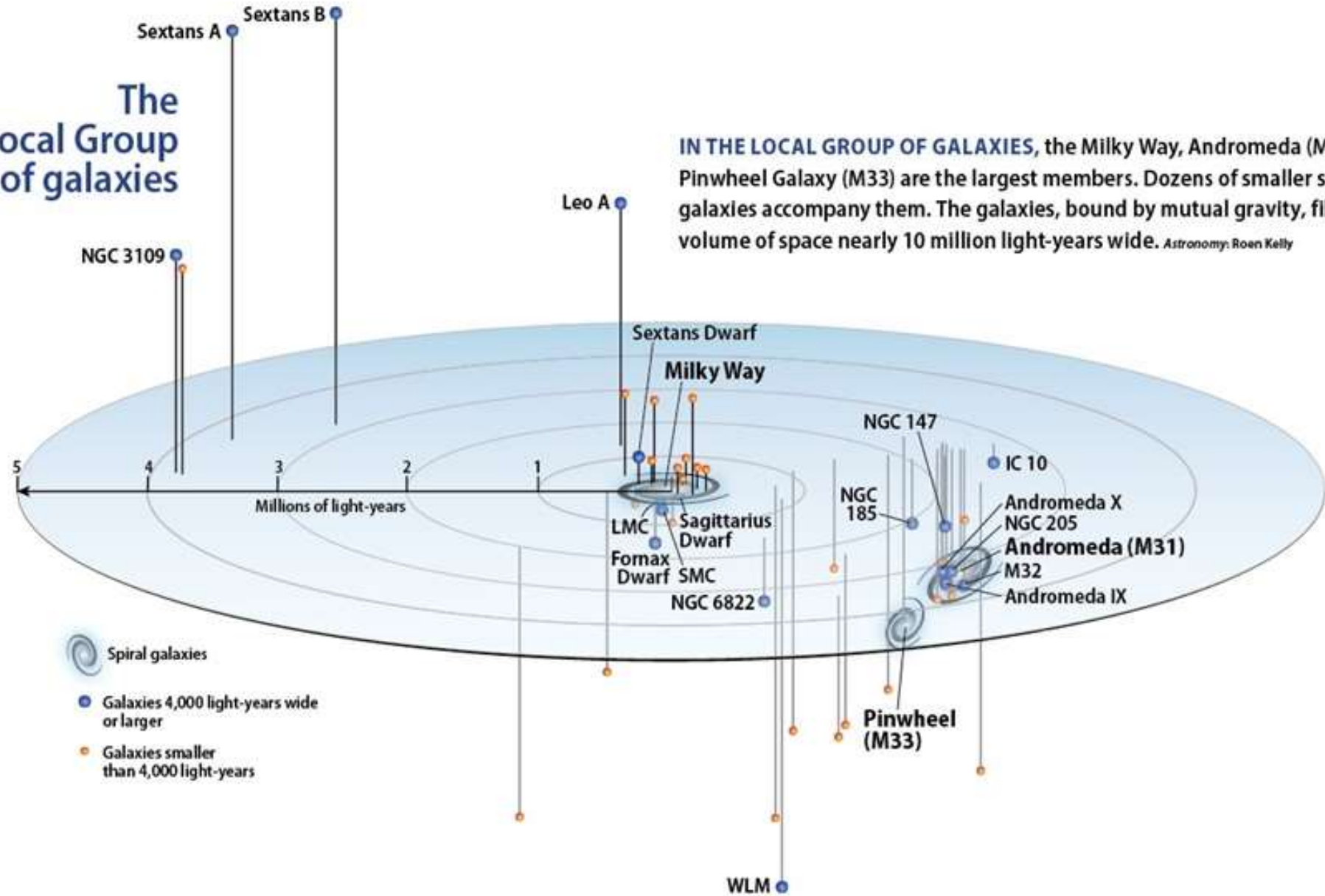


Special Topic #1: The Great Collision

- Our galaxy, the Milky Way, and its nearest large neighbor, the Andromeda Galaxy (M31), are on a collision course
- Billions of years from now, the merger will create a new arrangement of stars dubbed Milkomeda (“milk-AHM-mee-da”)
- Currently, the Milky Way’s thin disk of stars appears as a nebulous strip arching across the Summer sky
- As Andromeda grazes the Milky Way, a second lane of stars will join the one that presently graces the night sky
- After the final merger, the stars will no longer be confined to two narrow lanes, but instead scatter across the entire sky

