Nebula: Diffuse and Planetary

Culpeper Astronomy Club Meeting
August 27, 2018

Overview

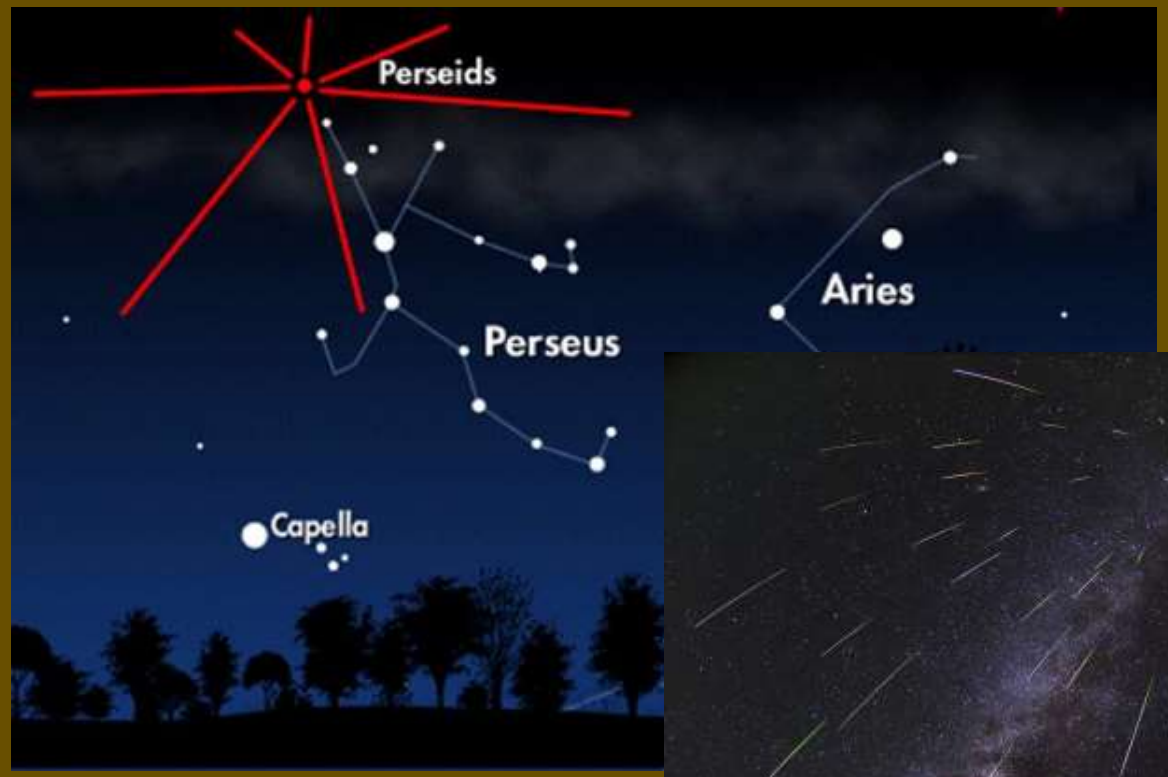
- Introductions
- Nebula: Types and Classes
- Constellations: Aquila, Delphinus, Scutum
- Observing Session

Observing Sessions

- USNA/NOVAC Star Party on academy grounds – 6 Aug
  - Luce Planetarium
  - Old Academy Observatory
  - 170 staff, alumni and families
- Observatory has 7.75”, 1857 vintage Clark refractor
- Planets the primary focus: Venus, Jupiter, Saturn, and Mars
- NOVAC provided several other scopes (4” refractors, 6” Dob and 10” and 14” SCT’s)

Observing Sessions

- Perseid Meteor Shower Session #1 – 12/13 August (Don and Chris)
  - 12-2 a.m. (18 meteors)
  - 4-5:30 a.m. (8 meteors)
  - 1 to -5 mag range
- Perseid Meteor Shower Session #2 – 13/14 August
  - 12:30-5 a.m. (>80 meteors)
  - At least half sporadic
  - Wide variety in mag and trails
- Planetary/Comet Observing – 23 Aug
  - Venus, Jupiter, Saturn, Mars…Neptune
  - Some DSO's
  - Comet 21P….NOT



