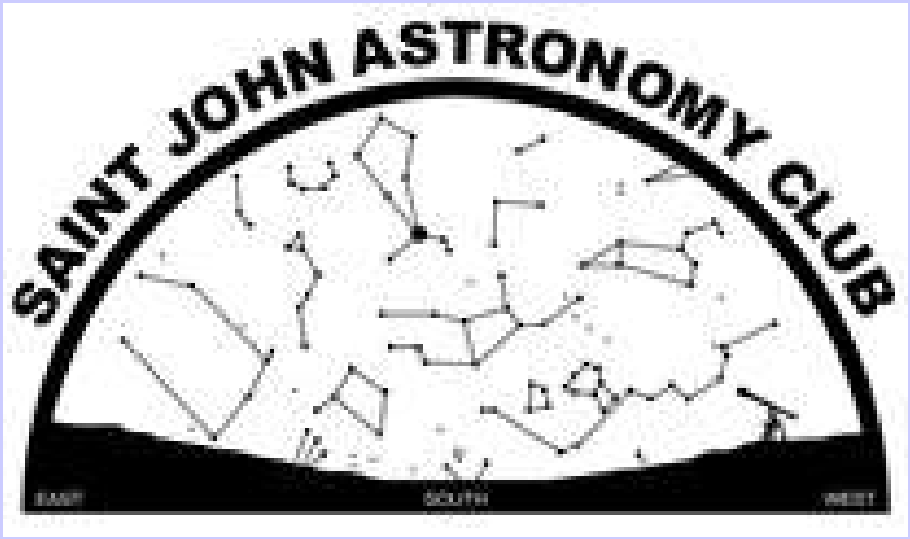
ROYAL ASTRONOMICAL SOCIETY OF CANADA

RASC OBSERVER

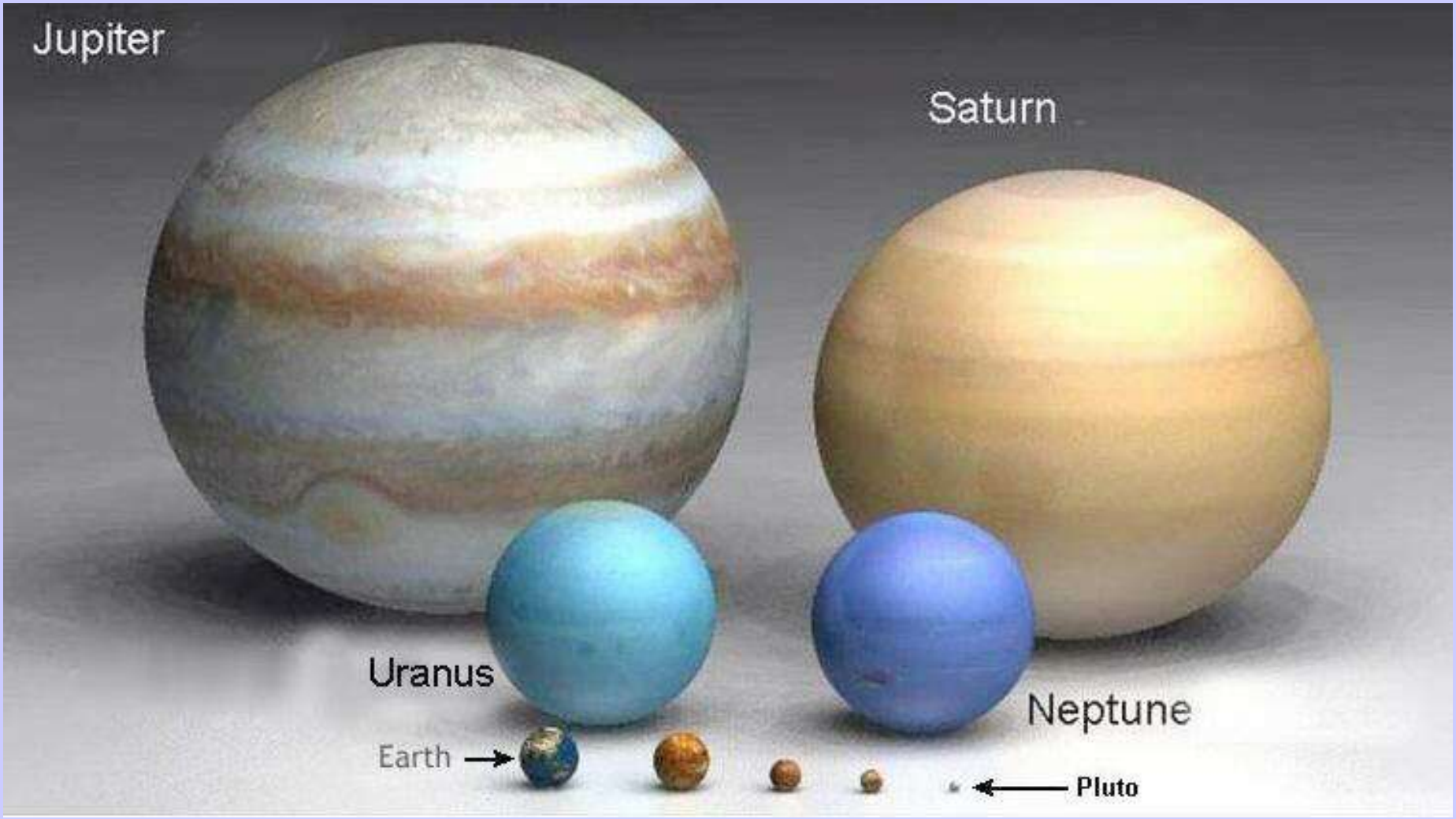
Explore the Universe Observing Certificate and Pin #3

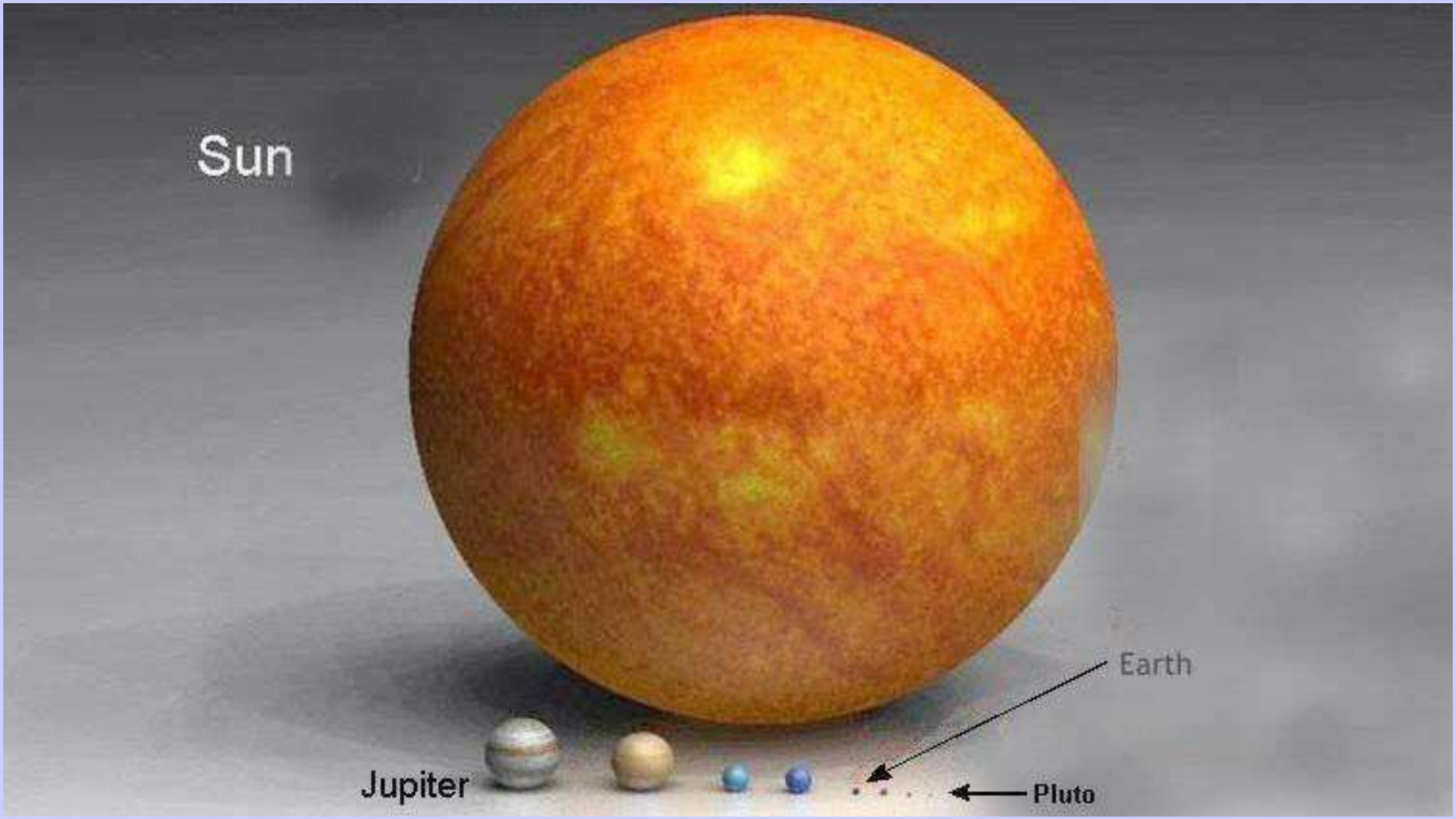


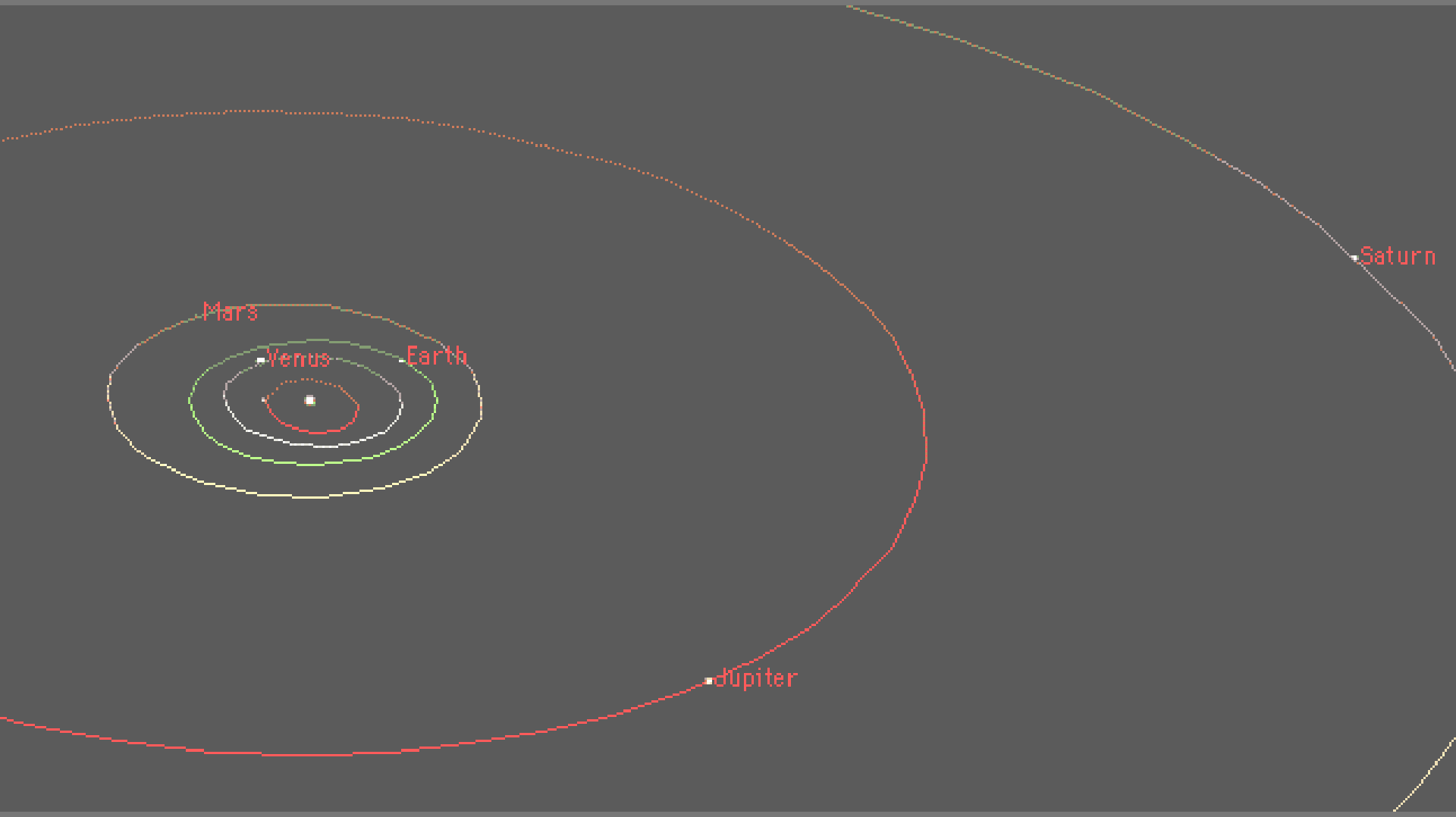
Lunar Phases (4 of 8)