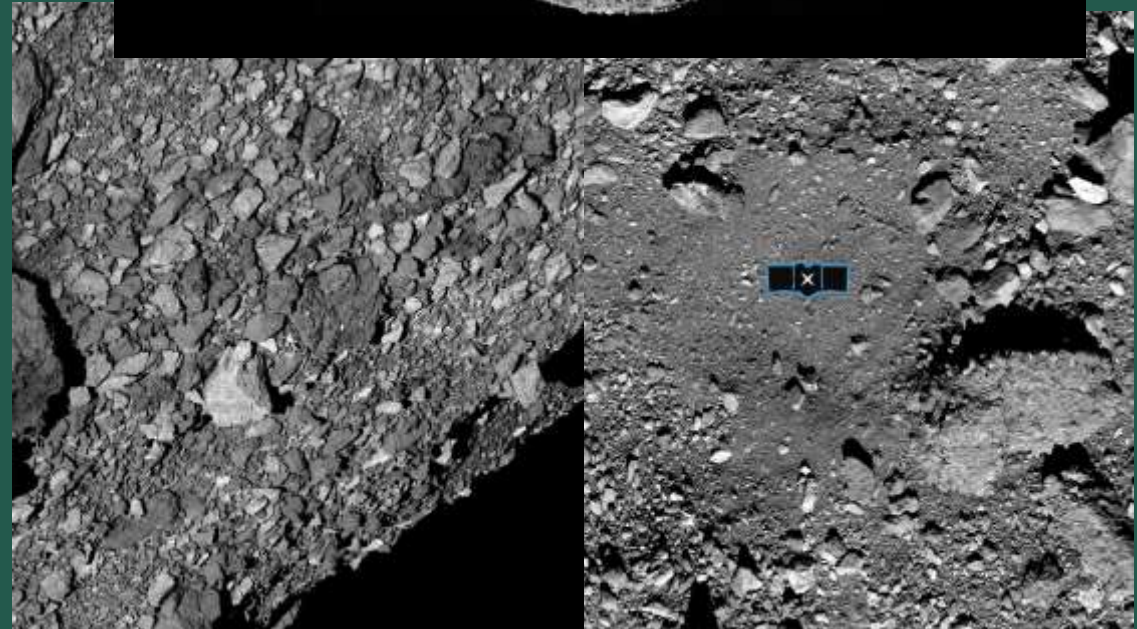


The Local Group of galaxies



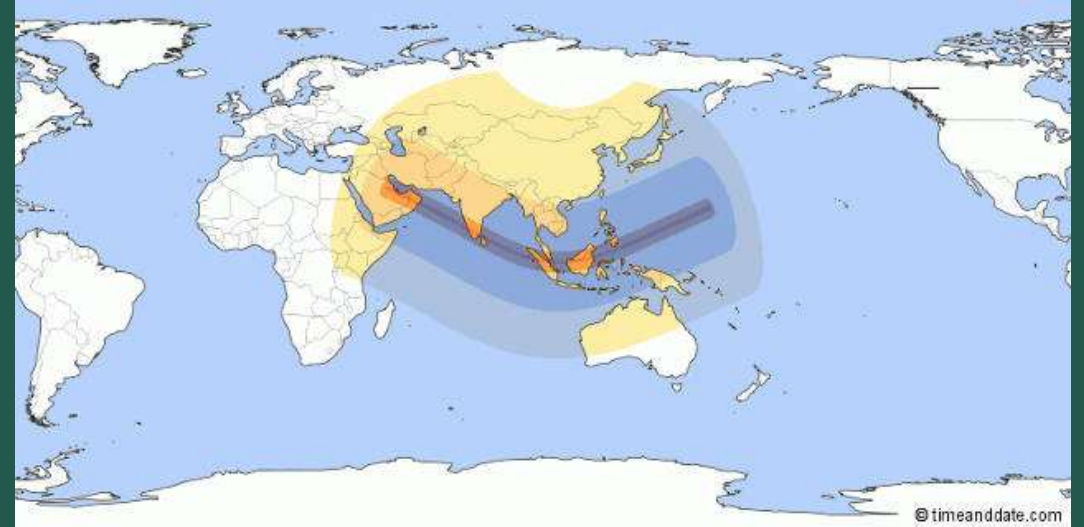
Special Topic #2: OSIRIS-Rex Touch Down

- OSIRIS-Rex launched Sept 8, 2016; used thrusters to rendezvous with asteroid Bennu on Dec 2018
- One of the oldest rocks formed during the earliest days of the solar system, some 4B years ago
- Spent year mapping Bennu's terrain (at distance of 2,230 feet); will touch down to collect