Solar Eclipse – August 21, 2017

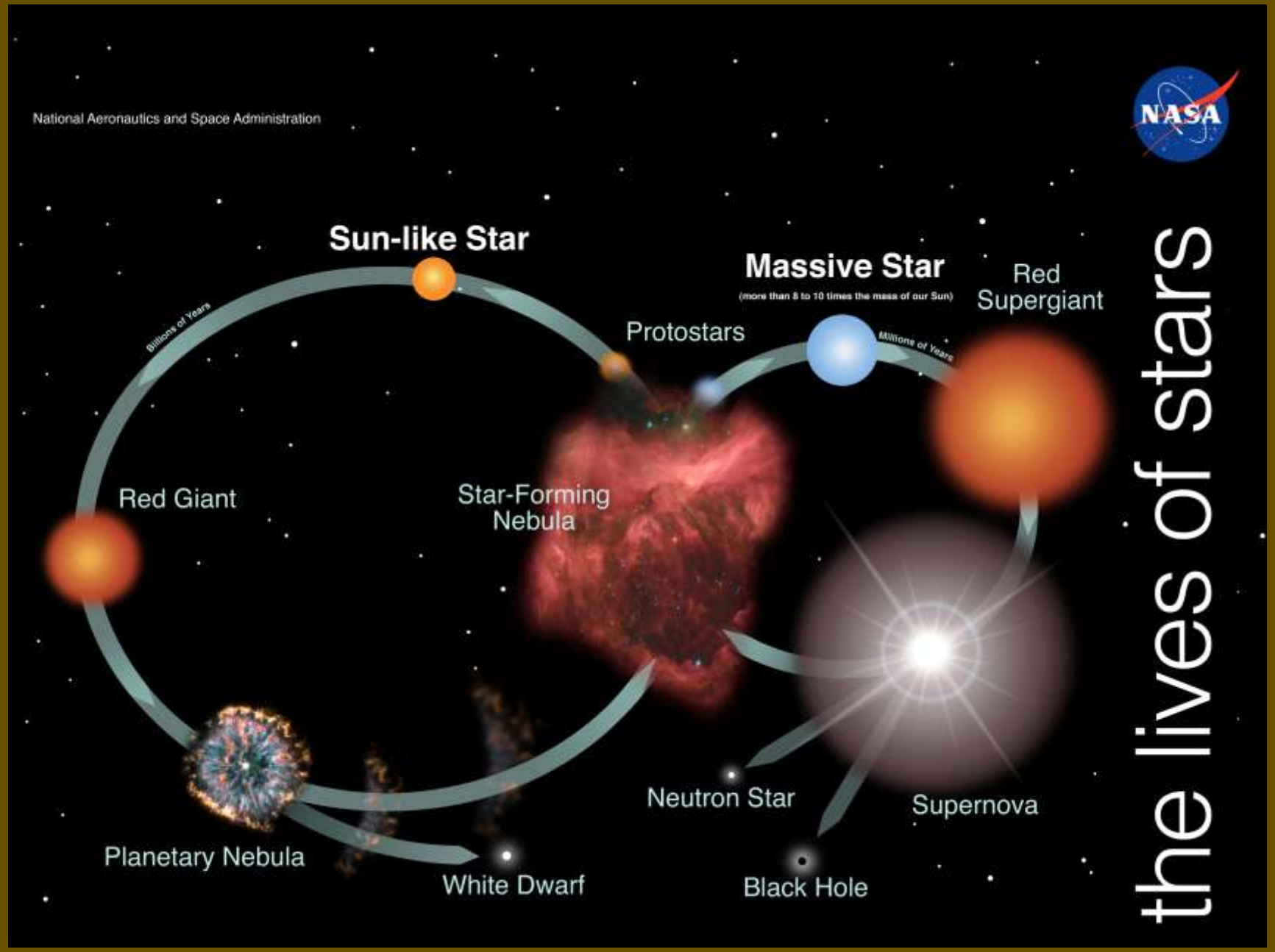
- Partial Solar Eclipse in Culpeper
  - About 82 percent covered
- Solar Eclipse Party sponsored by Culpeper County Library
  - 1100 Eclipse Glasses; 300-500 attendees
- Three scopes for visual:
  - Astroview 120, SV110ED, SV102

“The Year in Review…”

- Began the year with a study of the Sun, stars, their evolution…and the different types of stars (sizes, composition)…with plans to return to types (Carbon Stars, Variable Stars)…
- Looked at the clusters and groupings in which stars are organized…Binaries and Multiple stars, Open and Globular Clusters…
- Today we are going to take a more in-depth look at nebulae…the gaseous clouds from which stars are born…and to which they give rise when they die…
- Before the end of the year we will look at much larger and far more distant objects…the galaxies and galaxy clusters…

Nebula

- Nebula means “cloud” in Latin
- In astronomy, it is a massive cloud of gas and dust swirling in space
- First major classification is into:
  - Diffuse nebula: the clouds from which stars are born…and which may be created during the death’s of more massive stars
  - Planetary nebula: the clouds that dying stars eject