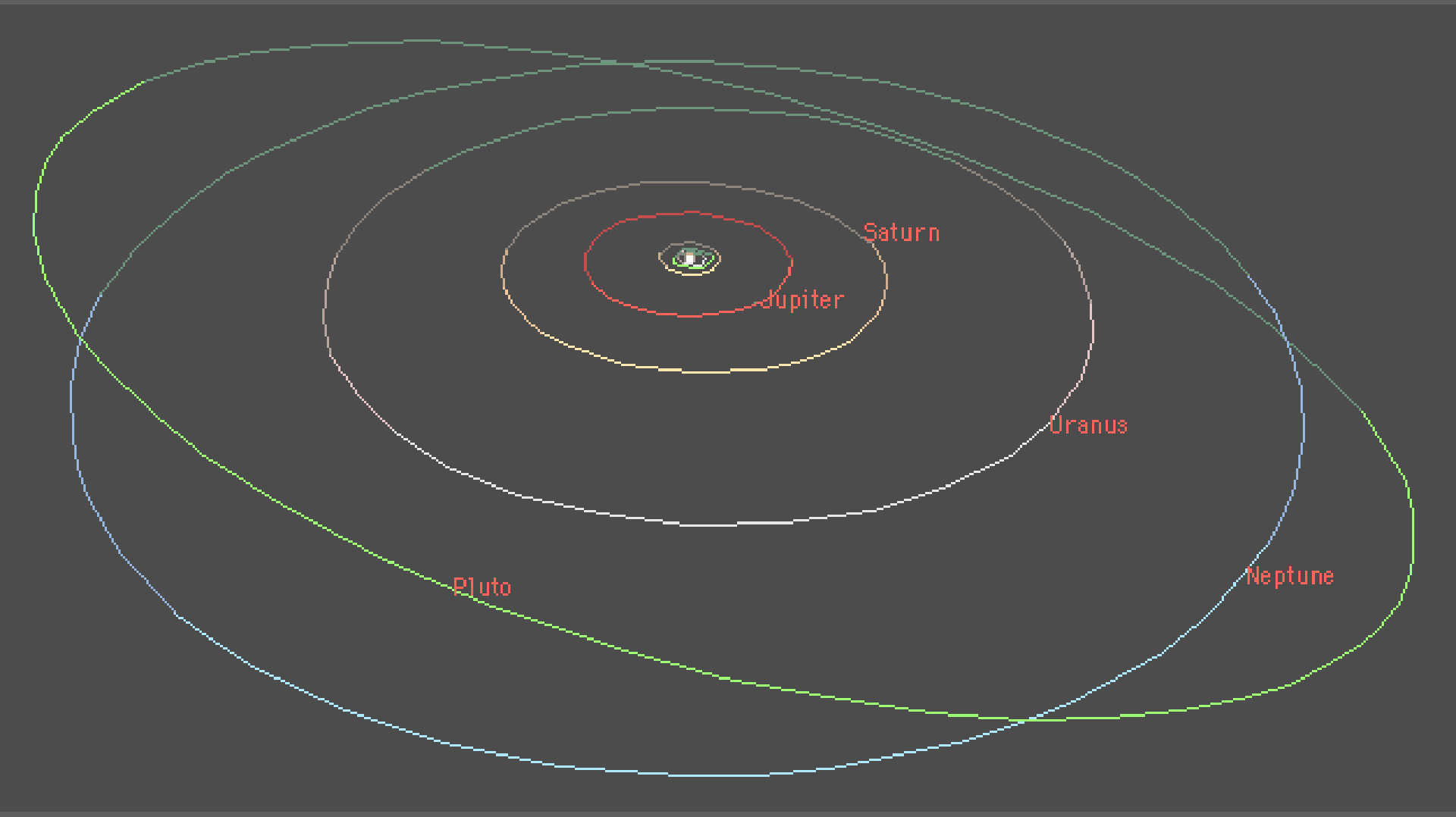
- Waxing Crescent – Day 3 seen within 3h of sunset
- First Quarter – within +- 18 hours
- Waxing Gibbous – 3-4 days after First Quarter
- Full Moon – within +- 18 hours
- Waning Gibbous – 3-4 days after Full Moon
- Third Quarter – within +- 18 hours
- Waning Crescent- Day 26 seen within 3h of sunrise
- Orbital Motion – track Moon's motion against stars

Formation of the Solar System


Jupiter
Saturn
Uranus
Neptune
Earth
Pluto

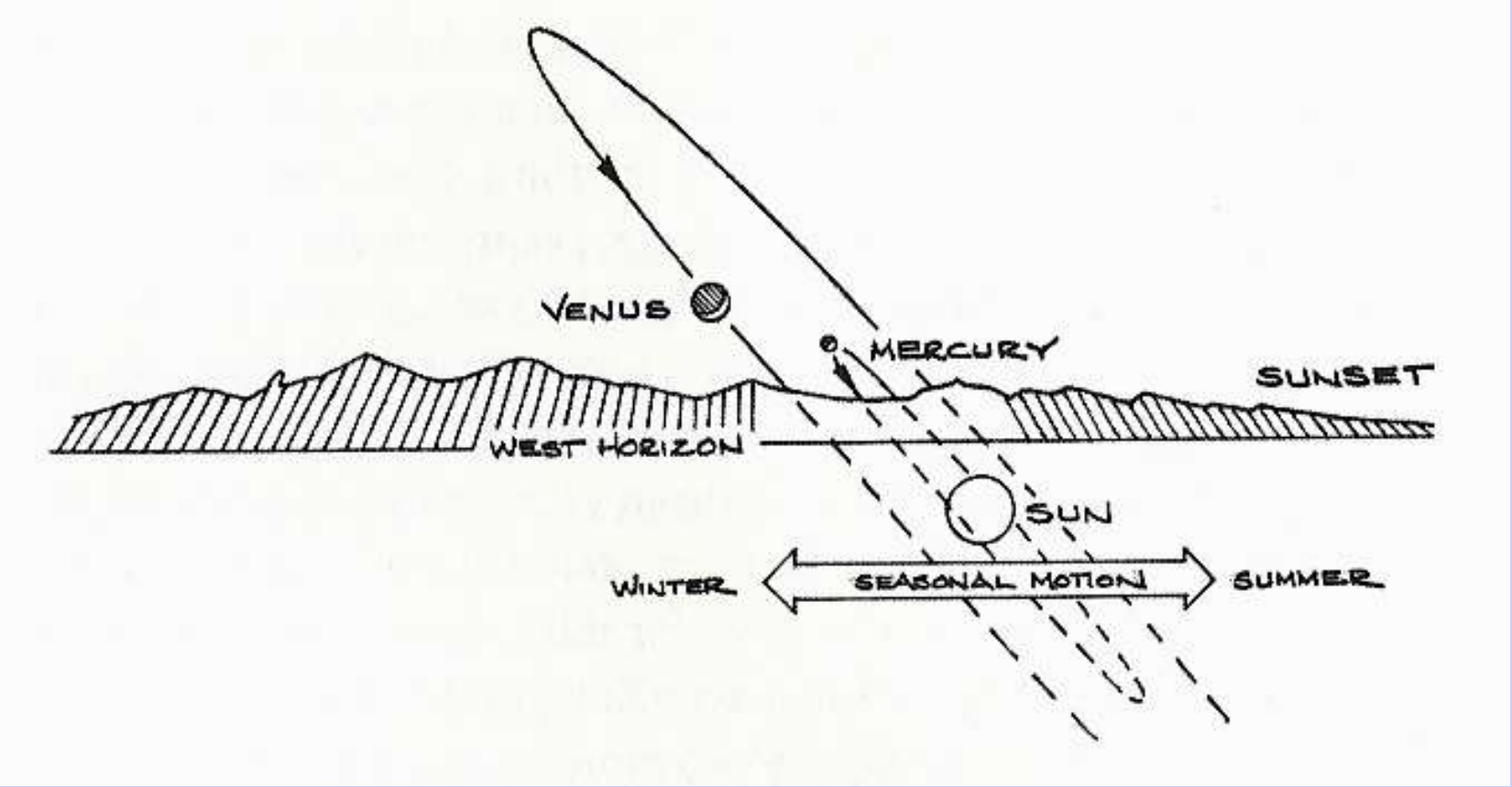

Sun
Earth
Jupiter
Pluto


Mars
Venus
Earth
Saturn
Jupiter


Saturn
Jupiter
Uranus
Pluto
Neptune

Inner Planets

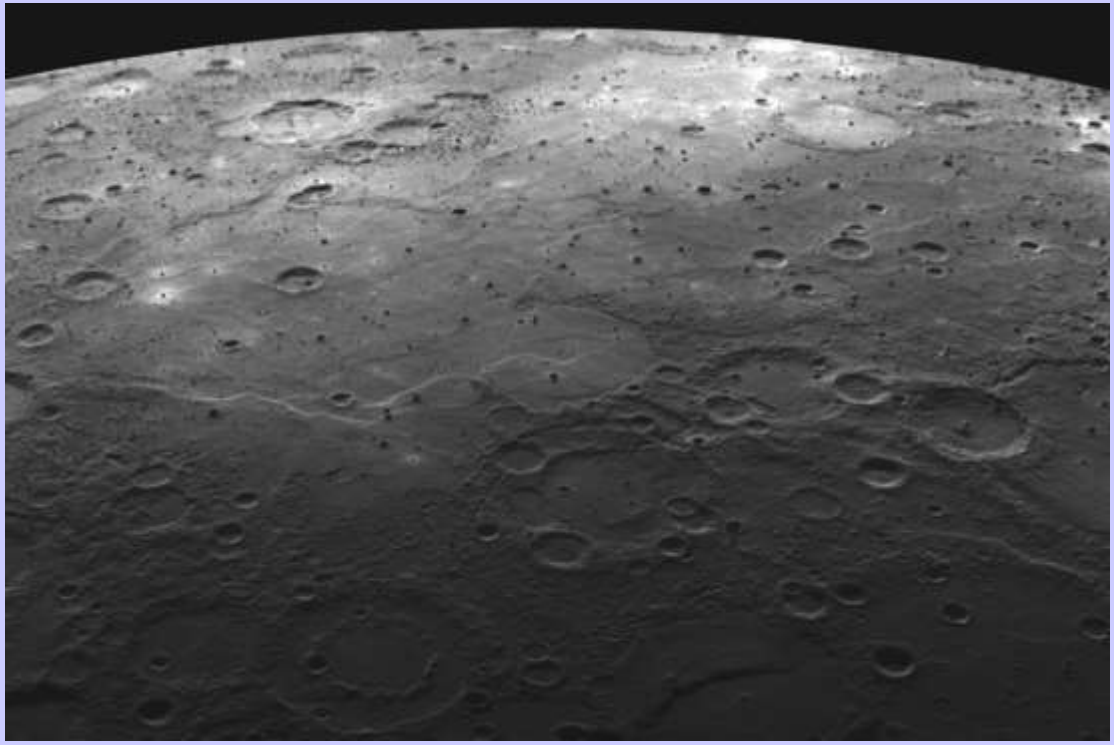
- **Move quickly through sky as the "morning star" or "evening star"**
- **Never seen overhead (except eclipse)**