- Team will run "dress rehearsals" preparing for the real sample collection July 2020
- In March 2021 will begin return journey to Earth, arriving in September 2023
- The sample return capsule will separate and enter the Earth's atmosphere



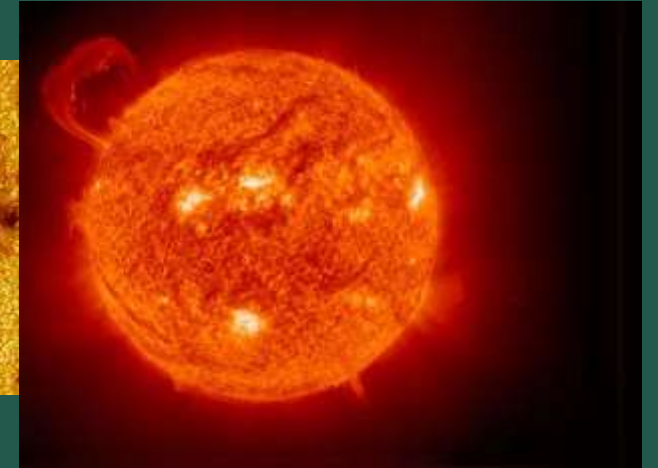
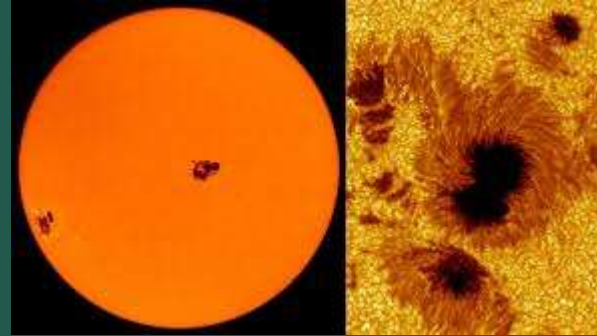
Special Topic #3: Annular Eclipse – Dec 26