National Aeronautics and Space Administration
NASA
Sun-like Star
Billions of Years
Red Giant
Planetary Nebula
White Dwarf
Star-Forming Nebula
Protostars
Massive Star
(more than 8 to 10 times the mass of our Sun)
Millions of Years
Red Supergiant
Supernova
Neutron Star
Black Hole
the lives of stars

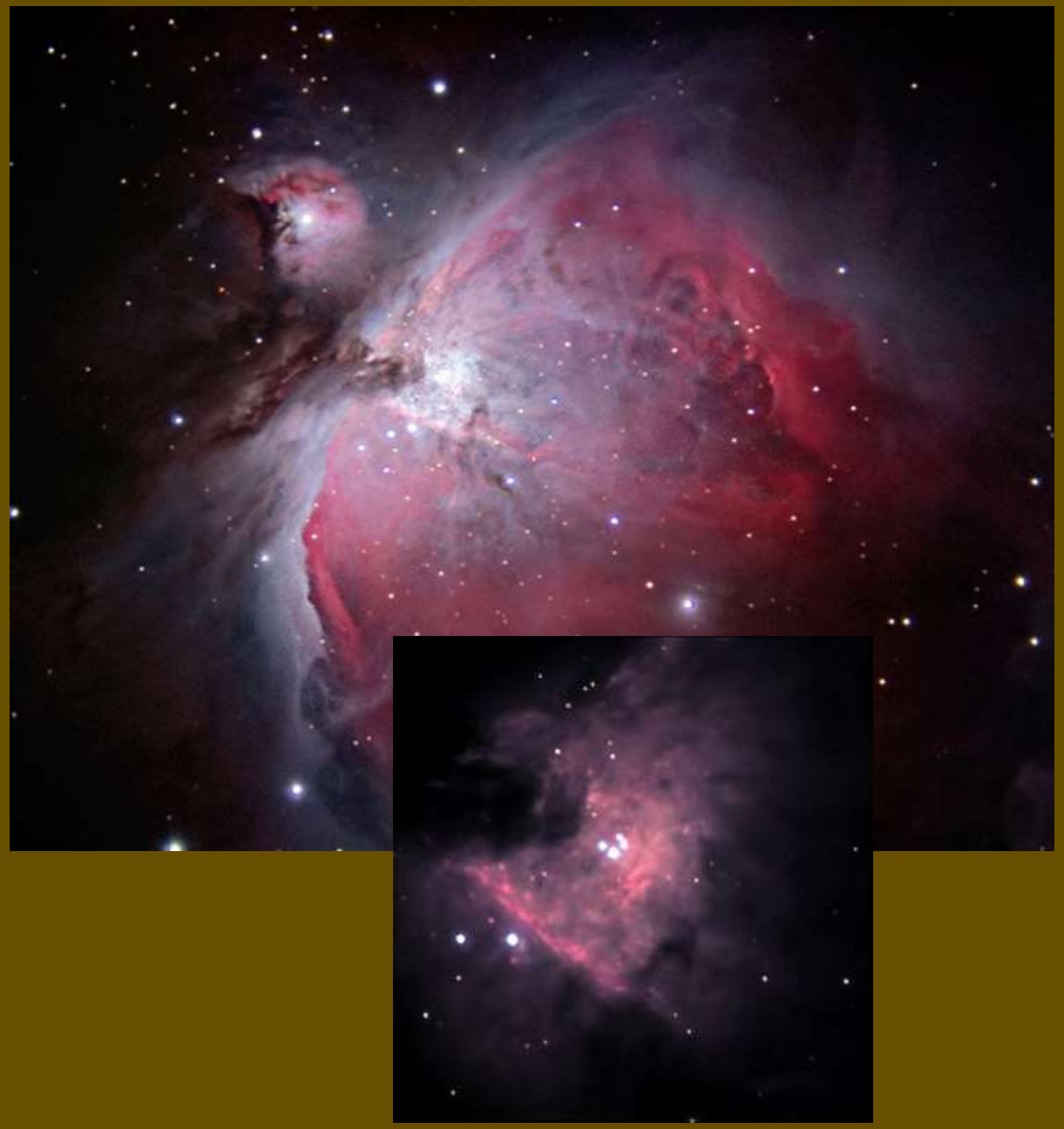
Diffuse Nebulae

- Emission Nebula: the gas glows due to the UV radiation of hot stars, mostly O and B stars
  - The Orion Nebula is an example of an Emission Nebula

- Reflection Nebula: glows due to the reflection of stars shining in or near the gas cloud
  - The Merope Nebula (surrounding the Pleiades) is an example of a Reflection Nebula

Orion Nebula (M42)

- The nebula is one of the brightest ones in the sky; visible to the naked eye
- The nearest known region of massive star formation to the solar system
- Has a visual magnitude of 4.0; 1,344 LY distant; 20 LY in diameter
- Both Emission and Reflection
  - Illuminated by the Trapezium