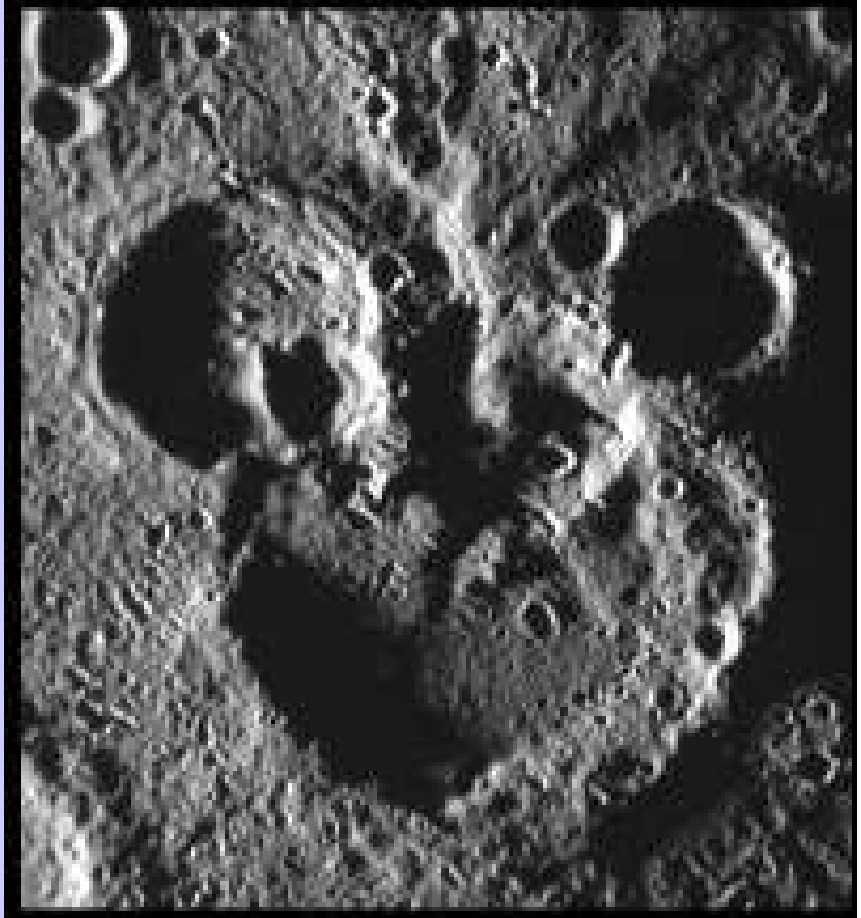


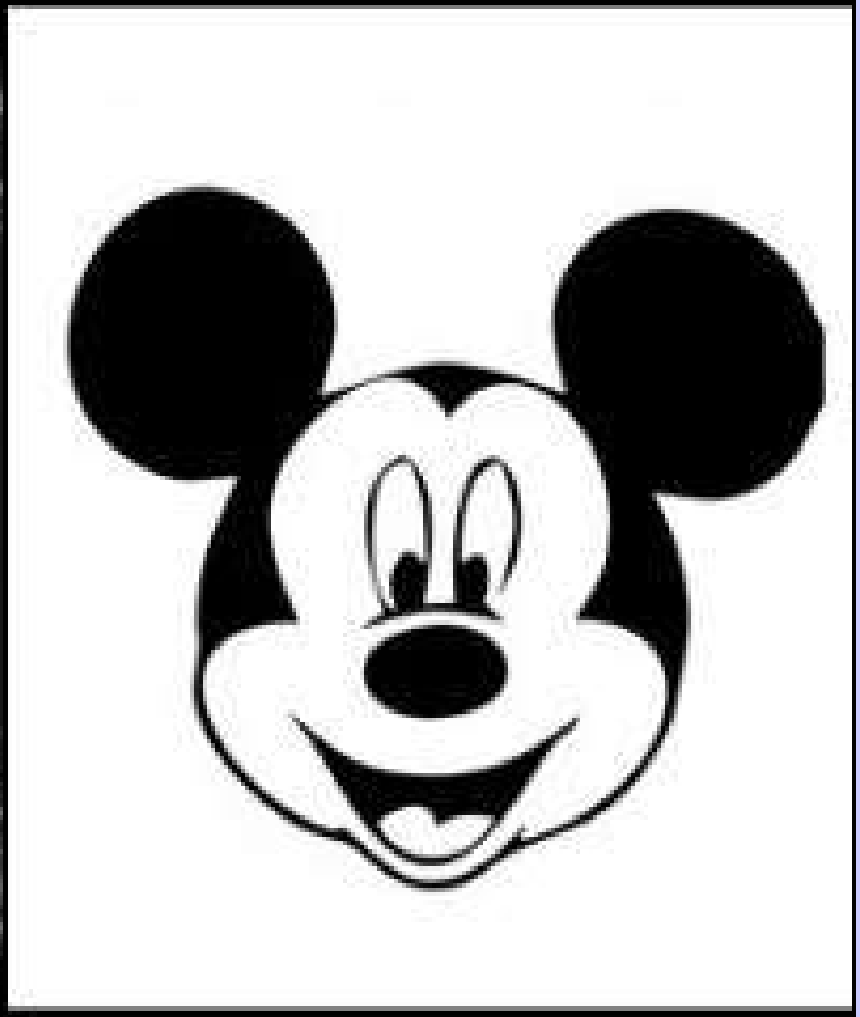
Mercury: Messenger of the Gods

- Year = 88 days
- Sidereal period of 116 days
- Seen morning or evening 6-7 times per year

- Usually need binos to see it
- Brighter nearer the Sun
- Best in spring evenings, autumn mornings





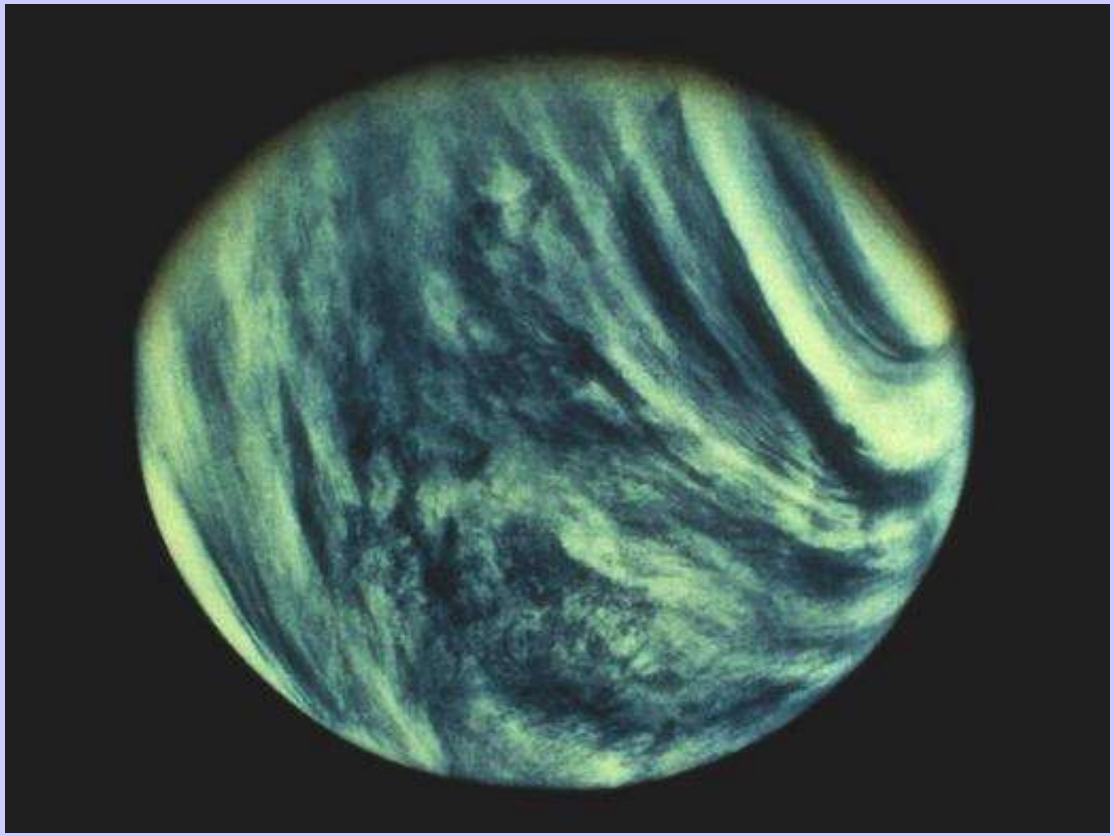


Mercury Craters TotallyLooksLike.com Mickey Mouse

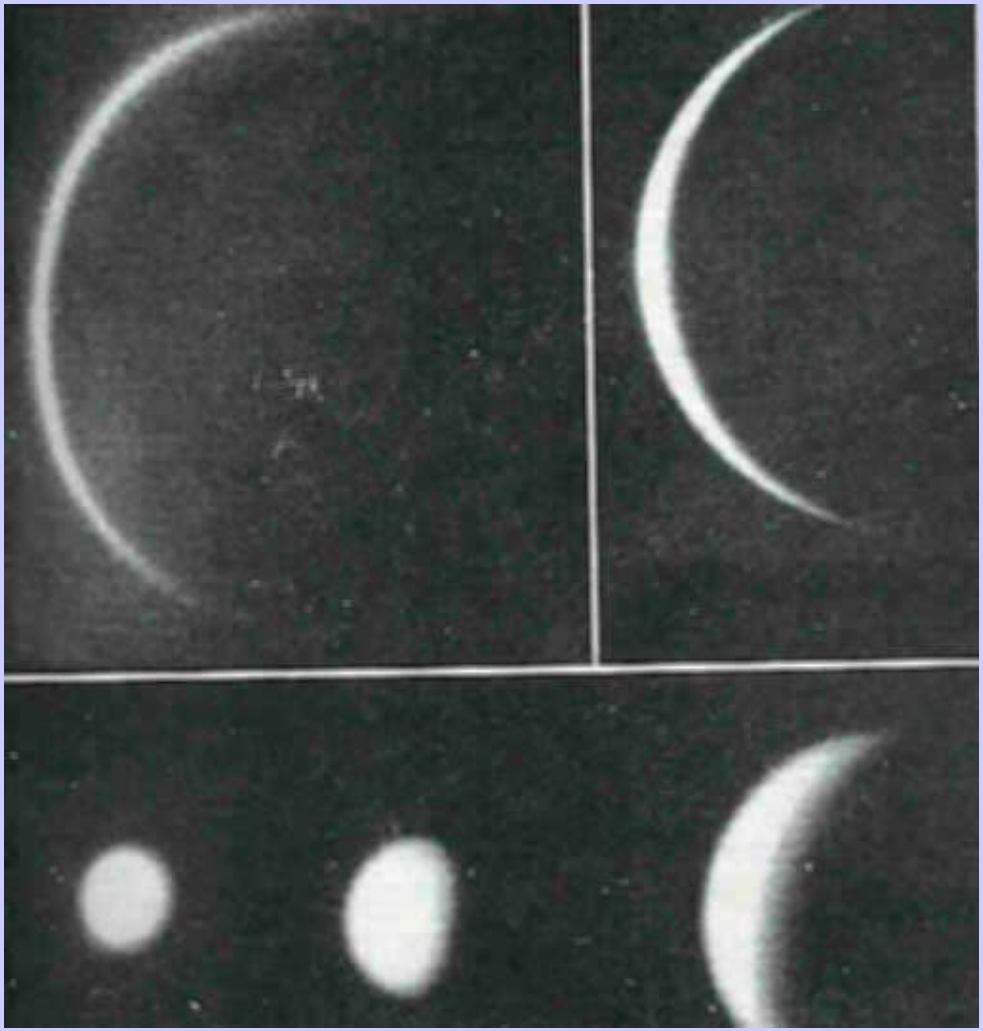
Venus – Goddess of Beauty

- Year = 225 d
- Synodic period of 585 days
- Seen morning or evening for 8 months

- 8 Earth years ~ 5 synodic periods
- Venus repeats 5 patterns every 8 years (morning and evening)