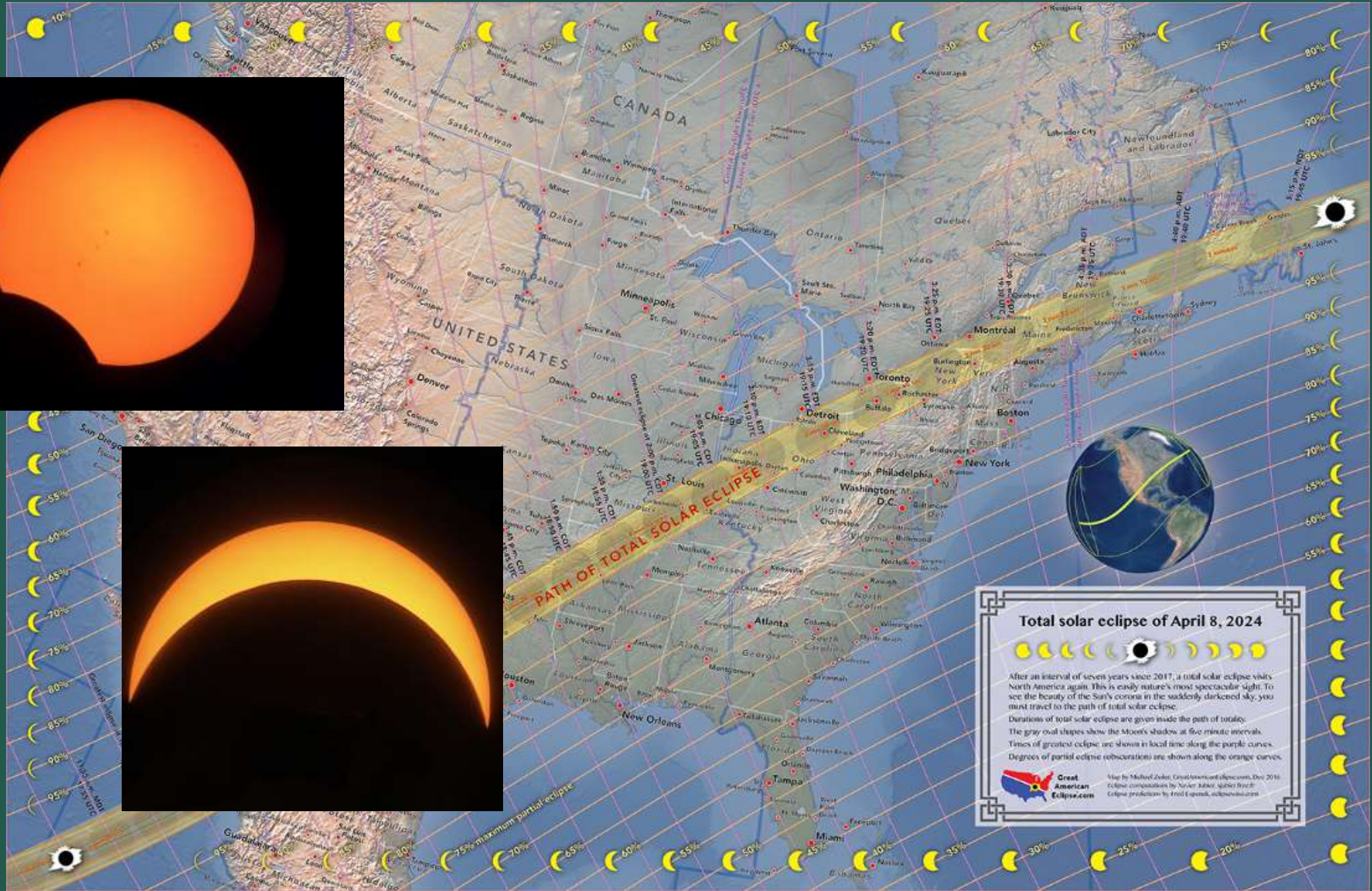
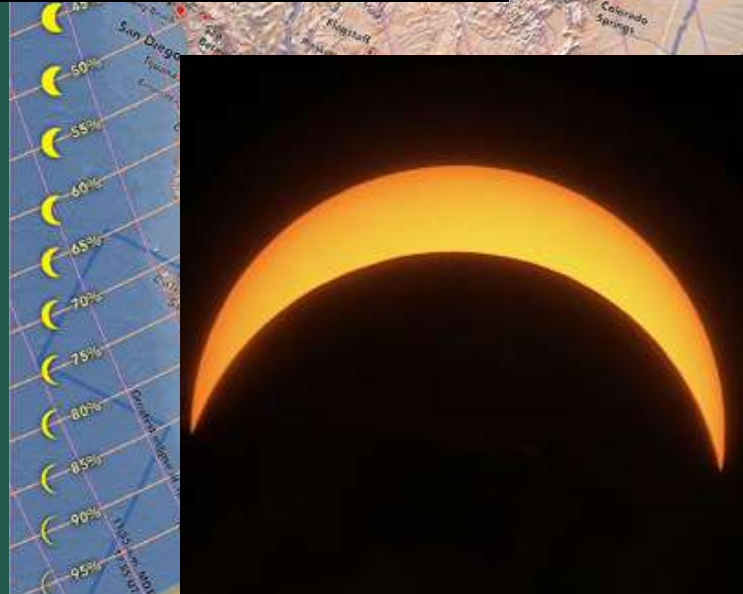
- Annular solar eclipse: Moon crosses the Sun completely centrally
 - Moon's orbit is in a position whereby our natural satellite is farthest away from Earth
- This means that the Moon's apparent size in the sky is not large enough to completely cover the Sun as witnessed during total solar eclipses.
- Creates a “ring of fire” effect
- Was visible in Eastern Hemisphere