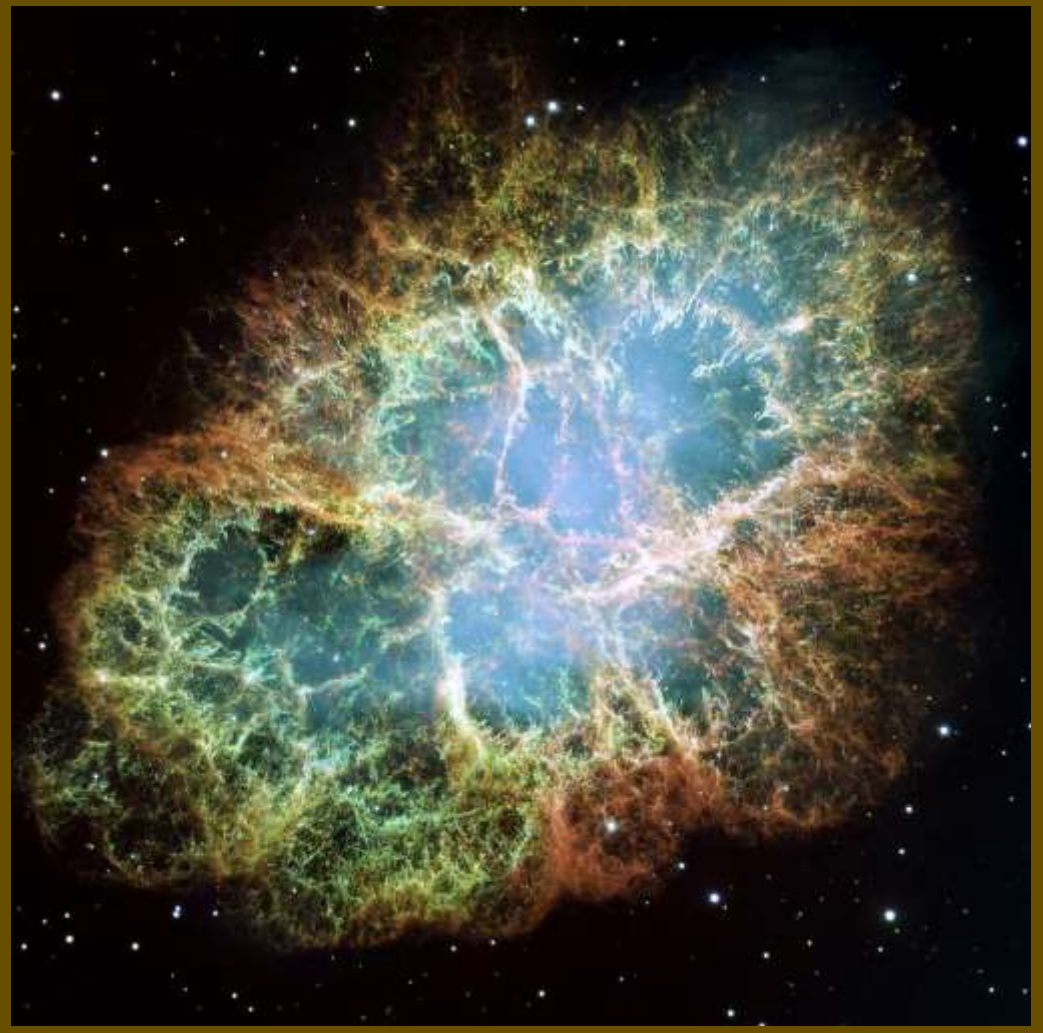


Merope Nebula

- The Merope Nebula is a reflection nebula located in the Pleiades star cluster
- It surrounds the star Merope (23 Tauri) and is illuminated by the star
- The nebula is a suspected supernova remnant
- Has an apparent magnitude of 13.0 and is approximately 440 LY distant
- The Merope Nebula envelops IC 349 (Barnard's Merope Nebula), a bright nebula 0.06 light years from the star Merope

Crab Nebula (M1) in Taurus

- Creation of the Crab Nebula corresponds to the bright supernova recorded by Chinese astronomers in AD 1054
- The “guest star” they observed for nearly a month gave rise to the Crab Nebula, a 6 LY wide remnant of the violent event
- At the center of the Crab Nebula are two faint stars, one of which is the star responsible for the existence of the nebula
  - A rapidly spinning neutron star (the ultra-dense core of the exploded star) is embedded in the center of the Crab Nebula
- Apparent magnitude of 8.4 and located 6,500 light-years from Earth



