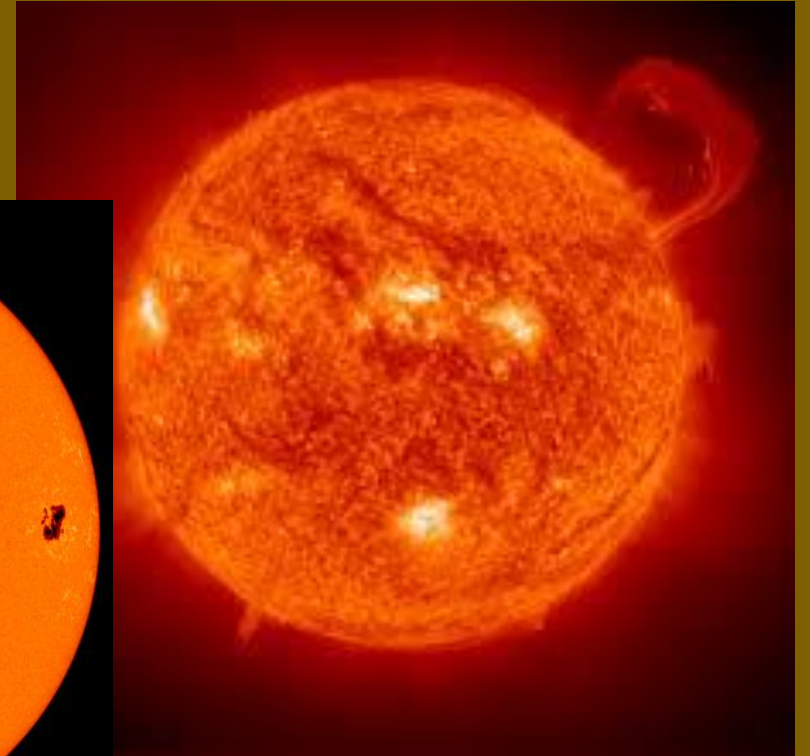


The Sun: The Nearest Star



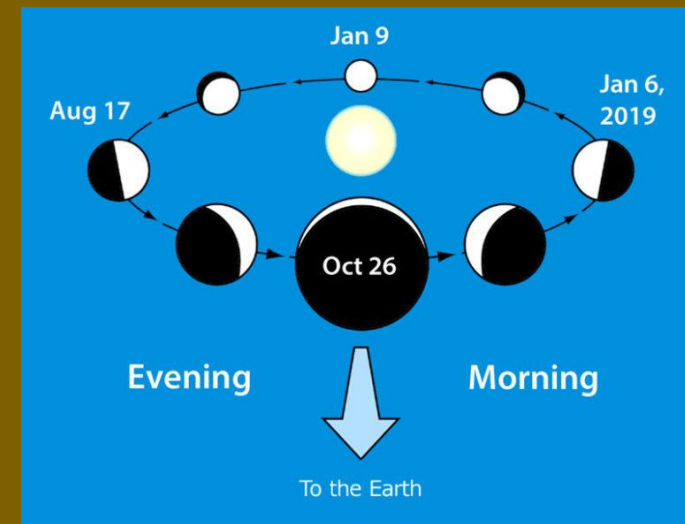
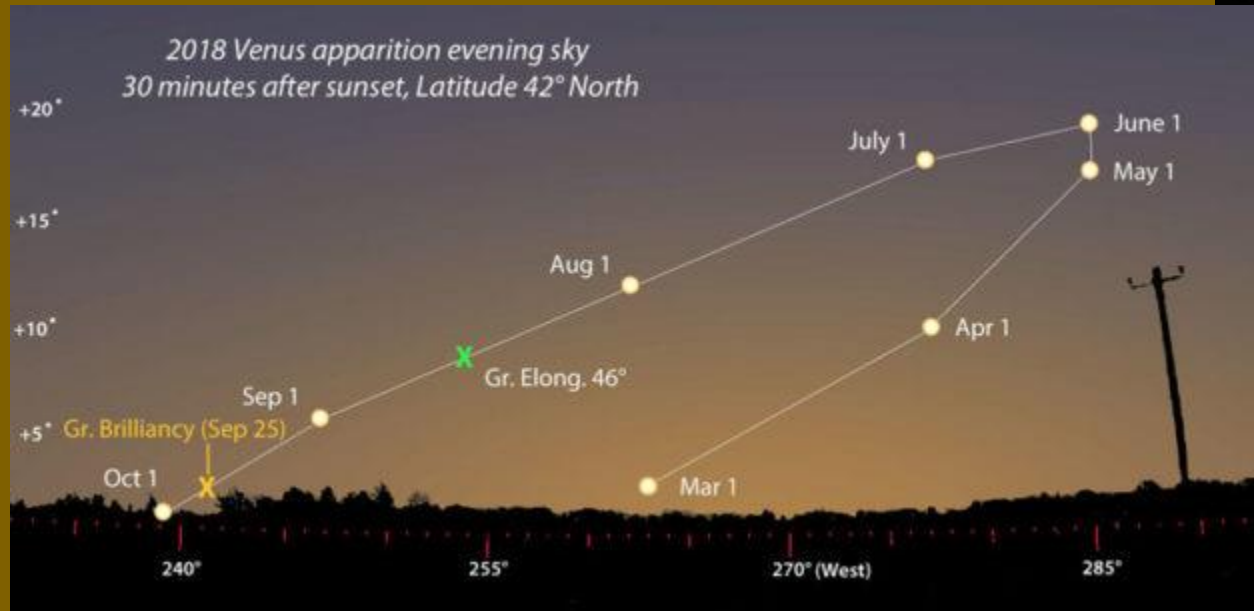
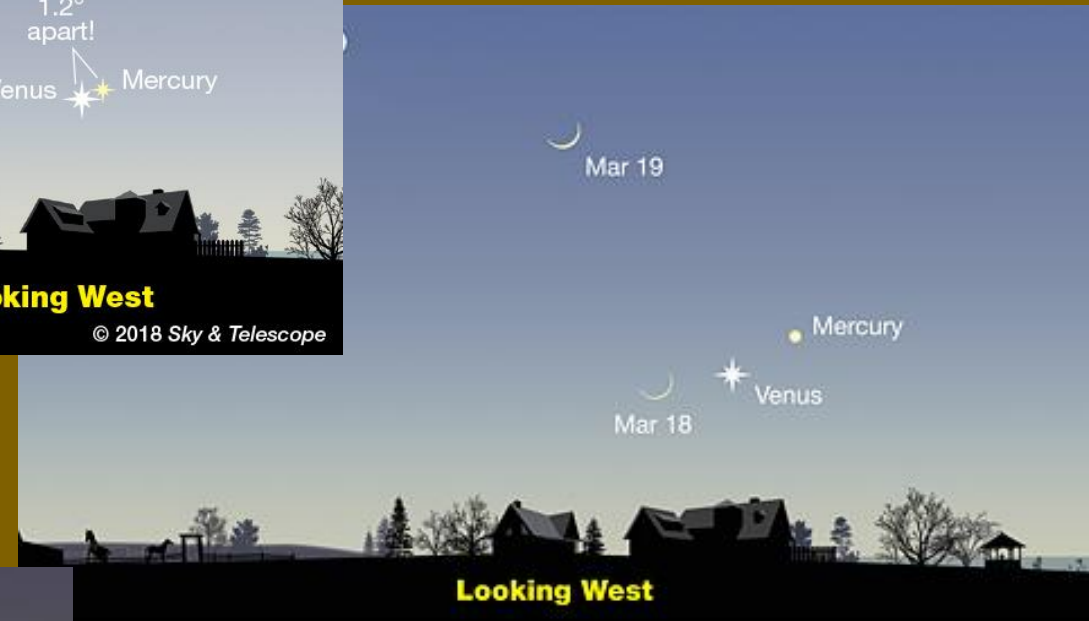
Culpeper Astronomy Club Meeting
March 19, 2018