The Sun

- The nearest star - 93M miles distant
 - 864,938 miles in diameter
 - 24-35 day rotation period
- Can view sunspots, prominences, flares
- Observe safely ONLY with proper equipment:
 - Eclipse glasses, Full aperture filters
 - Solar projection screens
 - PST telescopes (H-Alpha Filters)
- Next total solar eclipse visible in US occurs April 2024





Total solar eclipse of April 8, 2024

After an interval of seven years since 2017, a total solar eclipse visits North America again. This is easily nature's most spectacular sight. To see the beauty of the Sun's corona in the suddenly darkened sky, you must travel to the path of total solar eclipse.

Durations of total solar eclipse are given inside the path of totality. The gray oval shapes show the Moon's shadow at five minute intervals. Times of greatest eclipse are shown in local time along the purple curves. Degrees of partial eclipse (obscuration) are shown along the orange curves.



Great American Eclipse.com

Map by Michael Zele, GreatAmericanEclipse.com, Dec 2016
Eclipse computations by Xavier Jubier, Jubier.free.fr
Eclipse predictions by Fred Espenak, espenak.com

The Moon

- Rate of rotation equivalent to rate of revolution around the earth
 - Same side faces the earth
- Lots of interesting surface features
 - Craters, mare, mountains, valley's
 - Different phases provide opportunity to observe features under varying lighting conditions
 - Terminator prime area for observation
- More frequent lunar eclipse's provide for interesting events – May 26, 2021



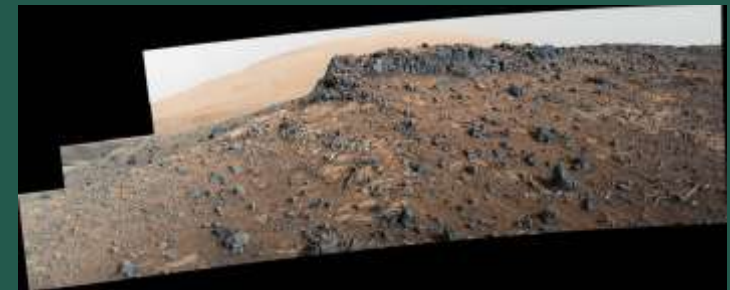
Mercury and Venus

- Two innermost planets from the Sun
- Mercury very difficult to observe because of close proximity to sun
 - Close to sunset or sunrise
 - Like the moon and Venus, Mercury also displays phases
 - Very heavily cratered surface
 - Next transit: Nov 11, 2032
- Venus: brightest “Evening/Morning Star”
 - Covered in highly reflective clouds
 - Presents distinct phases
 - Best viewing during “half” or “crescent” phase
 - Next transit: Dec 2117



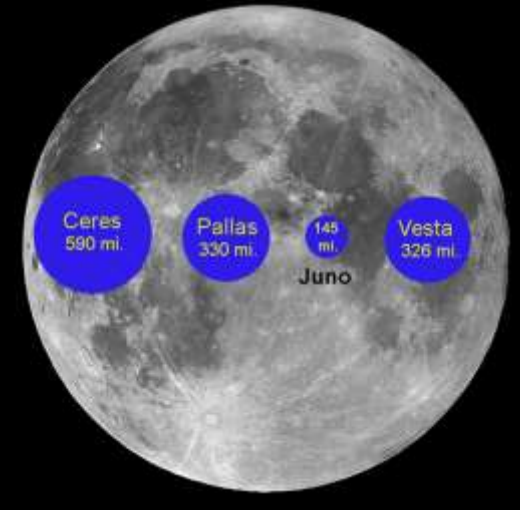
Mars

- Best observed during opposition
 - October 13, 2020
- Two moons too small for small telescopes
 - Deimos and Phobos
- Red Color: Result of iron oxides in the layer of fine dust that covers the planet
- Polar Caps: Like Earth, Mars has white polar caps; made of frozen water and carbon dioxide; change with the Martian seasons
- Dark Regions: These dark surface markings are crater fields, and they do change their appearance slightly over time