Rosette Nebula

- The Rosette Nebula is a large emission nebula in Monoceros
  - Has a visual magnitude of 9.0
  - Is about 5,200 light years distant
  - Is about 65 LY across
- The open cluster NGC 2244 is associated with the nebula
  - Its stars have been formed from the matter within the nebula

Trifid Nebula (M20)

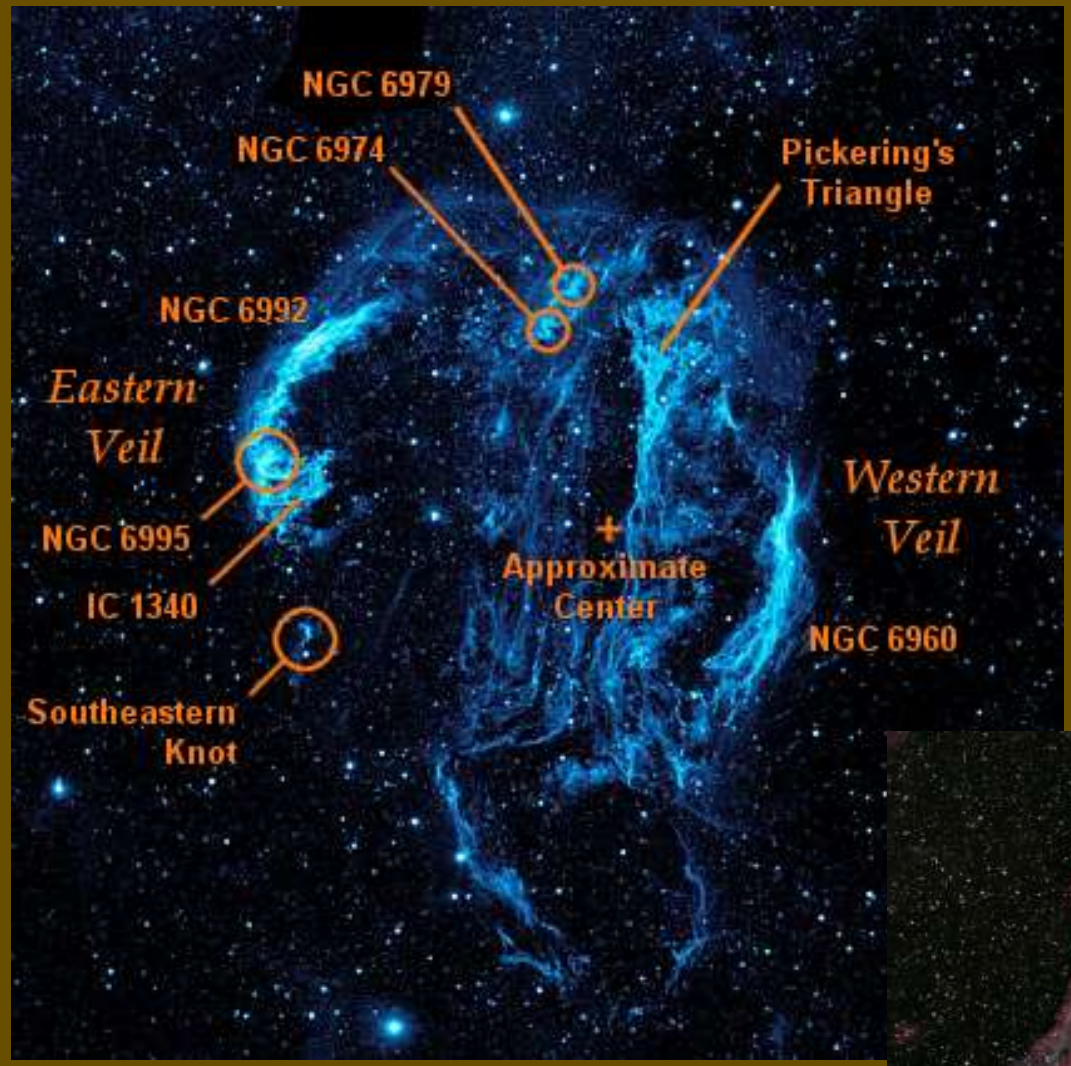
- The Trifid Nebula is a large star-forming region located in Sagittarius
- The nebula's name means "divided into three lobes," and refers to the object consisting of three types of nebulae and an open star cluster
- The open cluster is surrounded by an emission nebula, a reflection nebula, and a dark nebula within the emission nebula that gives it the trifurcated appearance from which it got its name
- It has a diameter of 42 LY and lies at a distance of 5,200 light years from Earth

Lagoon Nebula (M8)