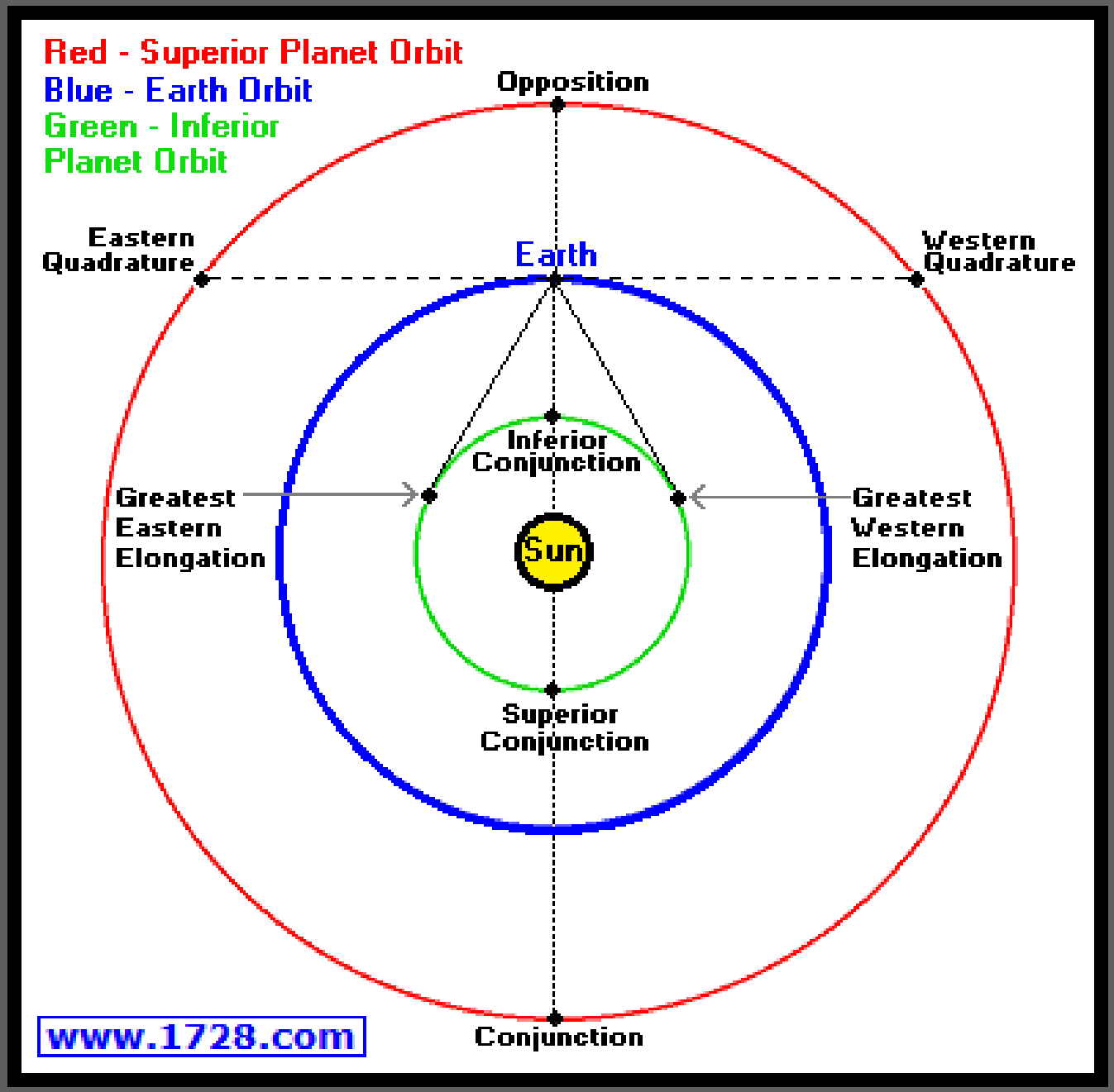
Observing Venus



Outer Planets

- **Conjunction: Earth–Sun–Planet (unseen)**
- **Opposition: Planet-Earth-Sun**
- **Retrograde motion near opposition**
- **Best observing near opposition because:**
  - **planet is closer, therefore larger in scope**
  - **high in late evening sky, less atmosphere**

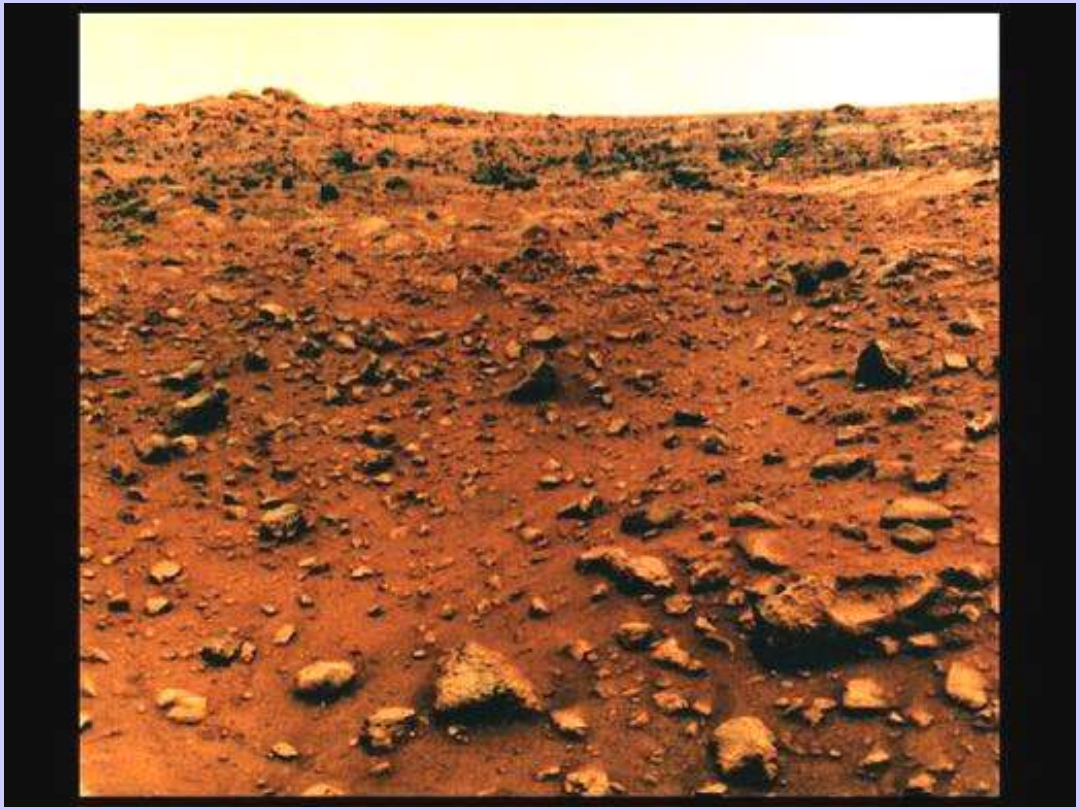
- **Conjunction also means two bodies appearing close together in the sky.**


Red - Superior Planet Orbit
Blue - Earth Orbit
Green - Inferior Planet Orbit
Opposition
Eastern Quadrature
Earth
Western Quadrature
Inferior Conjunction
Greatest Eastern Elongation
Sun
Greatest Western Elongation
Superior Conjunction
Conjunction
www.1728.com

Mars – God of War

- Year = 687 d
- Day = 24h 37m
- 25° tilt->seasons

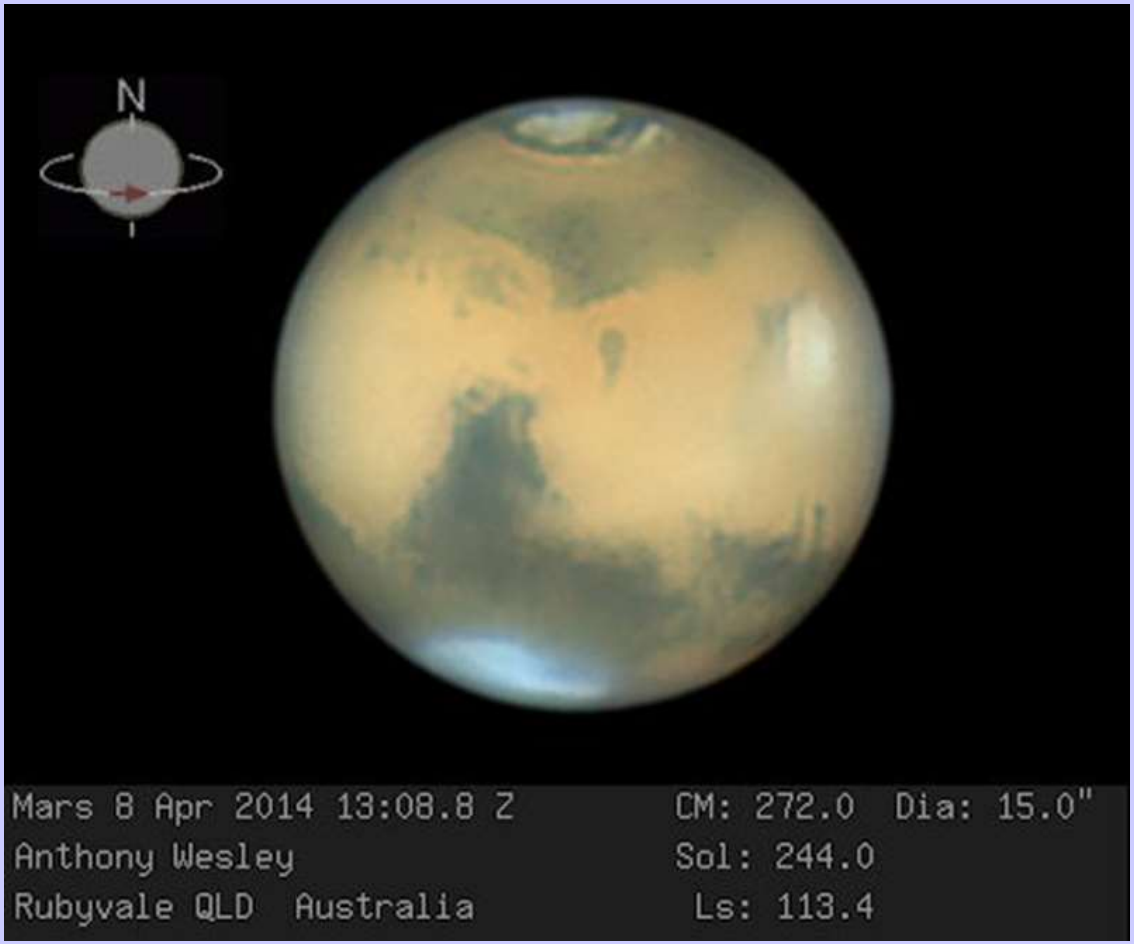
- thin atmosphere
- Iron in soil + O_2-> rust->blood->war
- 2 tiny moons



Observing Mars

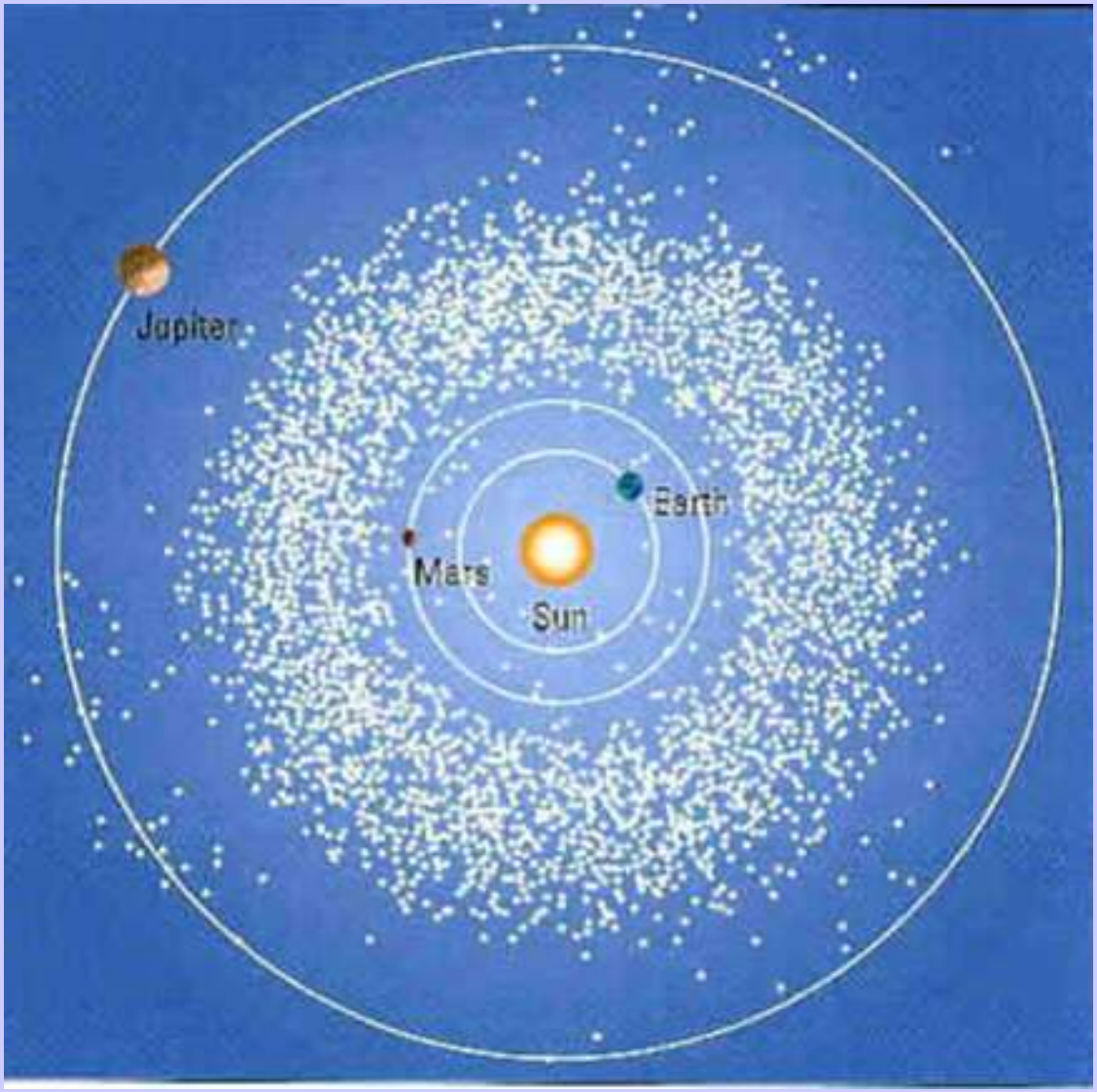
- Distinct orange
- Opposition every 2 years, 2 months
- Close opposition about every 15 years