Asteroids

- Remnants left over from the early formation of our solar system about 4.6 billion years ago
- Most known found between the orbits of Mars and Jupiter
- Collisions within this belt create fragments that are a source of meteoroids
- Three largest are observable
 - Ceres, Pallas and Vesta
- Several hundred observable with 3 inch telescope
 - Identified on Stellarium software



Jupiter

- From any sized telescope, a view of Jupiter and its four main moons are possible
 - The Galilean moons are the four largest moons of Jupiter—Io, Europa, Ganymede, and Callisto
 - Next opposition July 14, 2020
- When viewed through a large telescope, is very colorful—it is a disk covered with bands of blue, brown, pink, red, orange, and yellow
- Most distinguishing feature is “the Great Red Spot,” an intense windstorm larger than Earth, has continued for centuries



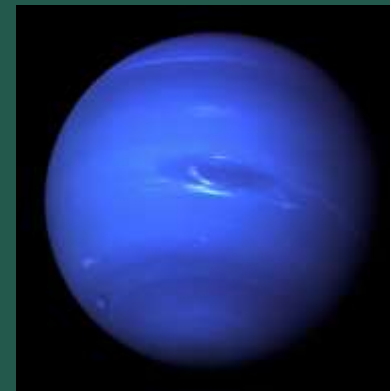
Saturn

- The rings of Saturn are visible in even the smallest telescope at 25X
- A good 3-inch scope at 50x can show them as a separate structure detached on all sides from the ball of the planet
- Dark belts/bright zones can often be made out on the ball of the planet; much vaguer than the belts and zones of Jupiter
- And, of course, there are Saturn's many moons; 62 at last count;
 - a 2-inch scope will show Titan;
 - a half dozen are sometimes within reach of a 10-inch.
- Next opposition July 20, 2020



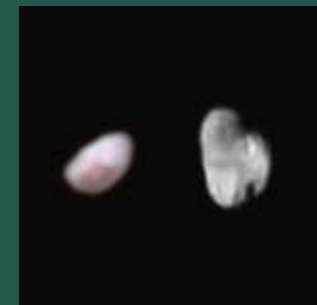
Uranus and Neptune

- Uranus:
 - At 100X or higher appears as a tiny disk rather than a pinpoint of light like a star
 - Can recognize Uranus just by its hue, which most people find faintly blue or green
- Neptune:
 - Neptune varies from magnitude 7.8 to 8.0, about two magnitudes fainter than Uranus
 - Neptune's disk is plainly visible at 200X through a 6-inch telescope on a night of steady seeing
 - Look for a hue quite similar to Uranus's, though somewhat bluer



Pluto and the Kuiper Belt

- The region of the solar system beyond the orbit of Neptune, believed to contain many comets, asteroids, and other small bodies made largely of ice
- New Horizons space mission has provided totally new perspective on this binary non-planetary system
 - Pluto and Charon
 - Four other moons
- Requires large aperture amateur scope to view as 14th mag object
- Have viewed Pluto at Morning Calm Observatory with the 30" Obsession
 - Appears as “star-like” object



Comets

- Visit our solar system periodically
- Most famous is Halley's Comet visiting every 76 years
 - Last visit was in 1986; next return mid-2061
- Best comet of 2019 was Comet 46p/Wirtanen
- First viewed on 7 Dec, 2018
 - Bino's, 4 inch, 30 inch



Meteor Showers

- During 2018, CAC had observing sessions for Perseid's, Orionid's, and Geminid's