- The Lagoon Nebula is classified as an emission nebula
- The nebula is located in Sagittarius, within the Milky Way Galaxy
- The Lagoon Nebula is the brightest, largest nebula in Sagittarius
- Is estimated to lie at a distance between 4-6K LY distant
- It spans a region 110 by 50 LY

Veil Nebula

- The Cygnus Loop is a large supernova remnant, almost three degrees across, forming an emission nebula in Cygnus
- The Veil Nebula is the visual component of the Cygnus Loop
- It consists of several components:
  - Western Veil: NGC 6960, is sometimes also called the Witch's Broom; forms the western-most part of the nebula
  - Eastern Veil: consists of three bright regions – NGC 6992, NGC 6995 and IC 1340



Planetary Nebulae

- Planetary nebula have nothing to do with the planets
  - Name grew out of their appearance which in many cases resembles that of the blue-green planets Uranus and Neptune
- While they are typically associated with dying stars, just how closely associated remains questionable
- Central star is very hot…100K plus degrees and emitting massive amounts of UV radiation

The Ring Nebula (M57) in Lyra

- The Ring Nebula is a famous planetary nebula, relatively easy to find and is a popular target among amateur astronomers
- Has an apparent magnitude of 8.8 and is approximately 2,300 light years distant
- Was formed when a shell of ionized gas was expelled by a red giant star that was in the process of becoming a white dwarf
    - Expanding at the rate of about 1 arc second per century

Little Dumbbell Nebula (M27) in Vulpecula

- It was formed when a dying star threw off its gas
  - Named Dumbbell because it has a double-lobed structure resembling a bar-bell
  - Sometimes called the “Apple Core” Nebula
- Messier 27 was the first planetary nebula ever discovered; first observed by Charles Messier in 1764
- The nebula has an apparent magnitude of 7.5 and is approximately 1,360 light years distant
- It is about 8 arc minutes (1.44 LY radius) in diameter and can easily be observed in binoculars and amateur telescopes.
- The central star, a white dwarf, is larger than any other known white dwarf

The Owl Nebula (M97) in Ursa Major

- The Owl Nebula is a planetary nebula about 2,600 LY distant; 9.9 magnitude
- It got its name because of the appearance of owl-like eyes
- Was first discovered in 1781; believed to have formed about 8,000 years ago
- The 16th magnitude central star:
  - Has 55 to 60% of the Sun's mass
  - Only 4% of the Sun's radius
  - An estimated surface temperature of 123,000 K.
- The star can be seen between the Owl's eyes
  - Its radiation is responsible for the nebula's glow

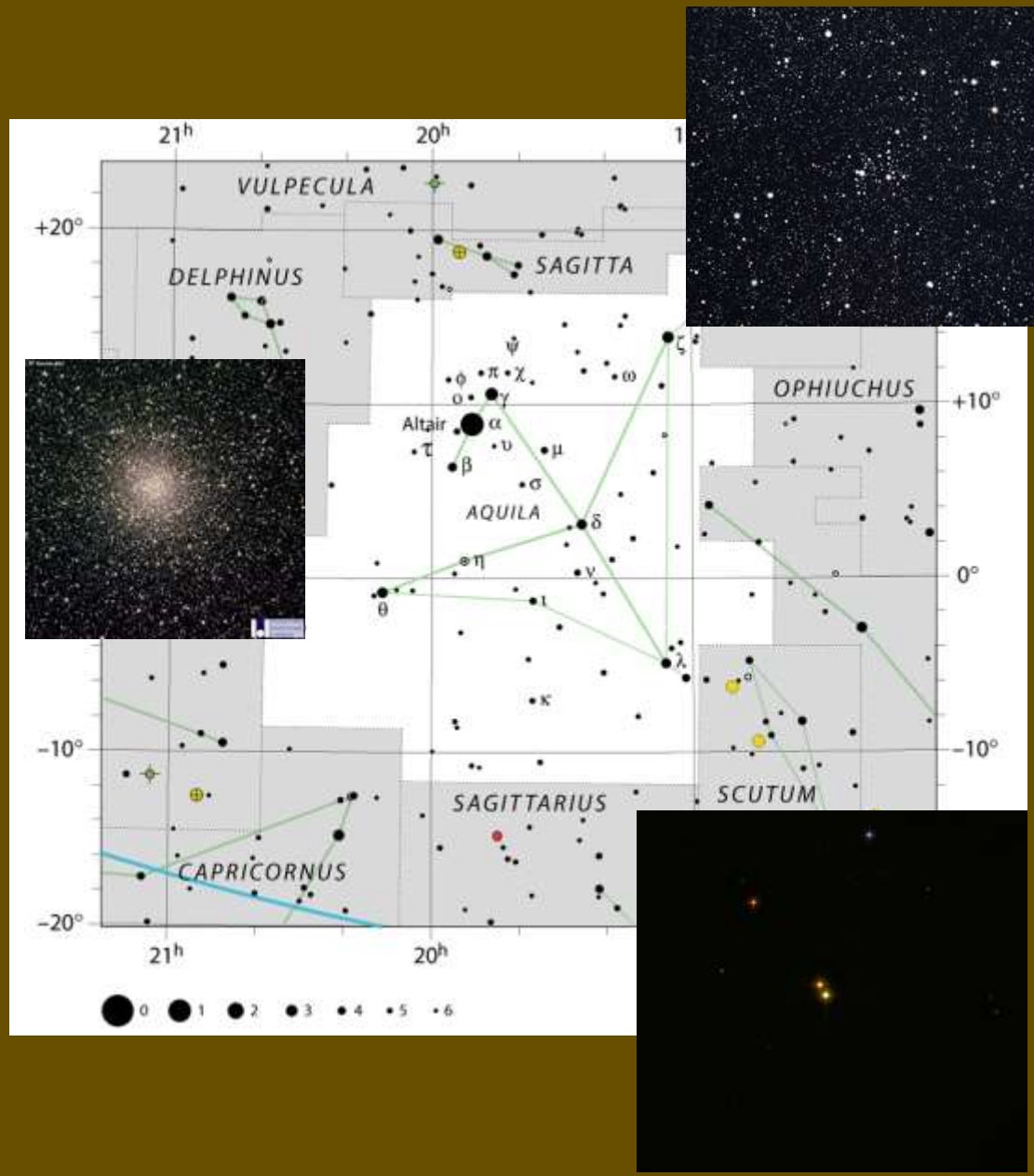
The Blinking Planetary (NGC 6826) in Cygnus

- NGC 6826 is 8.8 magnitude; blue-green in color
- Estimated to be 2,200 light-years distant
- “Blinking” demonstrates the effect of averted vision
  - Stare directly at this blue-green planetary nebula for several seconds and you see only the central star
  - Look slightly to the side and the faint nebula around the star appears suddenly
  - When you switch from straight on to averted vision, the nebula appears to blink on and off

Aquila - “The Eagle”

- Aquila is identified as the eagle that carried Zeus’ thunderbolts
  - Altair: “flying eagle” or “vulture”; one of the three stars that form the Summer Triangle
  -
- Double Stars:
  - 15 Aquilae: binary star; 5 mag yellow star and 7 mag companion

- Deep Sky Objects:
  - NGC 6709: Open Star Cluster; stars are loosely arranged into a diamond-like shape
  - NGC 6760: Globular Cluster

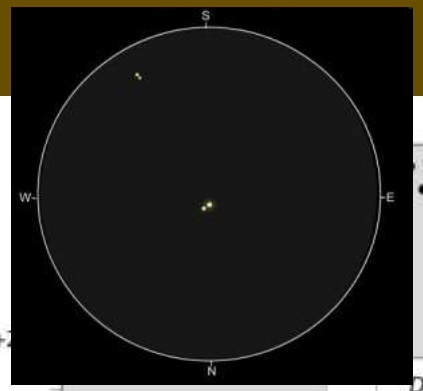


Delphinus - “The Dolphin”

- One of the smallest constellations; represents the dolphin sent by Poseidon to find Amphitrite, his future wife

- Gamma Delphini - binary star; 101 light years distant; yellow-white dwarf and an orange subgiant; mag of 5.14 and 4.27; 9” sep

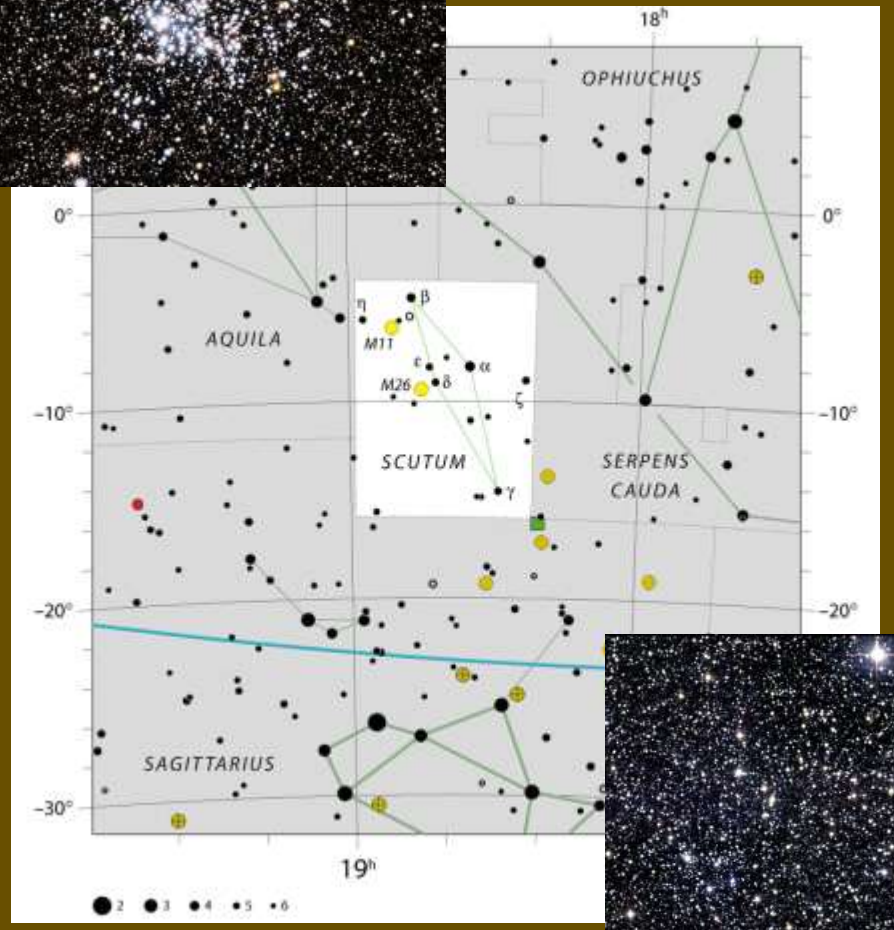
- Deep Sky Objects:
  - NGC 6934 - large globular cluster near Epsilon Delphini; 50K LY distant; 8.83 mag
  - NGC 6891 - small planetary nebula located near the star Rho Aquilae; 7.2K LY distant
  - NGC 7006 - globular star cluster located 137K LY distant; The cluster has a visual magnitude of 10.6; located close to Gamma Delphini



Scutum - “The Shield”

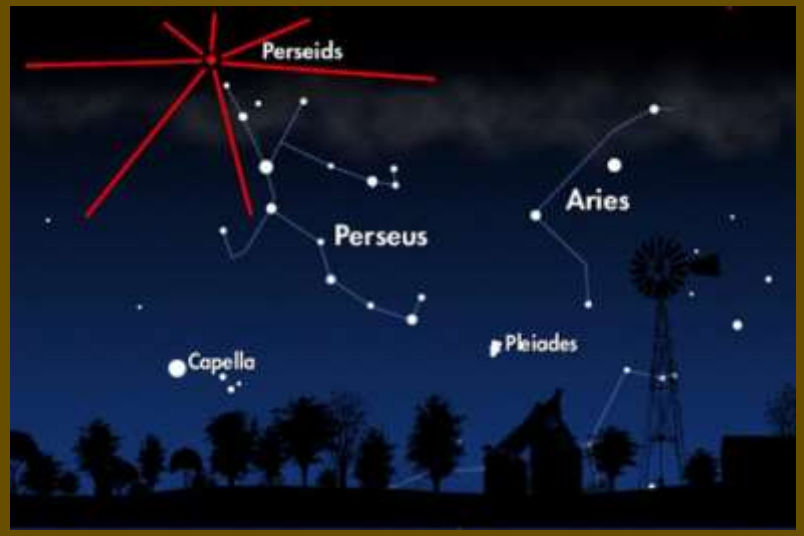
- Hevelius named it “Shield of Sobieski”
  - No associated myths
  - In honor of the Polish King Jan III Sobieski
  - Had been victorious in the Battle of Vienna in 1683

- Deep Sky Objects:
  - Messier 11: Wild Duck Open Star Cluster; one of the richest, most compact open clusters known; contains about 2,900 stars; brightest stars in the cluster form a triangle which represent a flock of wild ducks; mag of 6.3
  - Messier 26: Open Star Cluster; mag of 8.0; 5K LY distant; is about 22 LY across; believed to be about 89 million years old



Meteor Showers

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).					



Comet 21P/Giacobini-Zinner

- Comet 21/P Giacobini-Zinner is currently a fine binocular comet, shining at +7.7 mag
- We'll be able to track it right through perihelion on September 10
  - Could be 3rd mag by then
- This is its closest passage to Earth since September 14th, 1946
  - Won't be topped until the perihelion passage of September 18th, 2058
- Comet 21/P Giacobini-Zinner is also the source of the Draconid meteors, radiating from the constellation Draco on and around October 7th and 8th

Upcoming Events

- Next Meeting: September 24
  - Primary Topic: Galaxy Types or Variable Stars

- Orionid Meteor Shower:
  - Set to peak the night of Oct. 21-22
  - Bright Moon will lead to subpar views
  - Particles come from Comet 1P/Halley