- If steady air, can see dark marks & polar ice caps
- Dust storms can spoil everything



Asteroids aka Minor Planets

- Most between Mars & Jupiter, some within Earth's orbit
- Look like a star but move against the stars
- Ceres is now a dwarf planet
- Sketch the star field to see which moves, or
- Heavens-Above website

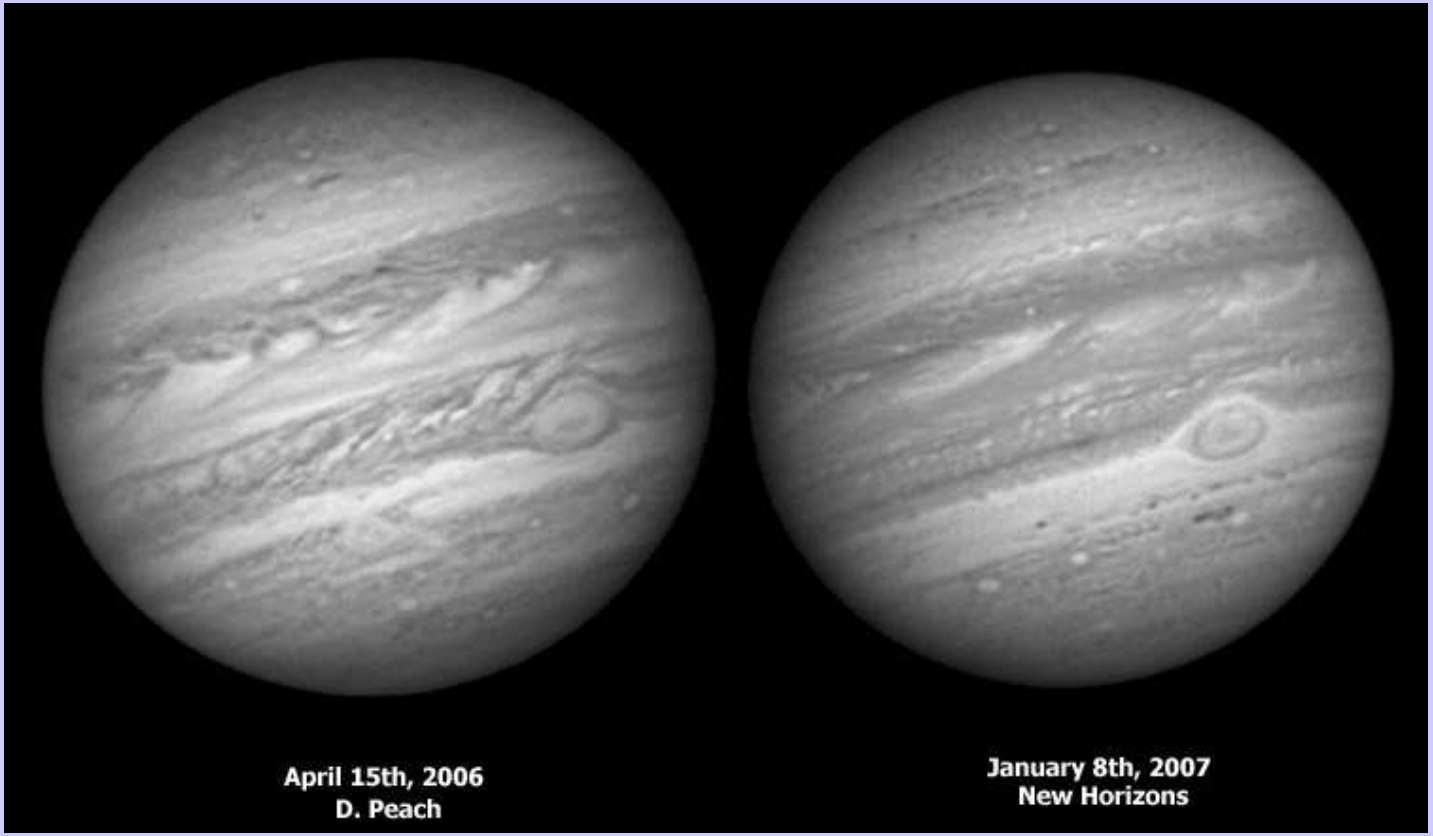


Jupiter – King of Gods

- Year = 11.9 years
- Day = ~ 10 h

- 79 moons, we see 4 in binos or scope
- Moons change position nightly
- Maps of moon locations in magazines
- Largest planet and usually second brightest

Observing Jupiter



- Dark belts, light zones
- Loops, swirls, spots between belts & zones;
- Great Red Spot

Jupiter: Galilean Moons

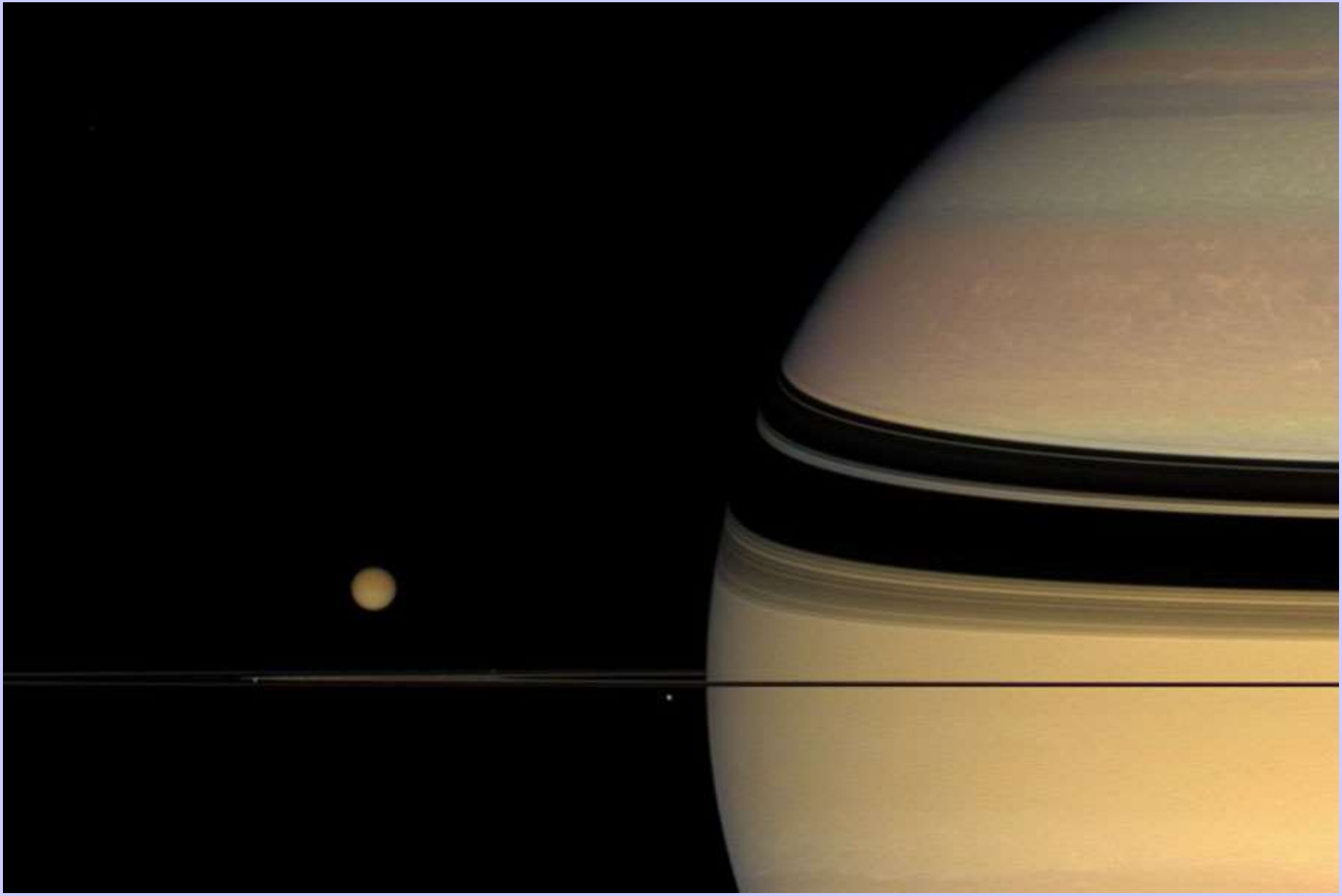
Paul Owen's Red Spot & Shadow

Saturn – God of Agriculture

- Year = 29.5 years
- Day = 10 h, 39 m
- Tilt = 27°

- Rings: ice particles
- 273,000 km x 30 m
- 62 moons, can see 1 with binos (Titan)

- Looks elongated in binoculars, spectacular in a telescope

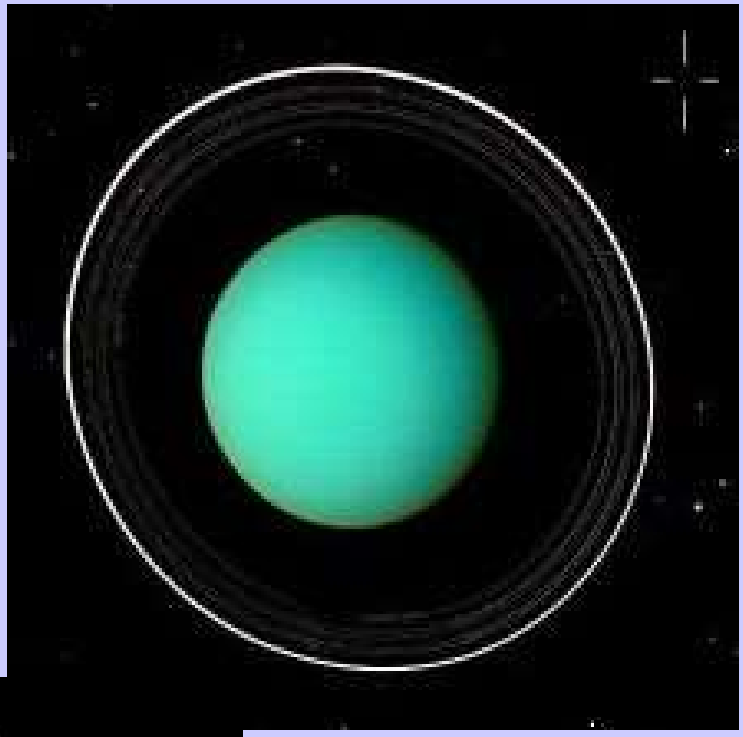


Uranus

Father of Titans

- Year = 84 years
- Day = 17 h 14 m

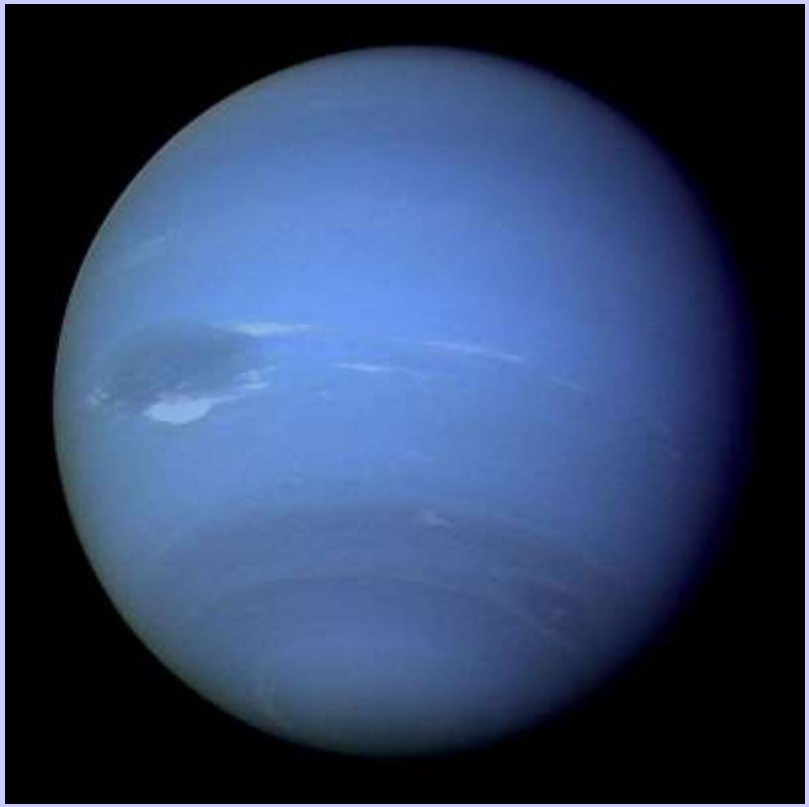
- Tilt = 83°
- 1781 by W Herschel
- Pale green disc in scope, easy in binos
- 27 moons



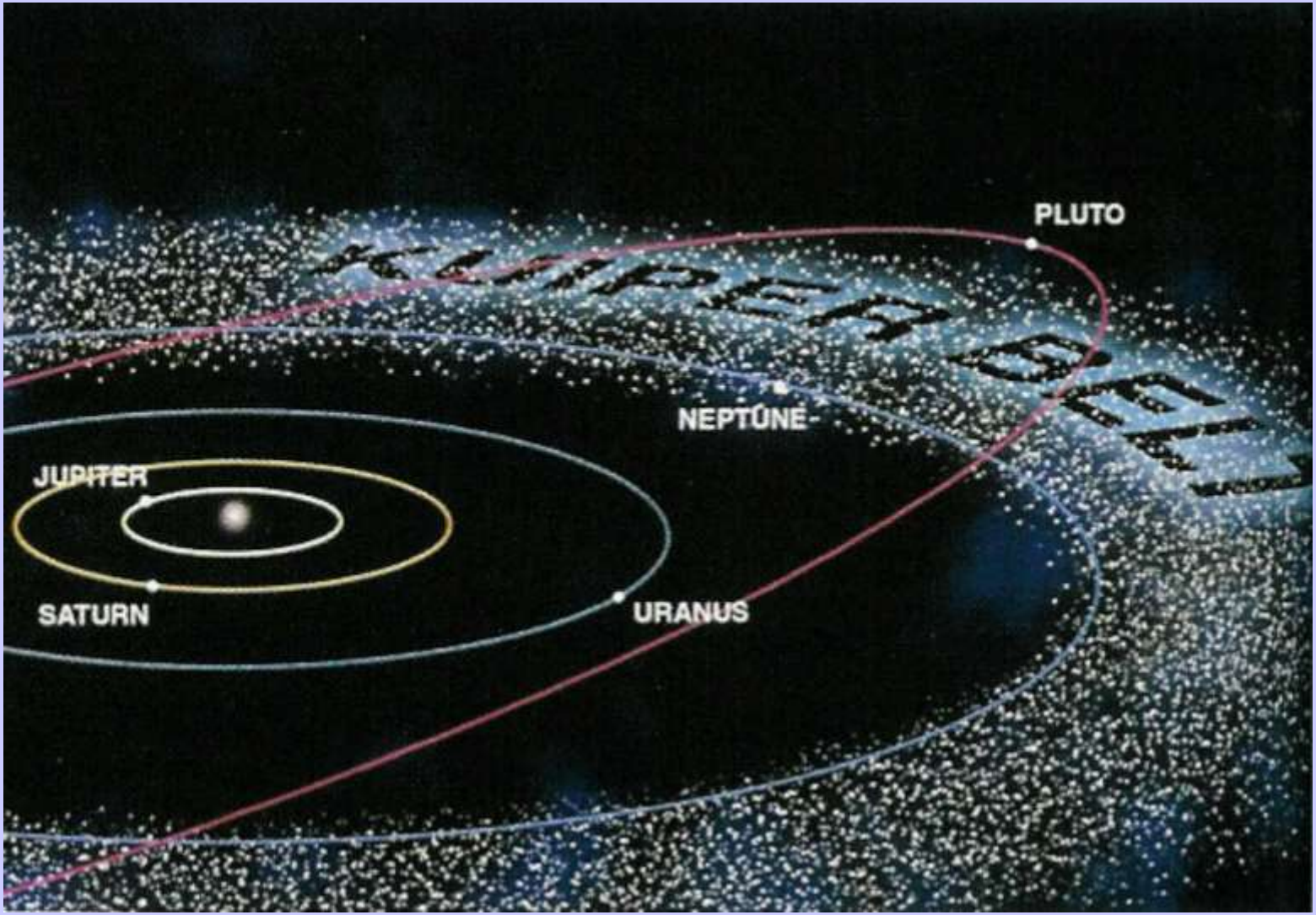
Neptune – God of the Seas

- **Year = 165 years**
- **Day = 16 h, 7 m**

- **Predicted (1845/6)**
- **Can be seen in binos**
- **14 moons**



Kuiper Belt



Comets

- Reside in Kuiper Belt (periodic) or Oort Cloud
- Dirty snowball; ice evaporates, dust tail from sunlight pressure
- Ion tail away from Sun
- Best in binos
- No sharply defined edges

Hale-Bopp

17P/Holmes

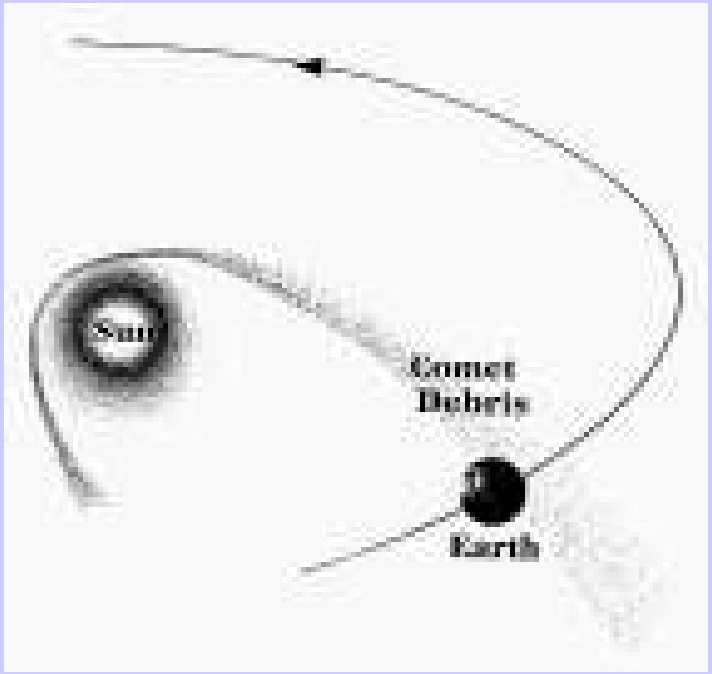
Zodiacal Light

- **Sunlight reflecting off bits of dust in ecliptic**
- **Wedge shape reaching halfway up the sky**
- **Best 2 weeks after Full Moon in spring (west), 2 weeks before Full Moon in fall (east) when ecliptic is steep**

Meteor Photo

Meteor Showers

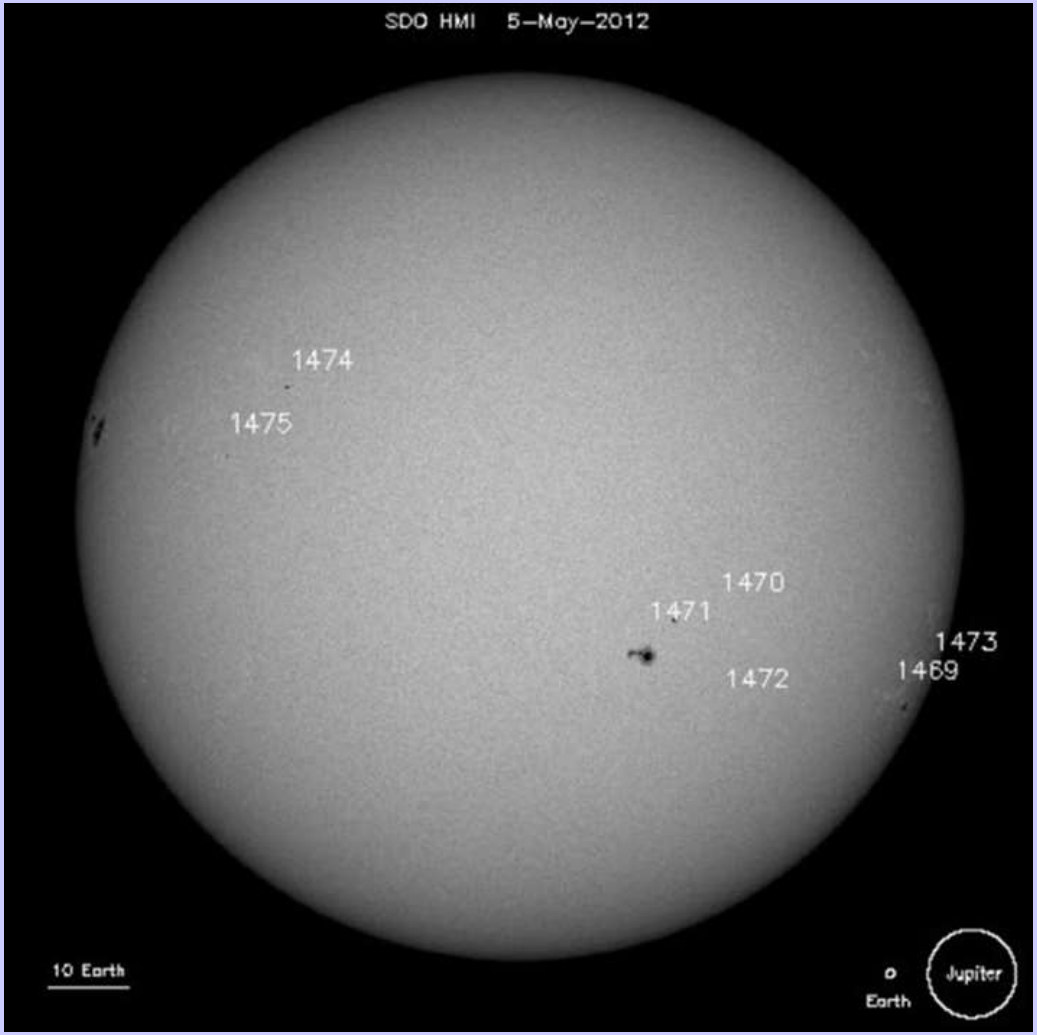
- Earth through comet trail
- Radiant – apparent point of origin, all directions
- Occur same time each year, best seen in dark skies with radiant high
- 10 – 100 per hour
- Shower named for constellation of radiant; Perseids (Aug), Leonids (Nov), Geminids (Dec)
- Meteor storm: > 1000/h



Perseid Shower peak August 12

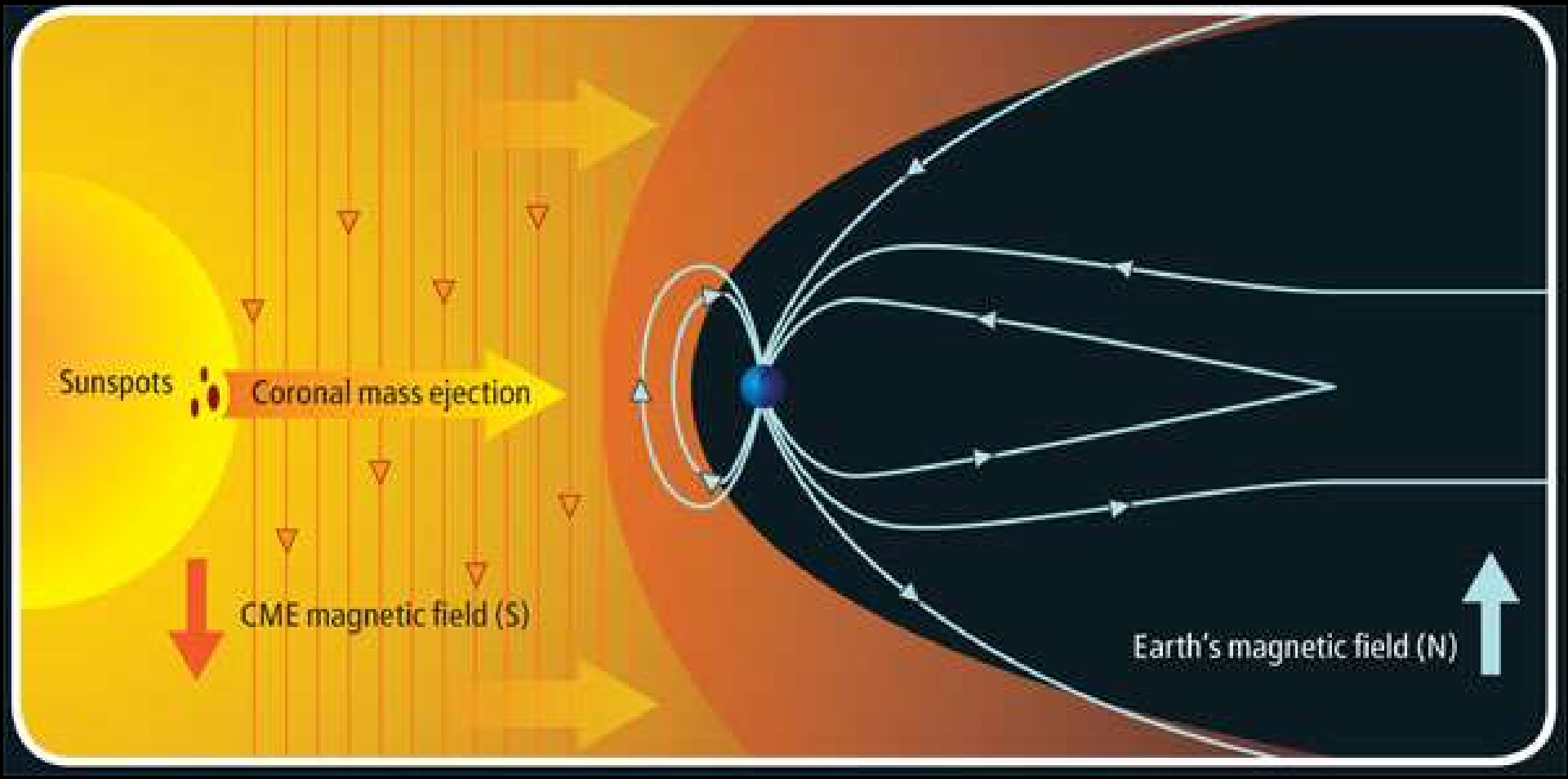
Solar Observing

- **Special filters are an absolute MUST**
- **Sunspots vary in number over 11 year cycle**
- **Areas below the surface ~ 1000C cooler – look dark**
- **Note gray penumbra, bright faculae**



The Chromosphere layer of the Sun can be detected with a telescope that looks for the red light it gives off, called Hydrogen-alpha light.

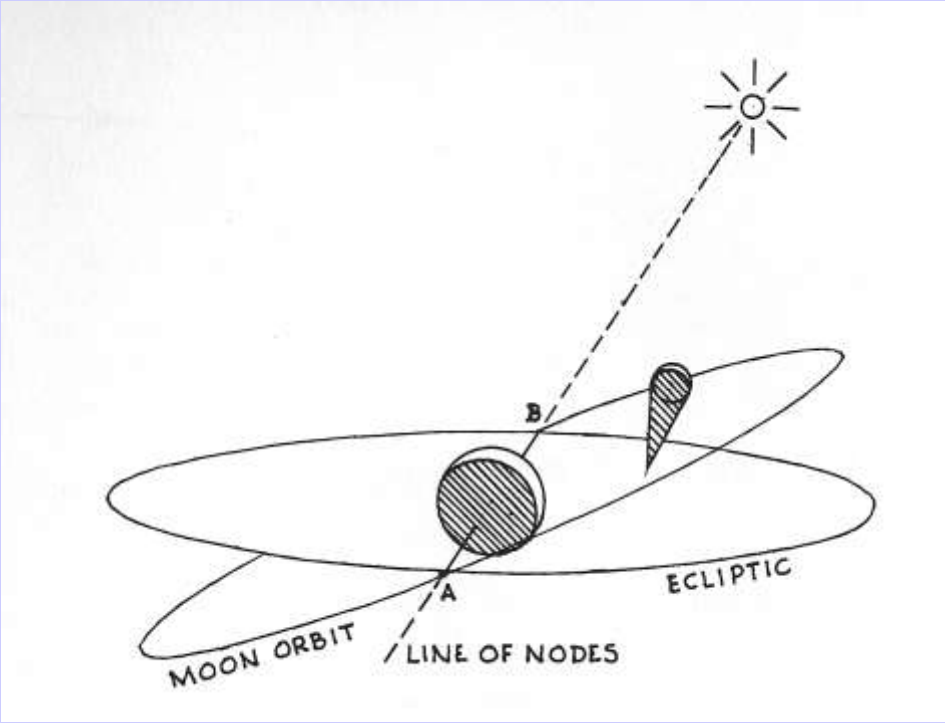
GEOMAGNETIC STORMS



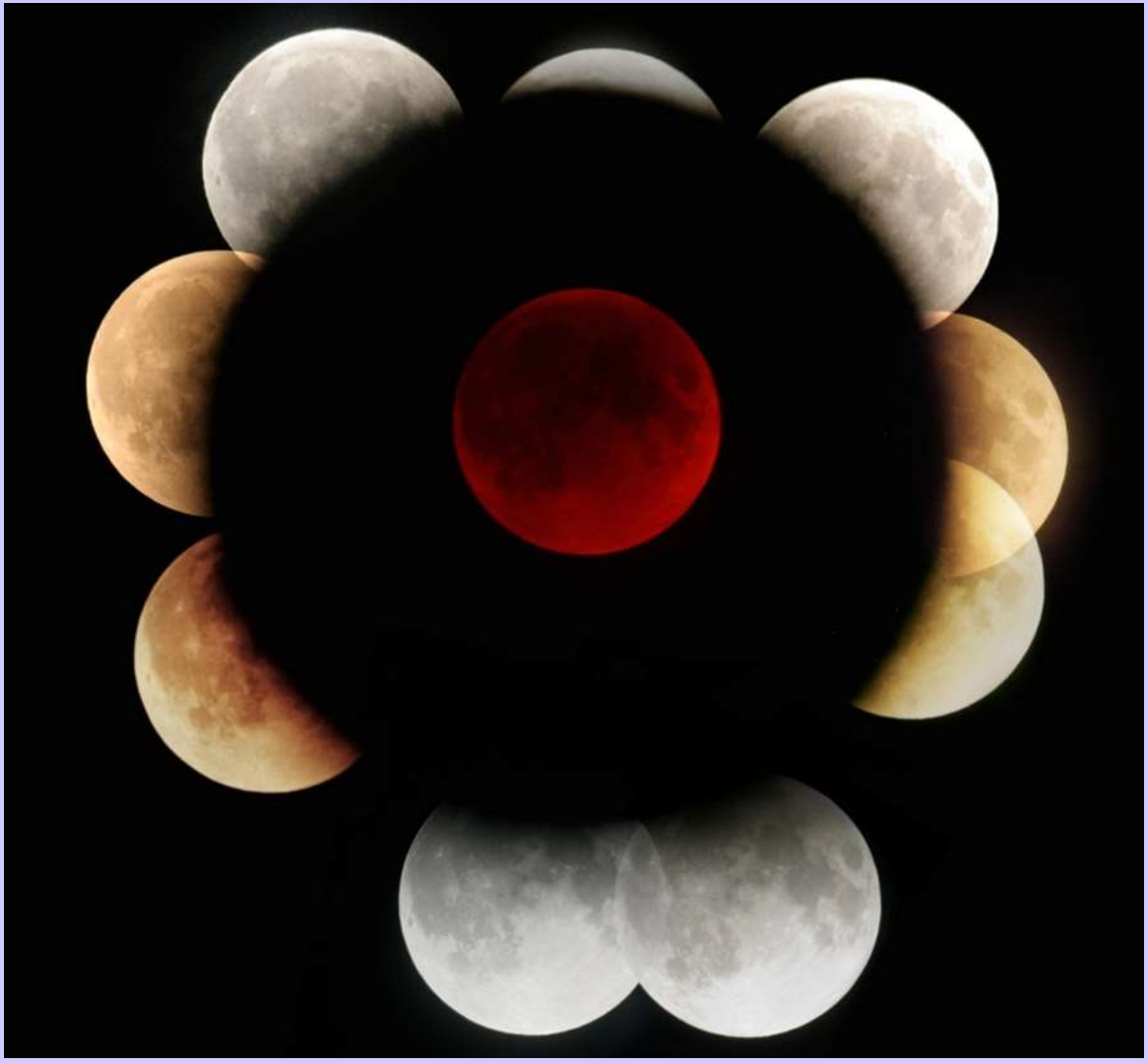
View from 5 Fathom Hole

Eclipses – Moon & Sun

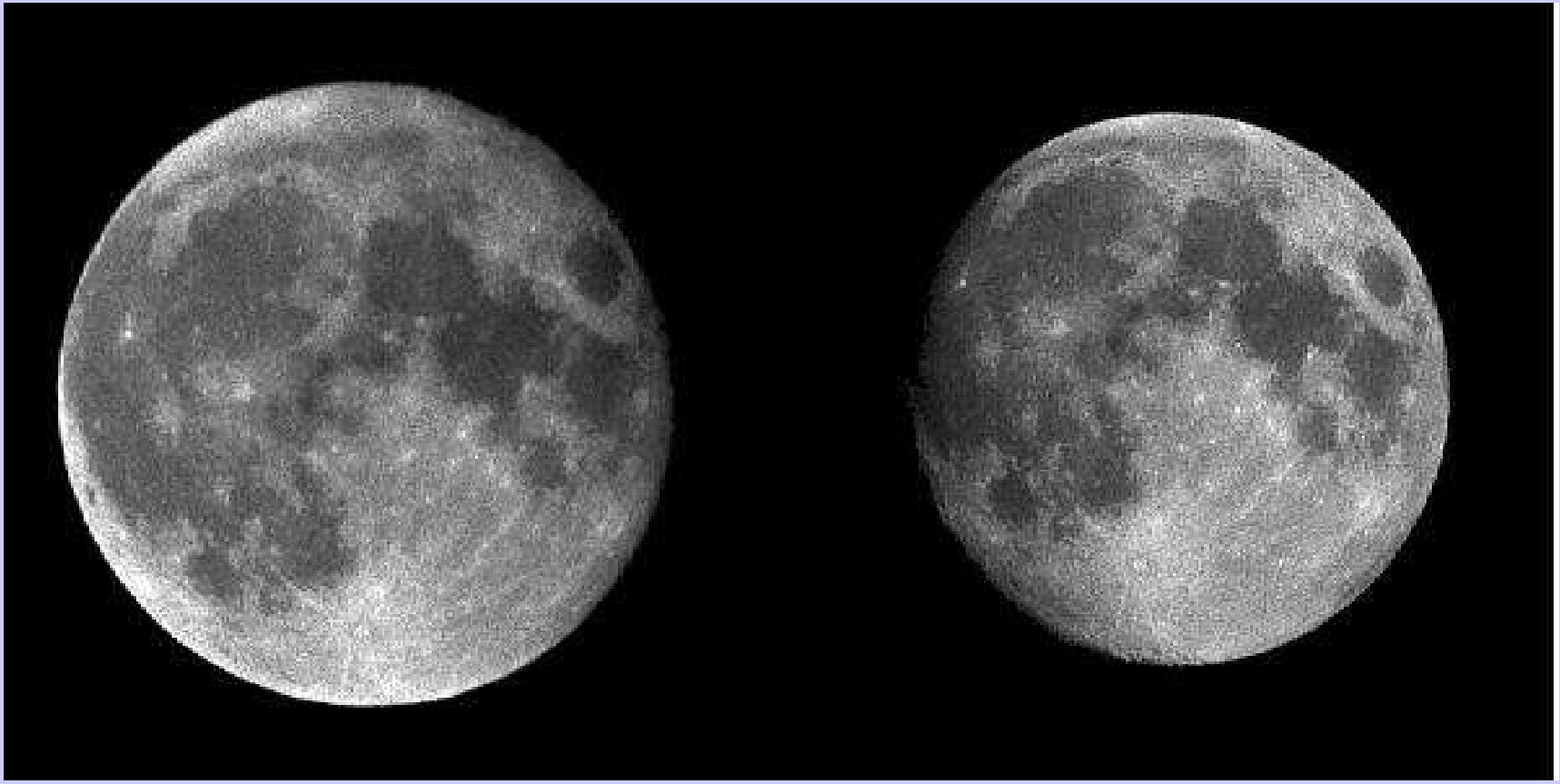
- **Sun & Moon about same size in the sky**
- **Moon's inclination 5°**
- **Orbit wobbles with 18.6 year period; eclipse period few weeks earlier**
- **Eclipses occur if Moon near ecliptic when Full (lunar) or New (solar)**



Earth's Shadow

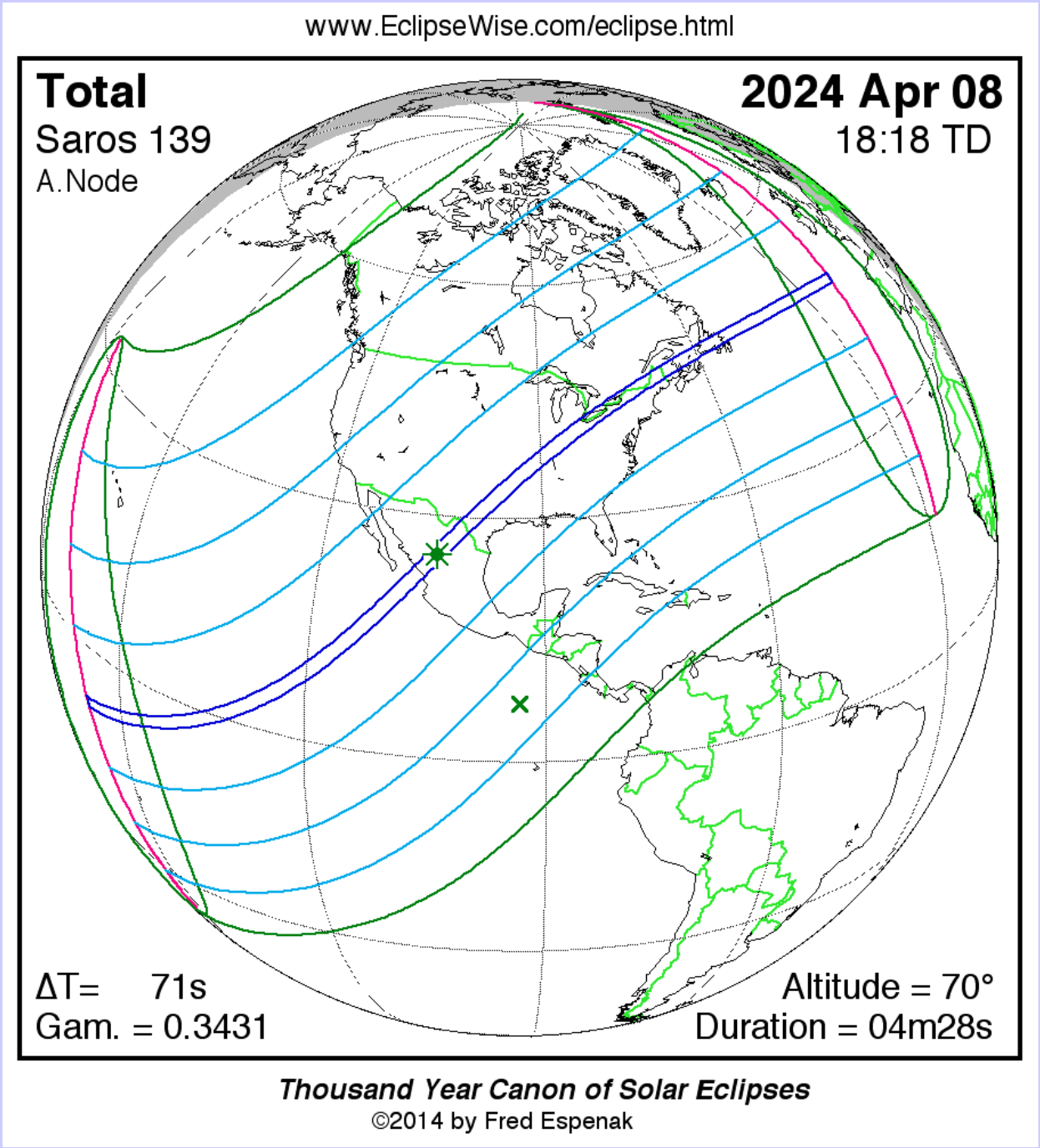


Moon at Perigee and Apogee



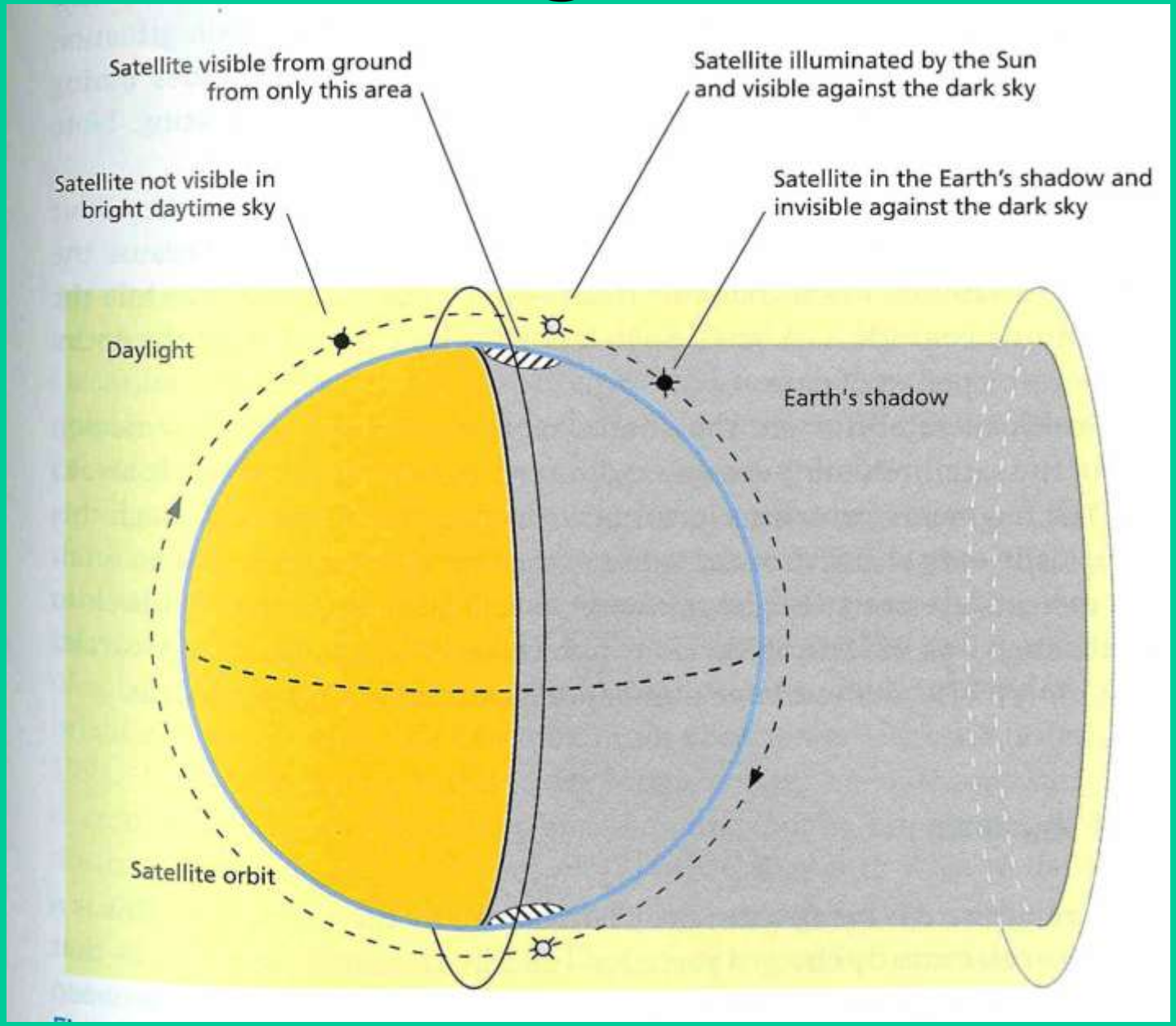
Solar Eclipses

- **Types: total, annular, partial**
- **Next partial eclipse here: June 10, 2021**
- **Next total eclipse here: April 8, 2024**


www.EclipseWise.com/eclipse.html
Total
Saros 139
A.Node
2024 Apr 08
18:18 TD
ΔT= 71s
Gam. = 0.3431
Altitude = 70°
Duration = 04m28s
Thousand Year Canon of Solar Eclipses
©2014 by Fred Espenak

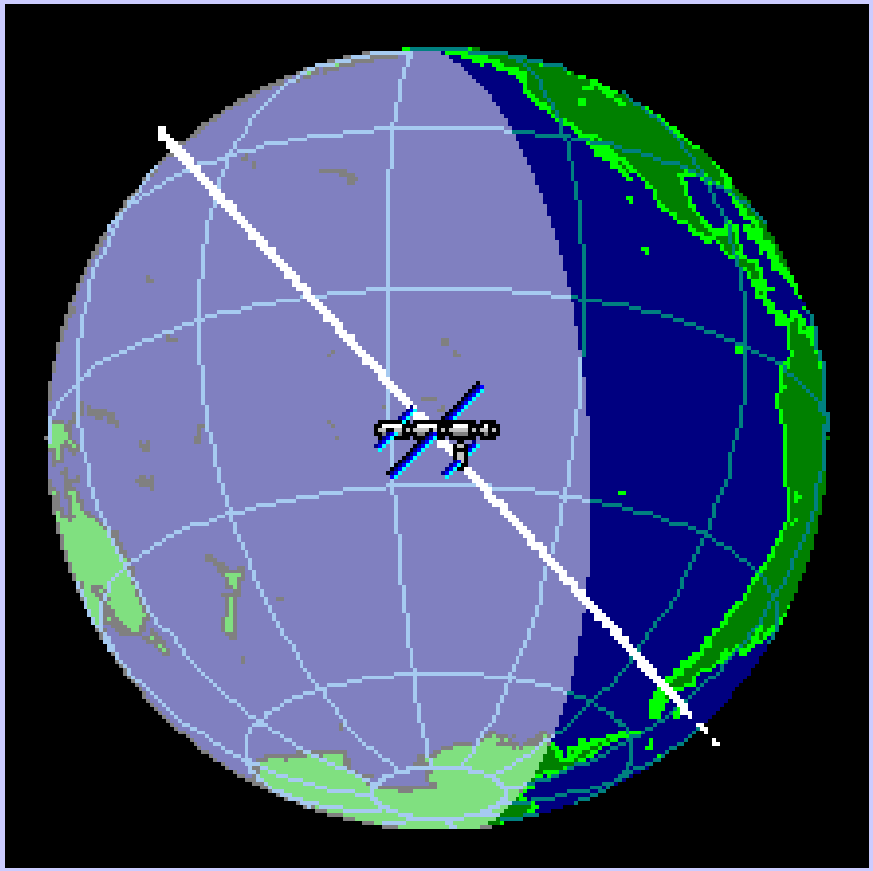
April 8 2024

Watching Satellites



Satellite Information

- Heavens-Above.com
- Create log-in name/pass
- Select location (menu)
- Gives info on ISS (space station), Iridium phone satellites, HST, others
- Solar system overview, constellations, star maps: Good all-round website



Heavens-Above.com

Date	Mag	Start			Highest Point			Ends		
		Time	Alt.	Az.	Time	Alt.	Az.	Time	Alt.	Az.
31 Oct	-0.7	19:22:37	10	NW	19:23:15	15	NW	19:23:15	15	NW
1 Nov	-2.7	18:34:51	10	NNW	18:37:56	236	NE	18:39:44	20	ESE
2 Nov	-0.2	19:24:21	10	W	19:26:28	16	SW	19:28:35	10	SSW
3 Nov	-1.5	18:35:19	10	WNW	18:38:24	35	SW	18:41:29	10	SSE