Principal nighttime meteor showers					
shower	average date of maximum	normal duration (days)	visual strength (Northern Hemisphere)	entry velocity (km/sec)	associated comet
Quadrantid	January 3	1	medium	41	not known
Lyrid	April 22	1	irregular	48	Thatcher
Eta Aquarid	May 3	5	weak	66	Halley
Southern Delta Aquarid	July 29	8	medium	41	not known
Capricornid	July 30	3	medium	23	not known
Perseid	August 12	5	strong	59	Swift-Tuttle
Andromedid	October 3	11	weak	21	Biela
Draconid	October 9	1	irregular	20	Giacobini-Zinner
Orionid	October 21	2	medium	66	Halley
Taurid	November 8	30	weak	28	Encke
Leonid	November 17	less than 1	irregular	71	Tempel-Tuttle
Geminid	December 14	4	strong	34	(3200) Phaethon*

*This body was classified as an asteroid on discovery, but it is now suspected to be a burnt-out comet.
Source: Data derived primarily from A.F. Cook in NASA SP - 319 (1973).

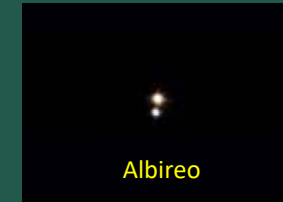


Stars

- Binary/Multiple Stars
 - Numerous targets available
 - Can be Physical or visual
 - Provide great contrasting colored pairs
 - Can be challenging to split depending on scope size and atmospheric conditions
- Carbon Stars
 - Most are Red Giants
 - Red complexion comes from carbon in their atmosphere
- Variable Stars
 - Observed over time