Overview

- Introductions
- The Sun
- Stellarium
- Constellations: Monoceros, Canis Major, Puppis
- Observing Session

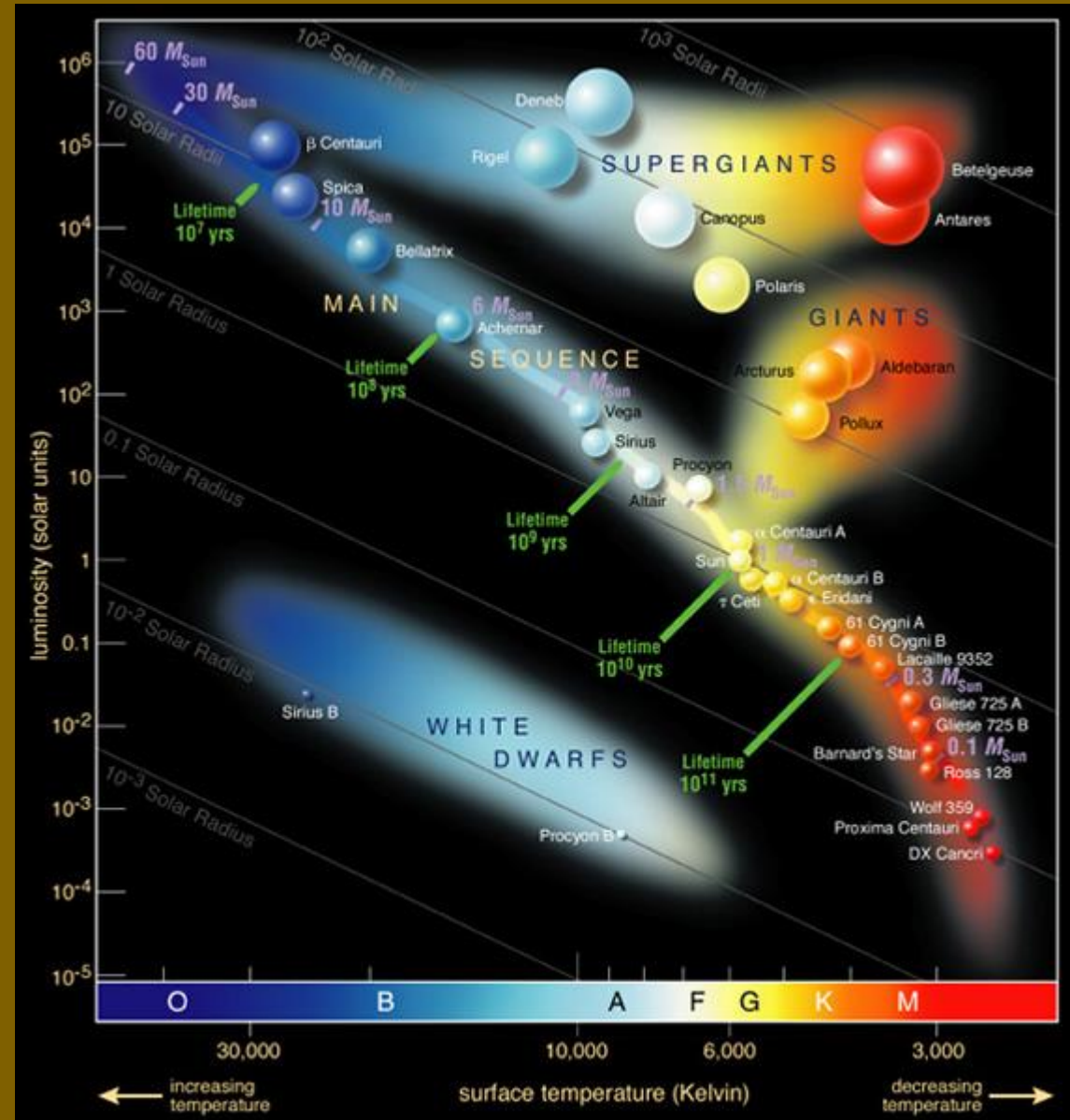
Night Sky Events

- Check Sky and Telescope for weekly observing information
- www.skyandtelescope.com



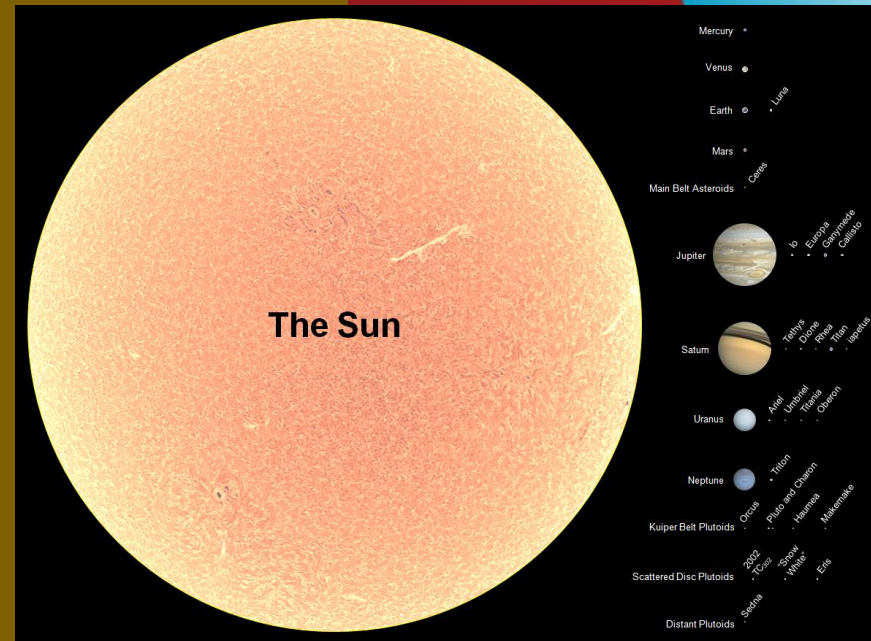
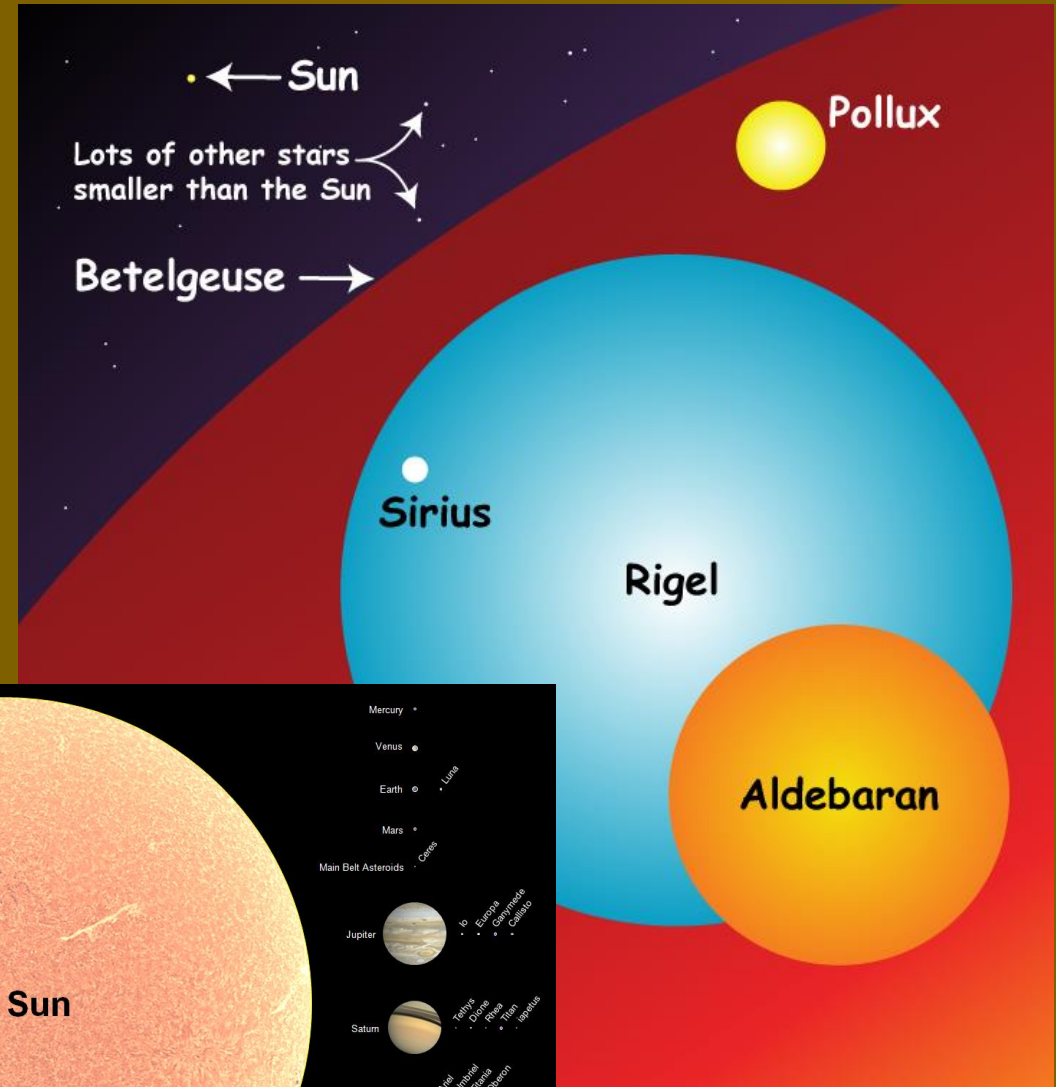
Hertzsprung-Russell (H-R) Diagram

- A graphical tool that astronomers use to classify stars according to:
 - Luminosity and spectral type
 - Temperature and color
 - Evolutionary stage
- Temperature – Luminosity (**Oh Be A Fine Girl/Guy Kiss Me**)
- Stars in the stable phase of hydrogen burning lie along the Main Sequence according to their mass



The Sun – The Facts

- The Sun is average:
 - Medium sized
 - Medium hot
 - Mid-life
- Huge ball of gas 865K miles in diameter
 - 92.96M miles distant
- Period of rotation:
 - At the equator – 25.4 days
 - Near the poles - 35 days

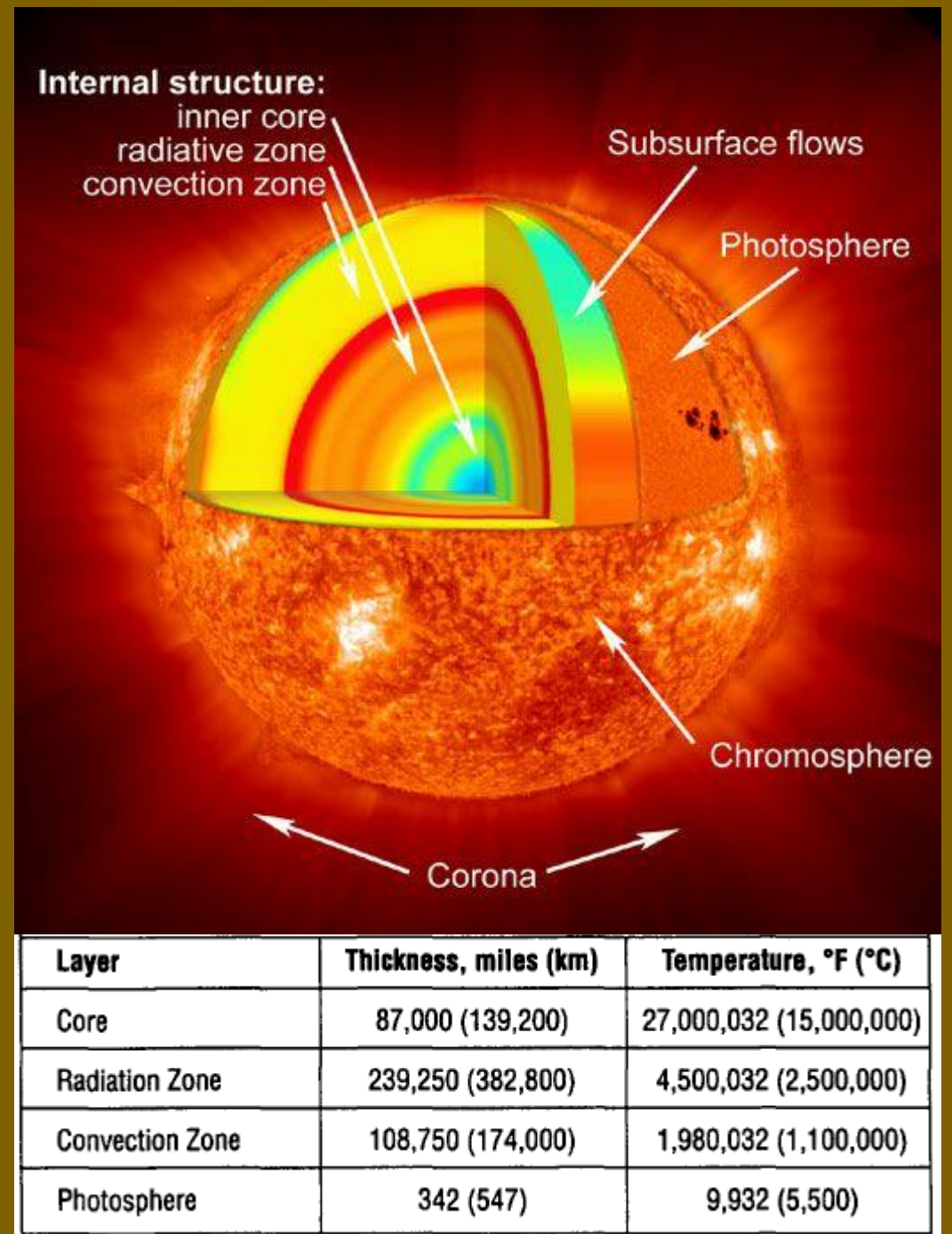


The Sun's Origin

- The Sun was born about 4.6 billion years ago
- It is one of more than 100 billion stars in the Milky Way
 - Orbits some 25,000 LY from the galactic core
 - Completes a revolution once every 250 million years or so
- Many scientists think the sun and the rest of the solar system formed from a giant, rotating cloud of gas and dust known as the solar nebula
 - As the nebula collapsed, it spun faster and flattened into a disk
 - Most of the material was pulled toward the center to form the sun
- The Sun has enough nuclear fuel to stay much as it is now for another 5 billion years
 - After that, it will swell and become a Red Giant
 - Eventually, it will shed its outer layers, the core will collapse and become a White Dwarf
 - Slowly, this will fade, to enter its final phase as a dim, cool Black Dwarf

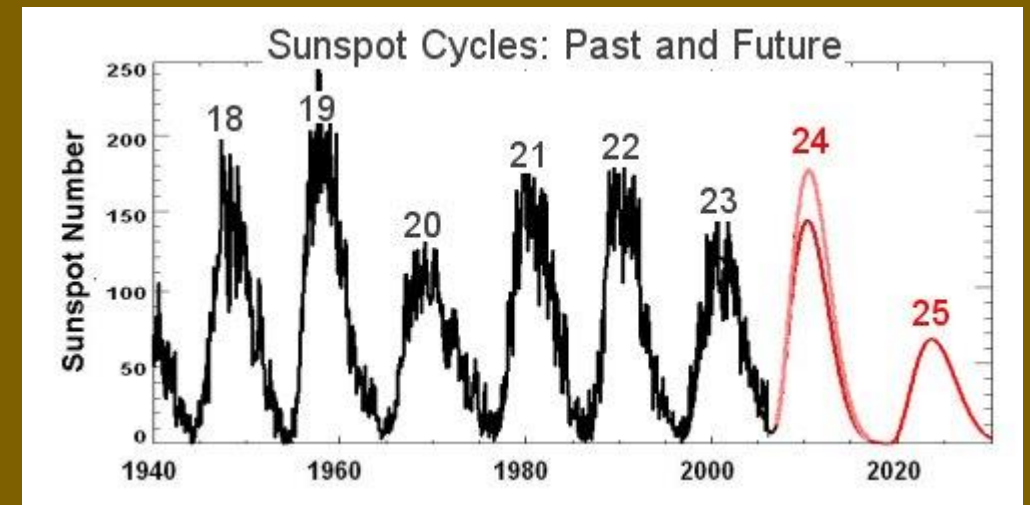
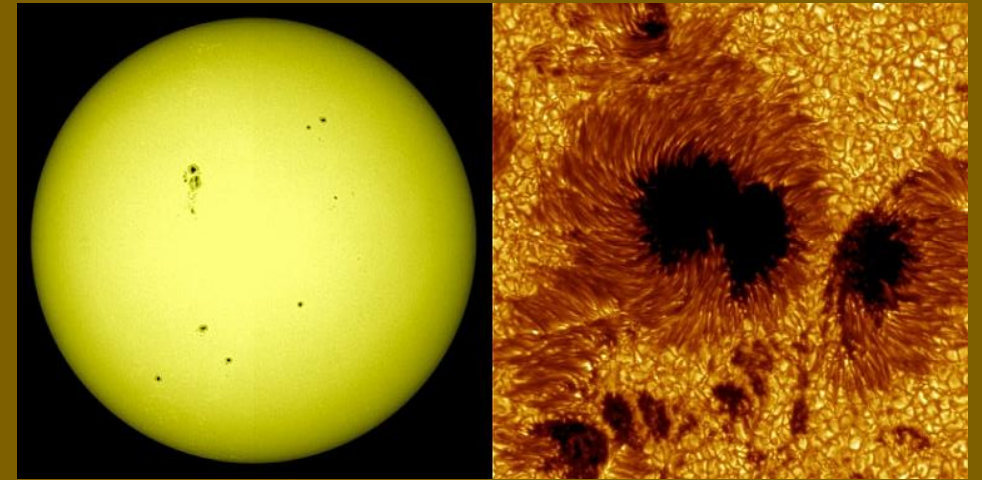
The Sun - Composition

- Primarily of Hydrogen (92%) and Helium (7.5%)
- Fueled by massive thermonuclear reactions:
 - Hydrogen is fused to into helium atoms
 - Results in massive amounts of energy
- The sun has six layers:
 - Three layers, the corona, chromosphere, and photosphere, comprise the sun's atmosphere or outer layer
 - The other three layers, convective zone, radiative zone, and core, comprise the inner layers
- The visible part of the sun is about 10K Degrees F
 - Temperatures in the core reach 27M Degrees F



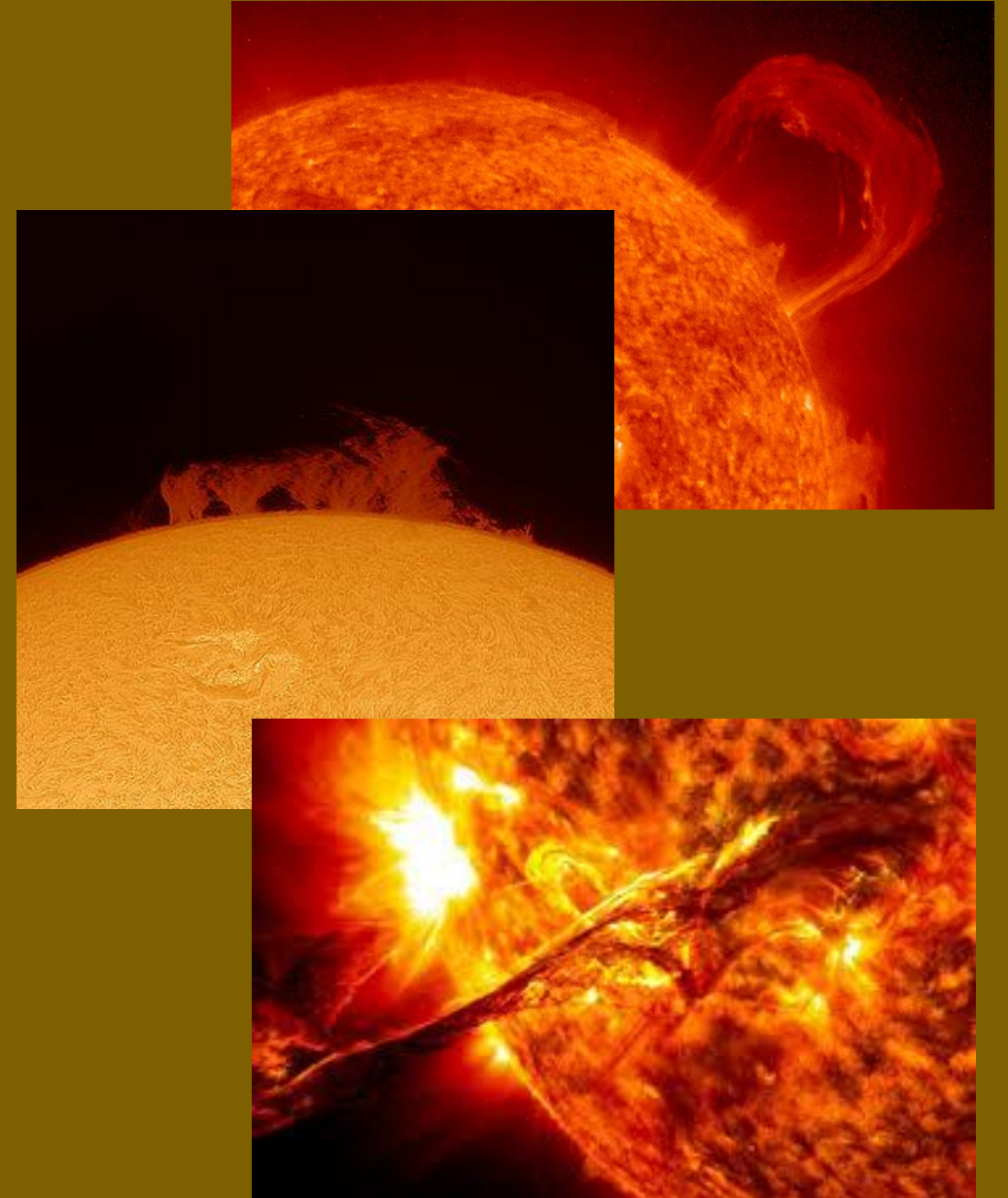
Sunspots and Solar Cycles

- Sunspots are darker, cooler areas on the surface of the sun (the photosphere)
 - The photosphere is about 10K degrees F while Sunspots are about 6K degrees F
 - They look dark only by comparison to the brighter and hotter regions of the photosphere
 - Can be very large, up to 30K miles in diameter
 - Occur over regions of intense magnetic activity, and when that energy is released, solar flares erupt from sunspots
- Solar Cycles: the nearly periodic 11-year change in the Sun's activity
 - Includes changes in the levels of solar radiation and ejection of solar material and changes in the number and size of sunspots and flares
 - Into Cycle 24; predicted size makes this the smallest sunspot cycle since Cycle 14

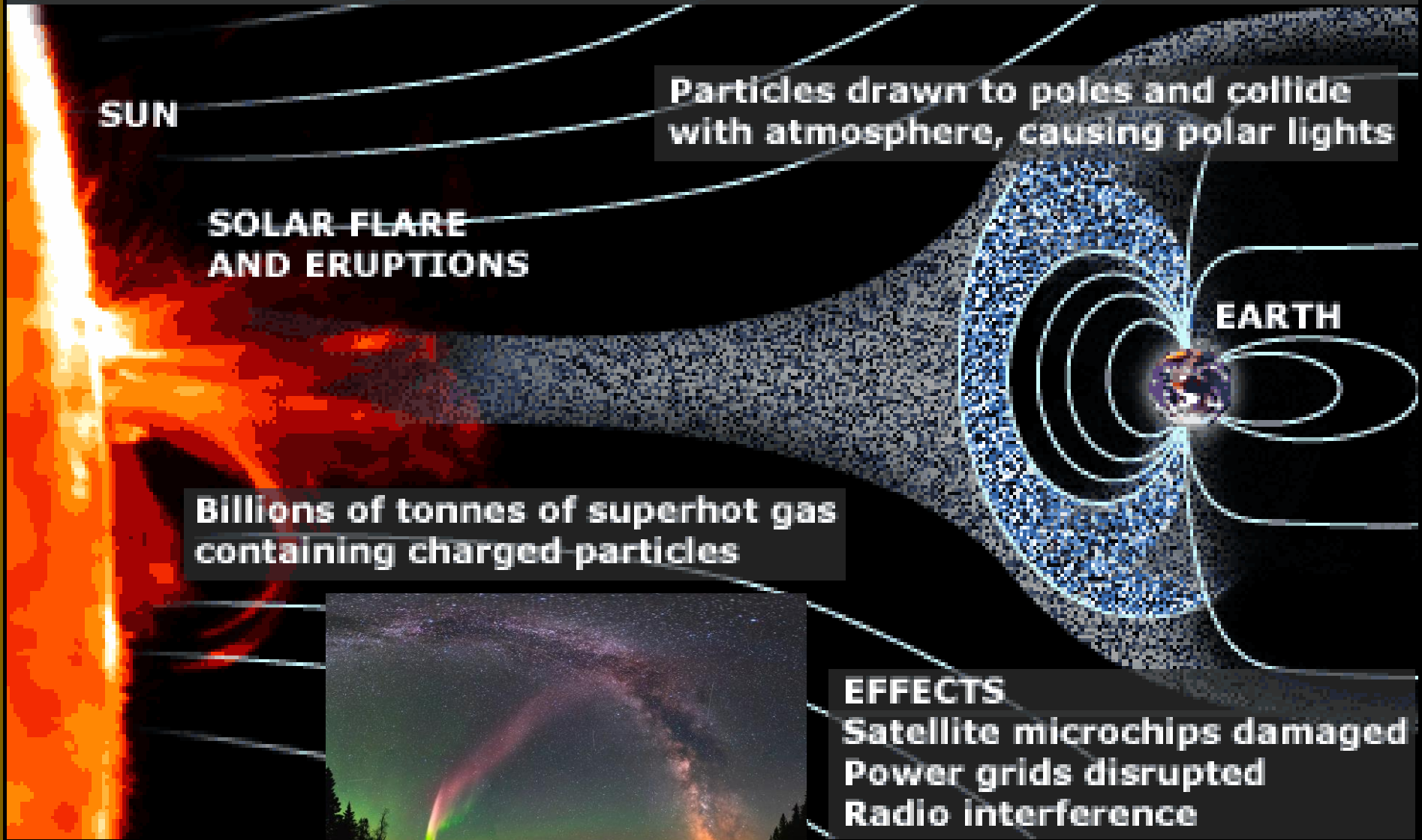


Other Solar Features

- Solar Prominence:
 - Arc of gas that erupts from the surface of the Sun
 - Can loop hundreds of thousands of miles into space
 - Held above the Sun's surface by strong magnetic fields and can last for many months
- Solar Flares:
 - Brief eruption of intense high-energy radiation from the sun's surface
 - Associated with sunspots and causing electromagnetic disturbances on the earth, as with radio frequency communications and power line transmissions



SOLAR ACTIVITY AND ITS EFFECTS ON EARTH



SUN

Particles drawn to poles and collide with atmosphere, causing polar lights

SOLAR FLARE AND ERUPTIONS

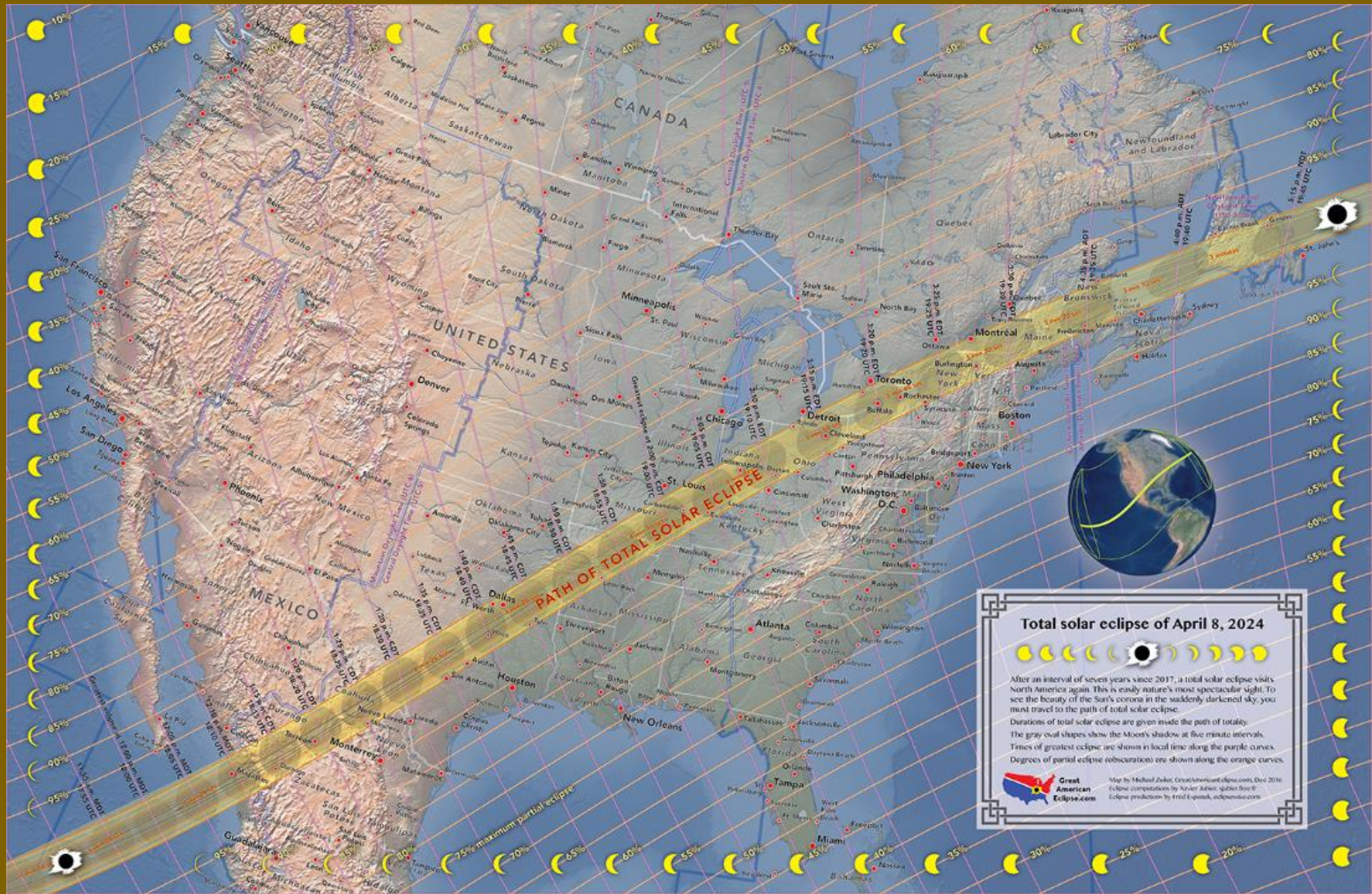
EARTH

Billions of tonnes of superhot gas containing charged-particles



EFFECTS

- Satellite microchips damaged
- Power grids disrupted
- Radio interference



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.



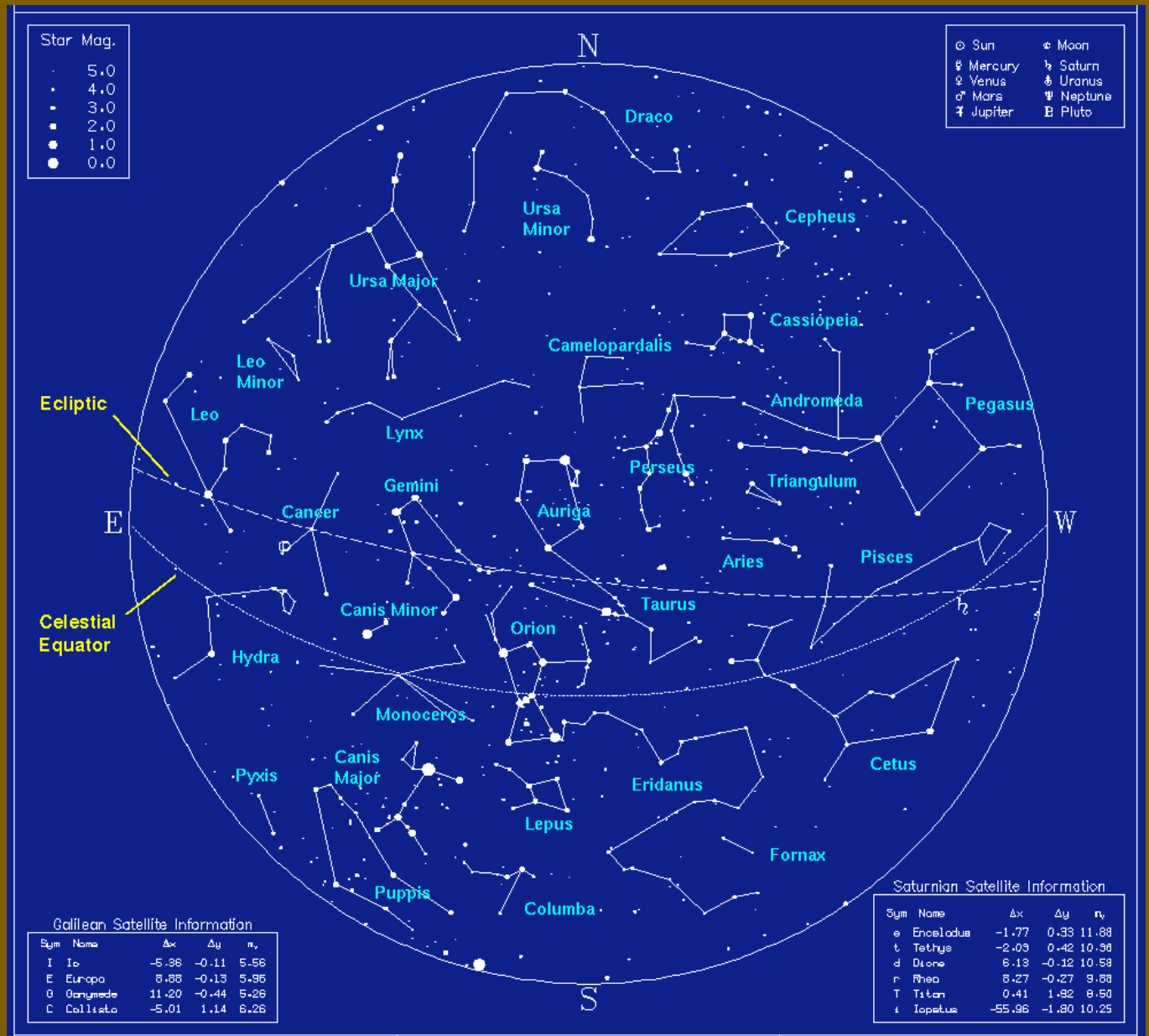
Great American Eclipse.com

Map by Michael Zeke, GreatAmericanEclipse.com, Dec 2016
Eclipse computations by Xavier Jubier, updates from IAU
Eclipse production by Fred Espenak, esp@nasa.gov

Stellarium.org

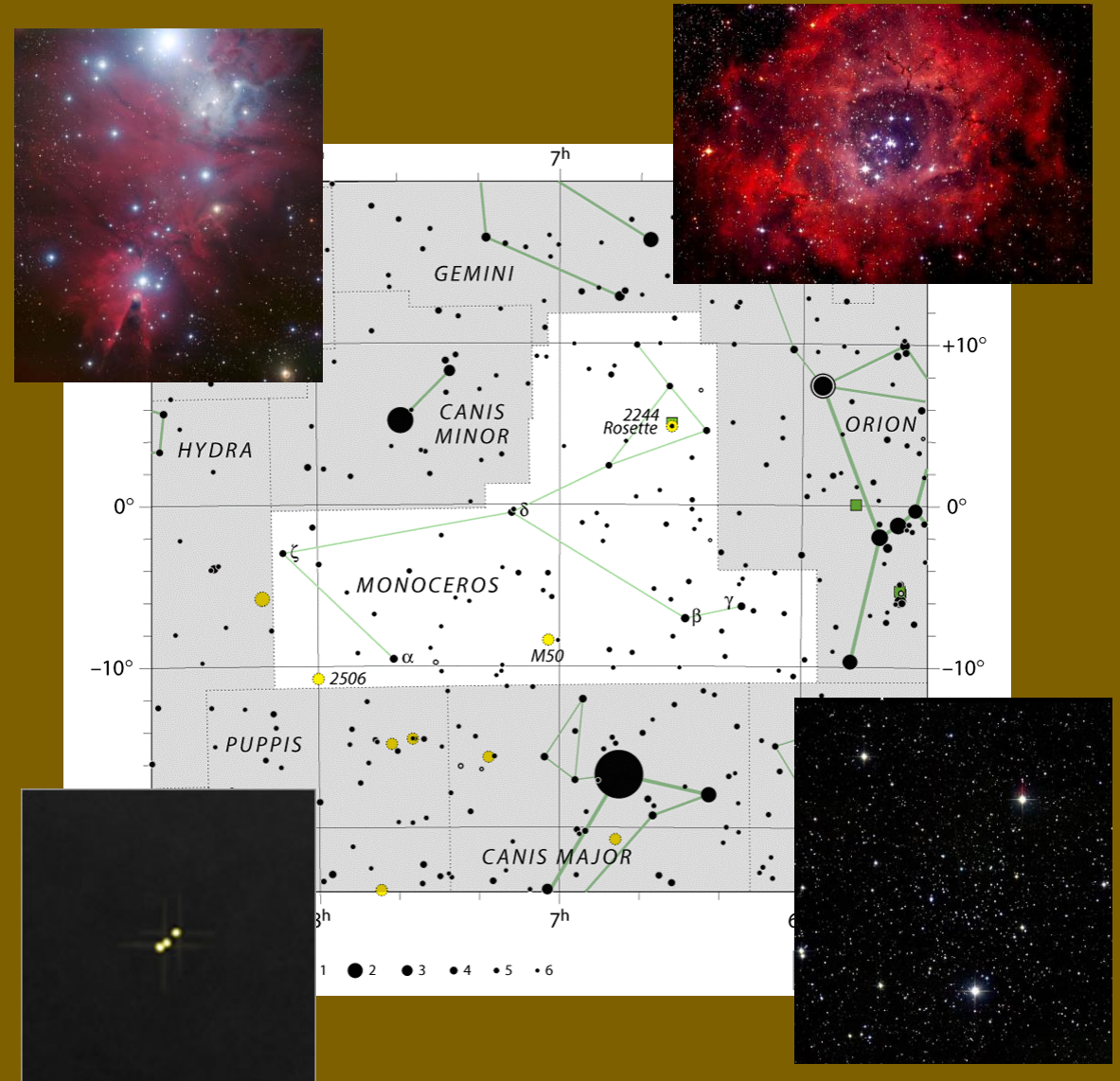
Constellations

- Will explore three this evening
 - Monoceros, The Unicorn
 - Canis Major, The Big Dog
 - Puppis, The Stern



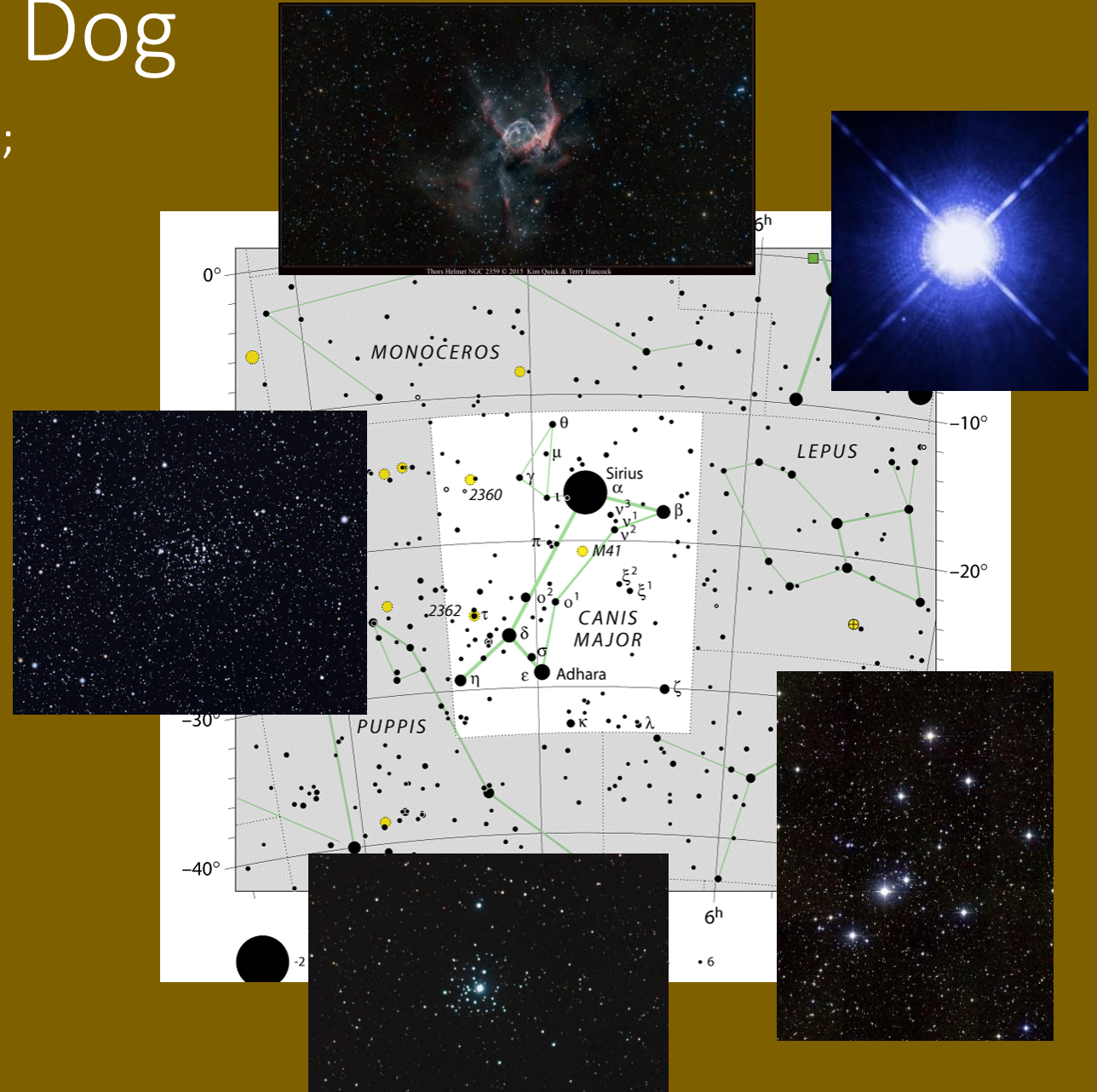
Monoceros - The Unicorn

- The constellation was created to fill the area between Orion and Hydra, where there weren't any constellations introduced in Greek times
 - No particular myth associated with it
- Beta Mon is a triple star system
- Messier 50 is an open cluster
 - Distinct for its heart-shaped figure
- The Rosette Nebula is a large emission nebula
- NGC 2264 is a New General Catalogue designation for two deep sky objects
 - Christmas Tree Cluster
 - Cone Nebula



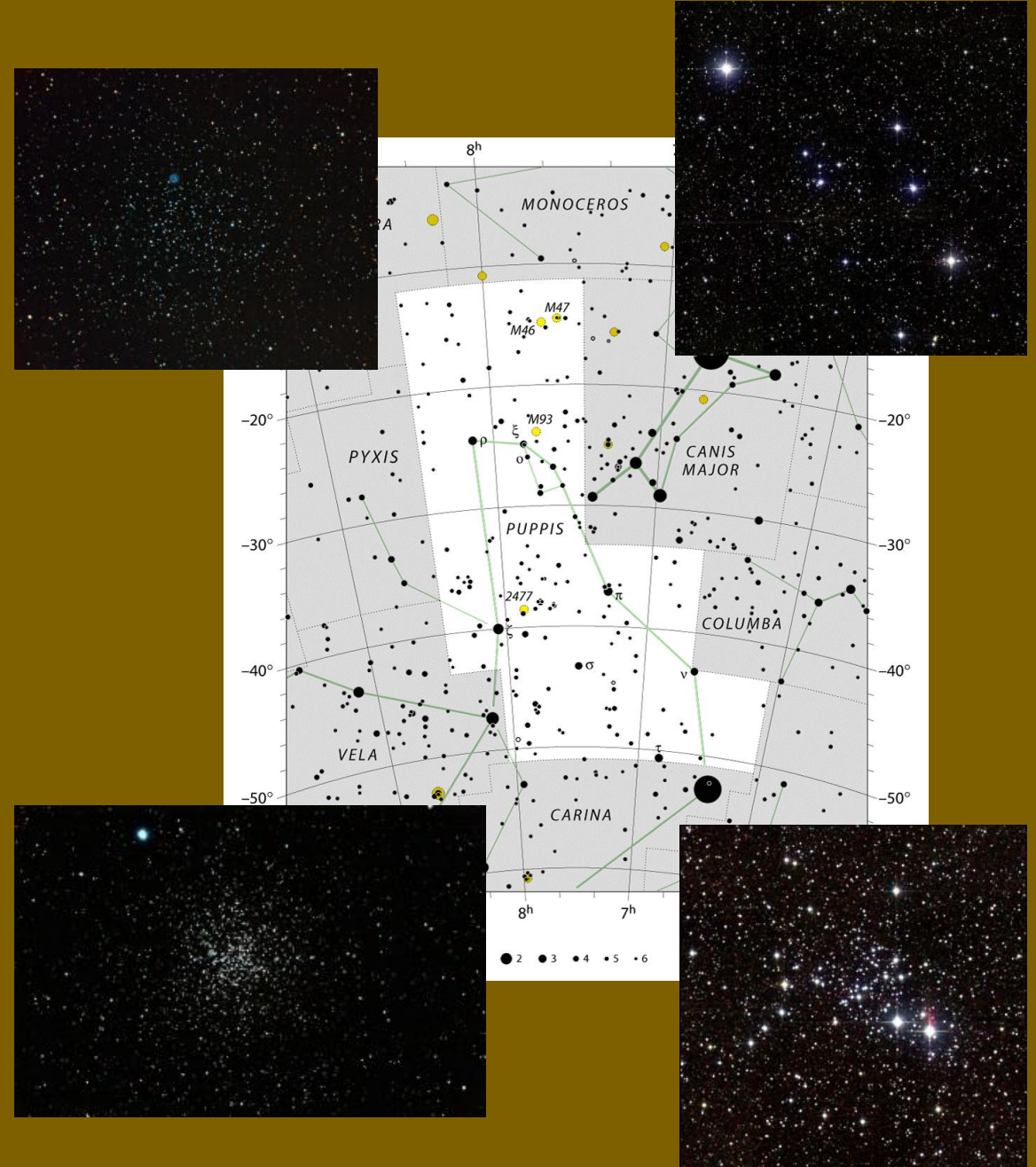
Canis Major – The Big Dog

- Larger of the the two hunting dogs used by Orion; chasing the Hare
- Within the constellation can be found Sirius, the brightest star in the night sky
 - Known as the "Dog Star"
 - Derived from the Greek word seirios which means "scorcher"
 - Sirius – Difficult Binary (50 yr period)
- Open Star Clusters
 - M41, NGC's 2360, 2362
- Thor's Helmet (NGC 2359)
 - Emission Nebula - 30LY Wide; 15K LY Distant
 - Formed of ionized gases that emit light of various colors
 - Source of ionization is high-energy photons emitted from a Wolf-Rayet star named HD 56925



Puppis – “The Stern”

- Represents the stern of a ship; used to be part of the much larger constellation which represented the ship on which Jason and the Argonauts sailed to get the Golden Fleece
- Deep Sky Objects:
 - Messier 46: Open Cluster with an apparent magnitude of 6.1; 5.5K LY distant; nice Planetary Nebulae in FOV
 - Messier 47: Open Cluster about a degree west of Messier 46; contains about 50 stars, the brightest of which is of magnitude 5.7
 - Messier 93: Open Cluster with apparent magnitude of 6.0; 3.6K LY distant
 - NGC 2477: Open Cluster with an apparent magnitude of 5.8; 3.6K LY distant; contains about 300 stars; about 700 million years old



Meteor Showers

- Some of the best are listed below along with dates when the most meteors are visible
 - Quadrantids, January 3-4 (Comet 2003 EH1)
 - Lyrids, April 22-23 (Comet Thatcher)
 - Perseids, August 12-13 (Comet Swift-Tuttle)
 - Orionids, October 20-21 (Halley's Comet)
 - Leonids, November 17-18 (Comet Tempel-Tuttle)
 - Geminids, December 13-14 (Asteroid 3200 Phaethon)
 - Ursids, December 23-24 (Comet 8P/Tuttle)
- The name of each shower refers to the constellation to which the meteors trace their apparent paths



Upcoming Events

- Next Meeting: April 23, 2018
 - Primary Topic: Stellar Evolution
- Lyrids Meteor Shower
 - Possible weekend session - 20-22 April