Double Stars



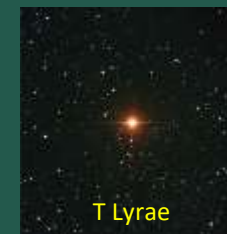
Albireo



Almach



Iota Cas



T Lyrae



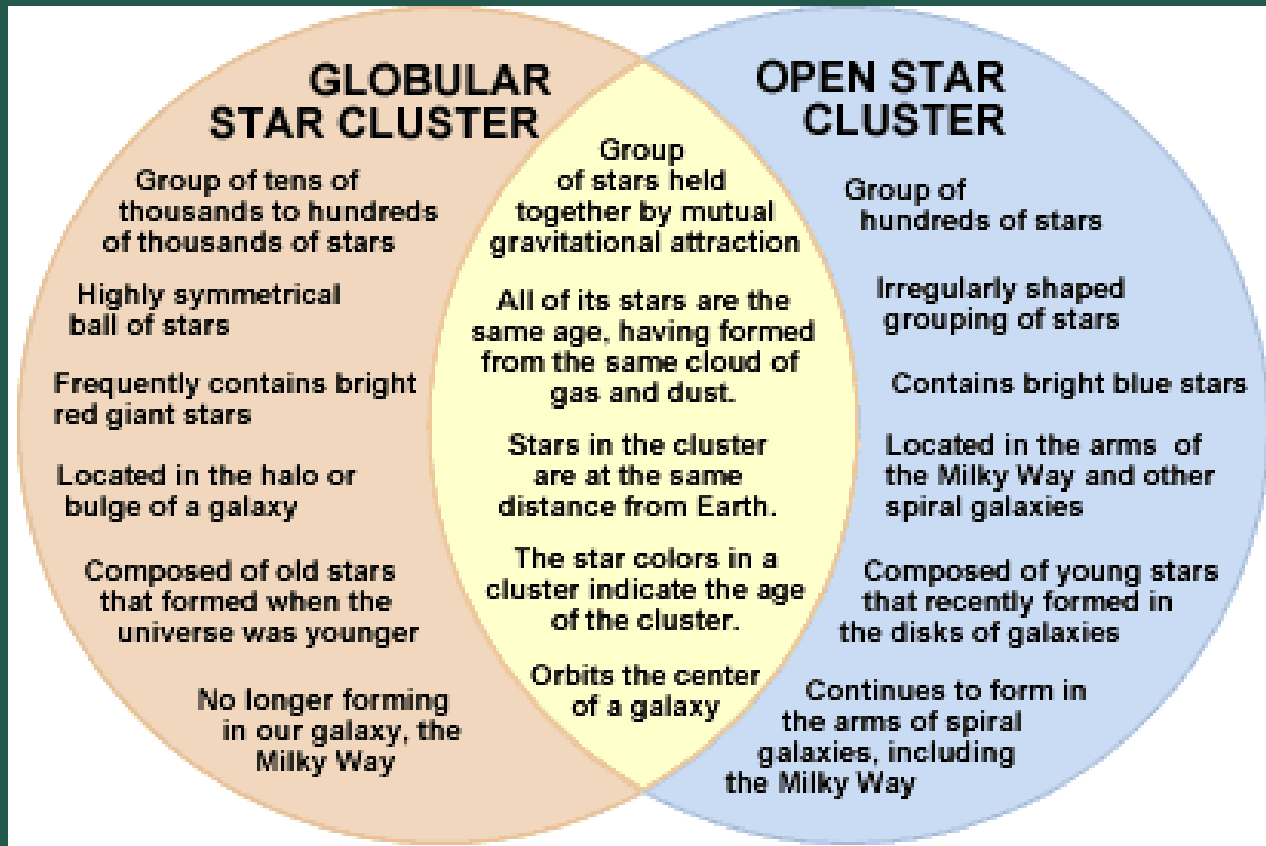
R Leporis



Garnet Star

Carbon Stars

Deep Sky Objects – Star Clusters



Double Cluster (Perseus)



Pleiades (Taurus)



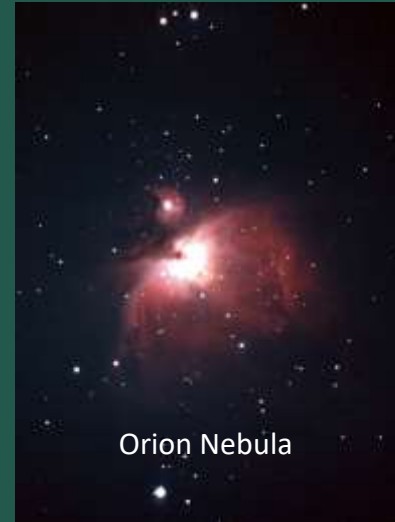
M13 (Hercules)



M22 (Sagittarius)

Deep Sky Objects– Nebula

- A nebula is an interstellar cloud in outer space that is made up of dust, hydrogen and helium gas, and plasma
- It is formed when portions of the interstellar medium collapse and clump together due to the gravitational attraction of the particles that comprise them
- Most nebulae are of vast size, even hundreds of light years in diameter
- Nebulae are often star-forming regions, such as in the “Pillars of Creation” in the Eagle Nebula
 - In these regions the formations of gas, dust, and other materials "clump" together to form larger masses, which attract further matter, and eventually will become massive enough to form stars
 - The remaining materials are then believed to form planets and other planetary system objects



Orion Nebula



Ring Nebula (Lyra)



Eagle Nebula (Serpens)



Dumbbell Nebula (Vulpecula)

Deep Sky Objects – Galaxies

- The Andromeda Galaxy (M31) is the closest large galaxy to the Milky Way and is one of a few galaxies that can be seen unaided from the Earth

Distance from Milky Way: 2.5 million light-years

Diameter: 260,000 light-years

Mass: 400 billion solar masses

Number of Stars: 1 trillion

- The Whirlpool Galaxy is a familiar one to stargazers and among the many close galaxy neighbors to our own Milk Way

Distance from Milky Way: ~25 million light-years

Diameter: about 75 thousand light-years across

Mass: ~160 billion suns

Number of Stars: > 100 billion

- The Triangulum Galaxy, also known as M33, is one of the closest spiral galaxies to the Milky Way

Distance from Milky Way: 3 million light-years

Diameter: 60,000 light-years

Mass: 100 billion solar masses

Number of stars: 40 billion stars



The Milky Way



Resources

- Sky and Telescope website: <http://www.skyandtelescope.com/>
- Stellarium software application: www.Stellarium.org
- Suggested books:

