What's Up?

Highlighting the Near and Deep Sky

June 2024

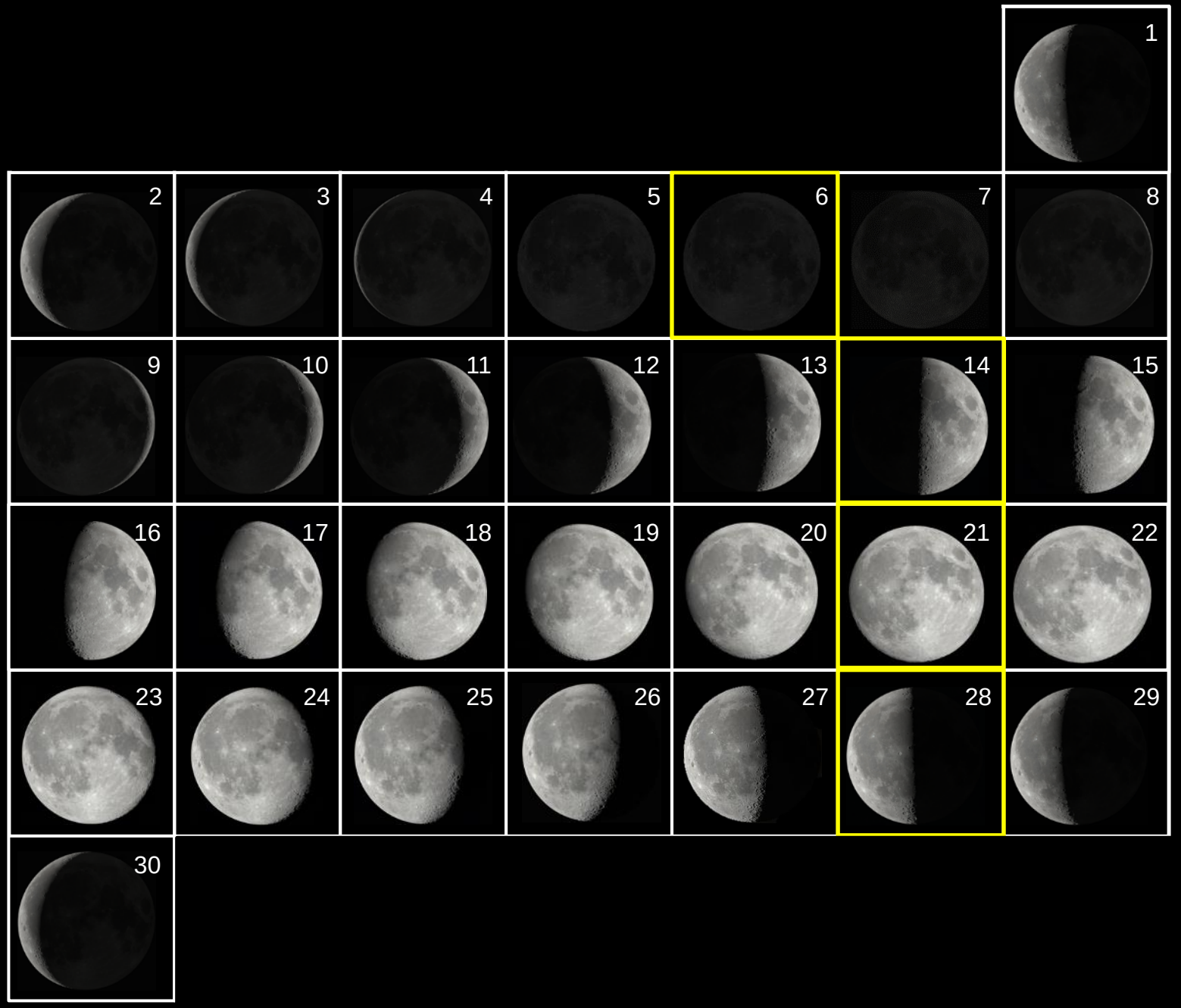
Moon Phases

New Moon
June 6
8:40am

First Quarter
June 14
1:19am

Full Moon
June 21
9:10pm

Last Quarter
June 28
5:55pm

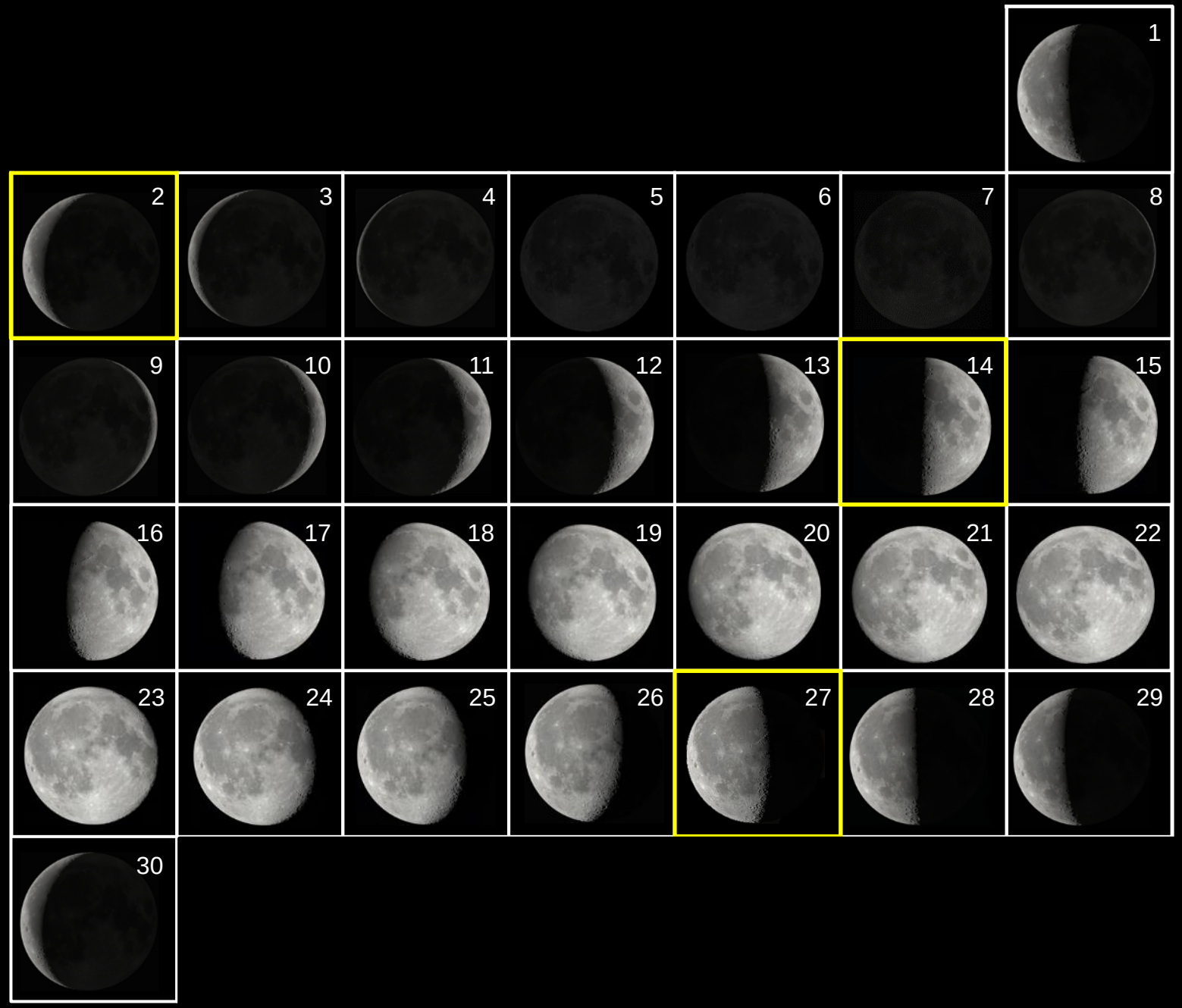


Moon Apsides

Perigee
June 2, 3:16am
228,728 miles
(368,102 km)

Apogee
June 14, 9:35am
251,082 miles
(404,077 km)

Perigee
June 27, 7:30am
229,464 miles
(369,286 km)



(Some) Forces on the Moon

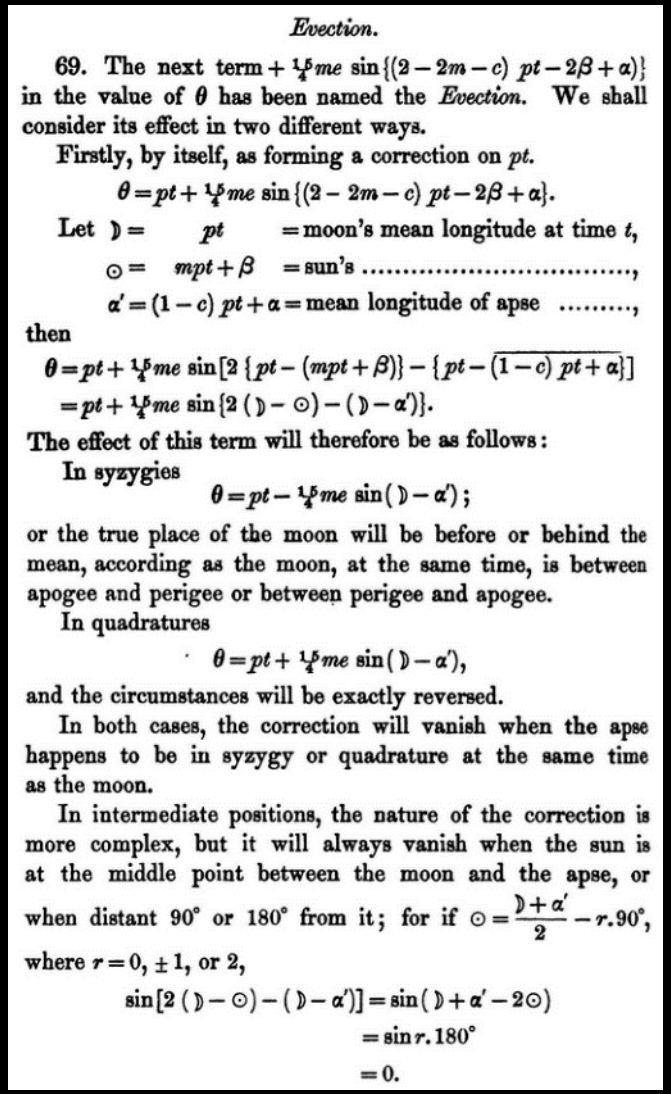
Evection

- Formerly called the Moon's second anomaly, and Latin for "carrying away."
- Short version: The gravitational pull by the Sun changes throughout the Moon's already-elliptical orbit as distance changes, sometimes aided and sometimes impeded by the gravitational pull of the Earth.

Variation

- That gravitational pull of the Earth is stronger at perigee and weaker at apogee, and each of these can occur at varying places in the Moon's orbit (sometimes during syzygy alignment, sometimes during quadrature, most of the time in between).

These forces result in a 205.89 day cycle of perihelion/aphelion distances, mostly from evection with a small contribution from variation.



Evection.

69. The next term $+ \frac{5}{4} me \sin\{(2-2m-c)\ pt - 2\beta + \alpha)\}$ in the value of θ has been named the *Evection*. We shall consider its effect in two different ways.

Firstly, by itself, as forming a correction on pt.

$$\theta = pt + \tfrac{5}{4} me \sin\{(2-2m-c)\ pt - 2\beta + \alpha\}.$$

Let $☽ = pt$ = moon's mean longitude at time t,

$⊙ = mpt + \beta$ = sun's .....,

$\alpha' = (1-c)\ pt + \alpha$ = mean longitude of apse .....,

then

$$\theta = pt + \tfrac{5}{4} me \sin[2\{pt - (mpt + \beta)\} - \{pt - \overline{(1-c)\ pt + \alpha}\}]$$
$$= pt + \tfrac{5}{4} me \sin\{2(☽ - ⊙) - (☽ - \alpha')\}.$$

The effect of this term will therefore be as follows:

In syzygies

$$\theta = pt - \tfrac{5}{4} me \sin(☽ - \alpha');$$

or the true place of the moon will be before or behind the mean, according as the moon, at the same time, is between apogee and perigee or between perigee and apogee.

In quadratures

$$\theta = pt + \tfrac{5}{4} me \sin(☽ - \alpha'),$$

and the circumstances will be exactly reversed.

In both cases, the correction will vanish when the apse happens to be in syzygy or quadrature at the same time as the moon.

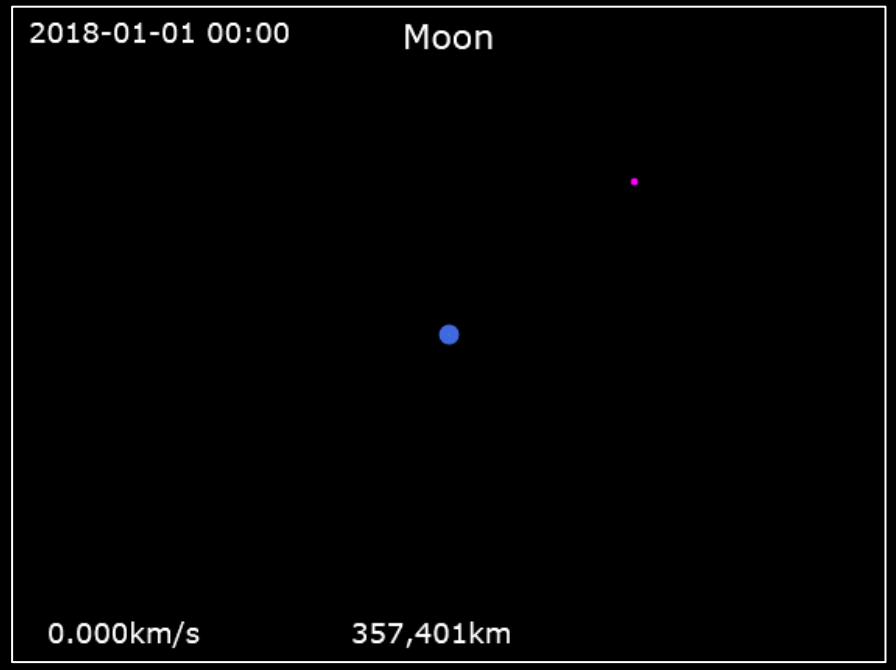
In intermediate positions, the nature of the correction is more complex, but it will always vanish when the sun is at the middle point between the moon and the apse, or when distant 90° or 180° from it; for if $⊙ = \frac{☽ + \alpha'}{2} - r.90°$, where $r = 0, \pm 1$, or 2,

$$\sin[2(☽ - ⊙) - (☽ - \alpha')] = \sin(☽ + \alpha' - 2⊙)$$
$$= \sin r.180°$$
$$= 0.$$

Lunar Precession

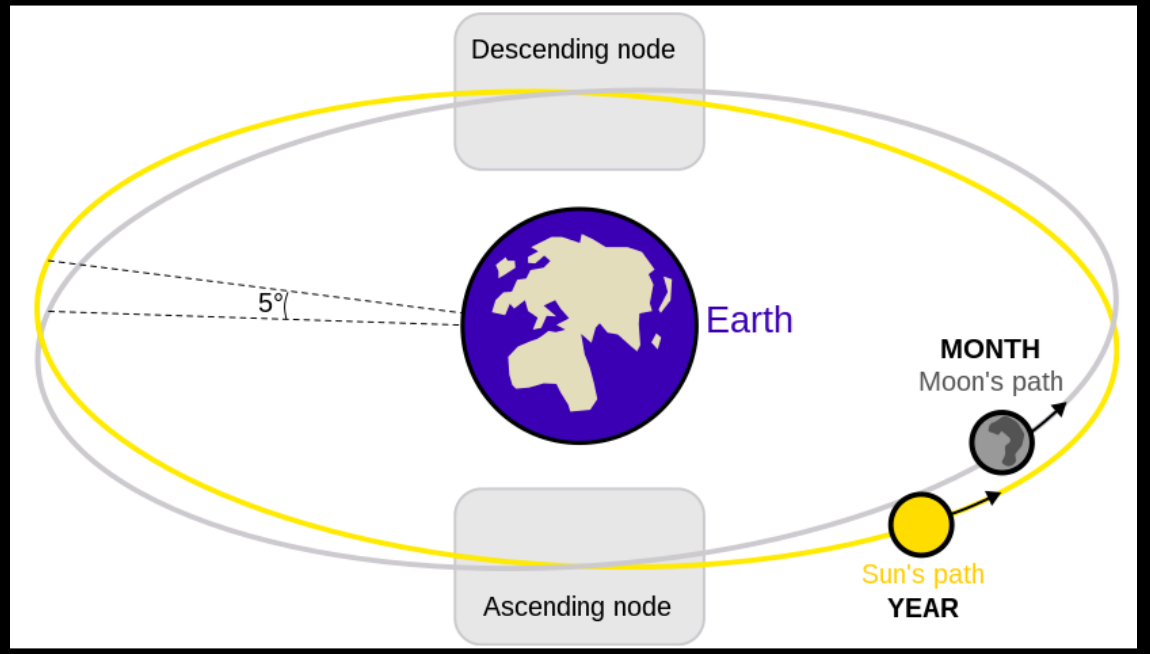
Apsidal Precession

- The major axis of the Moon's orbit (from perihelion to aphelion) makes a full rotation to the east every 8.85 years.

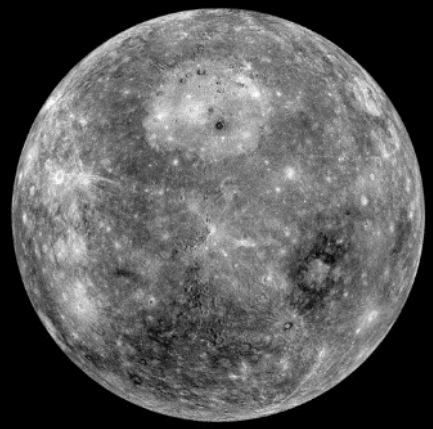
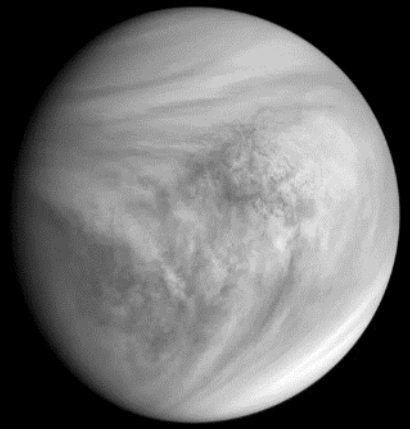
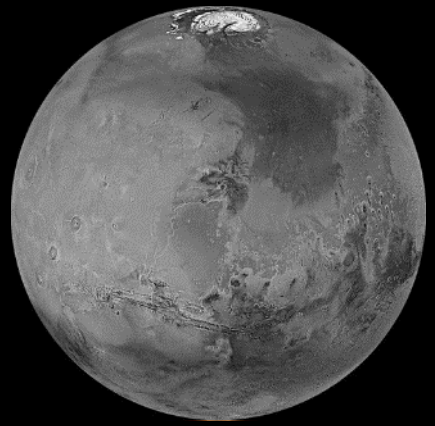
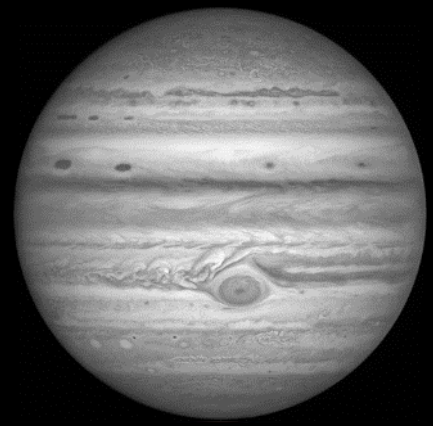
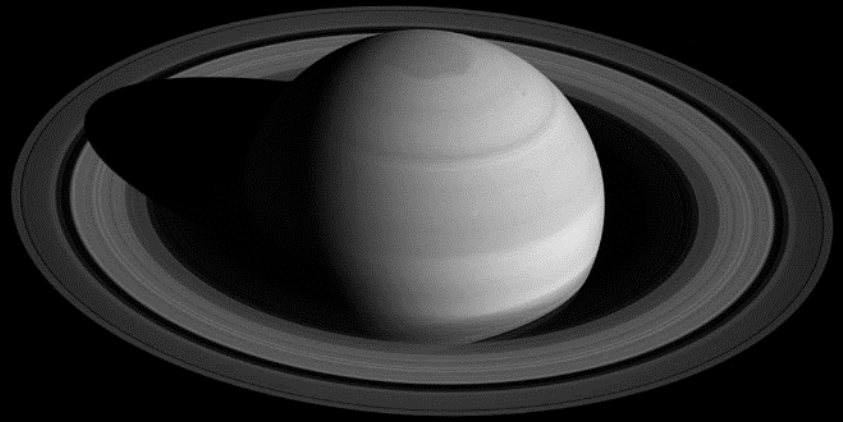
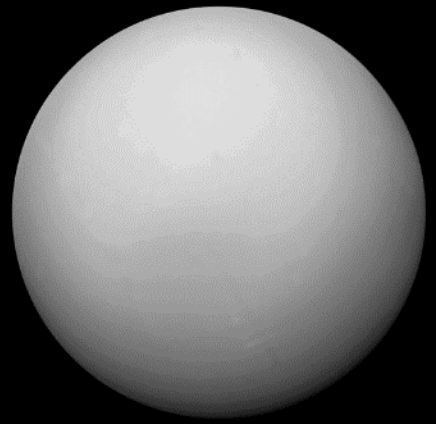
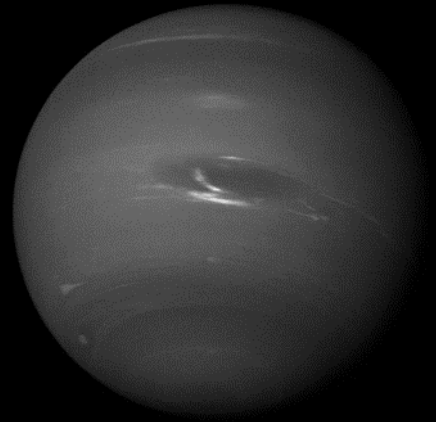


Nodal Precession

- The ascending node of the Moon's orbit (lunar orbit rising above solar) makes a full rotation to the west every 18.6 years.

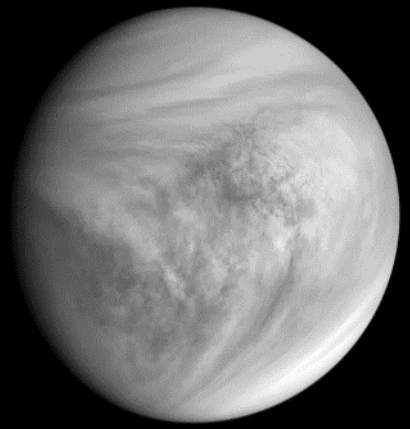


Evening Planets?

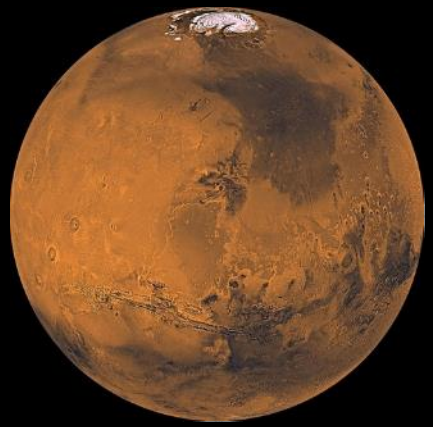








How About Morning Planets?

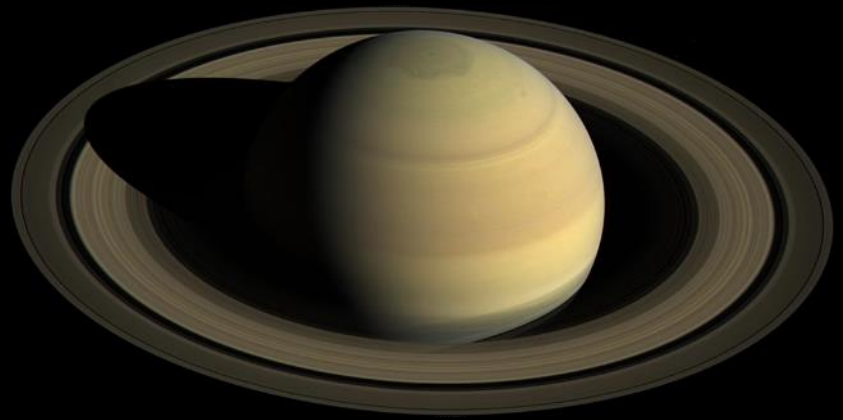
(all times for June 15)



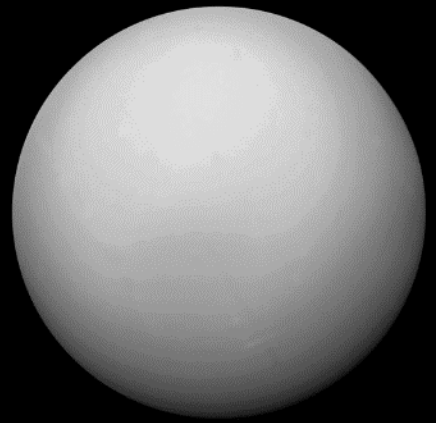
Rising at 03:11

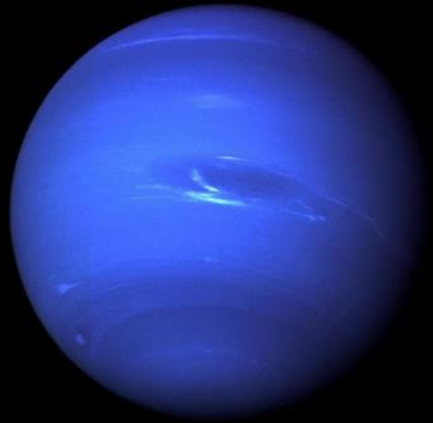


Rising at 04:43

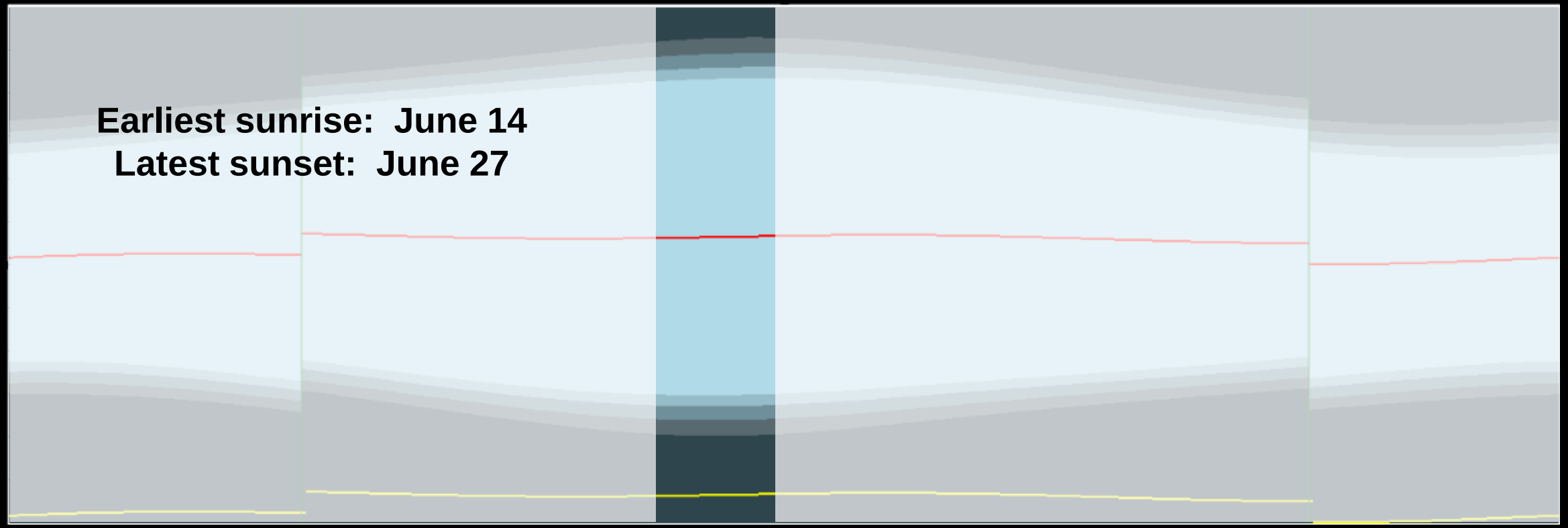


Rising at 01:21

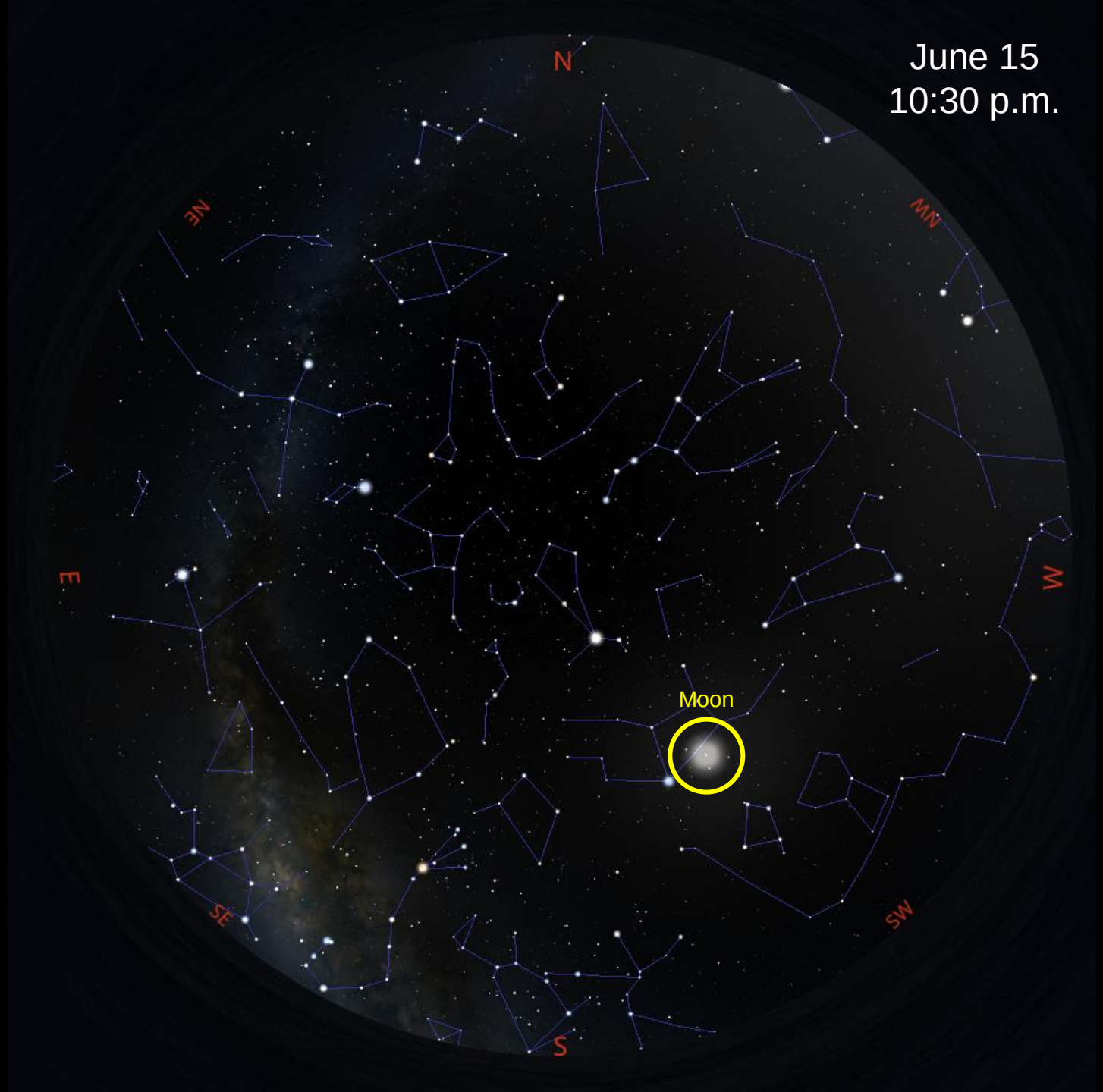




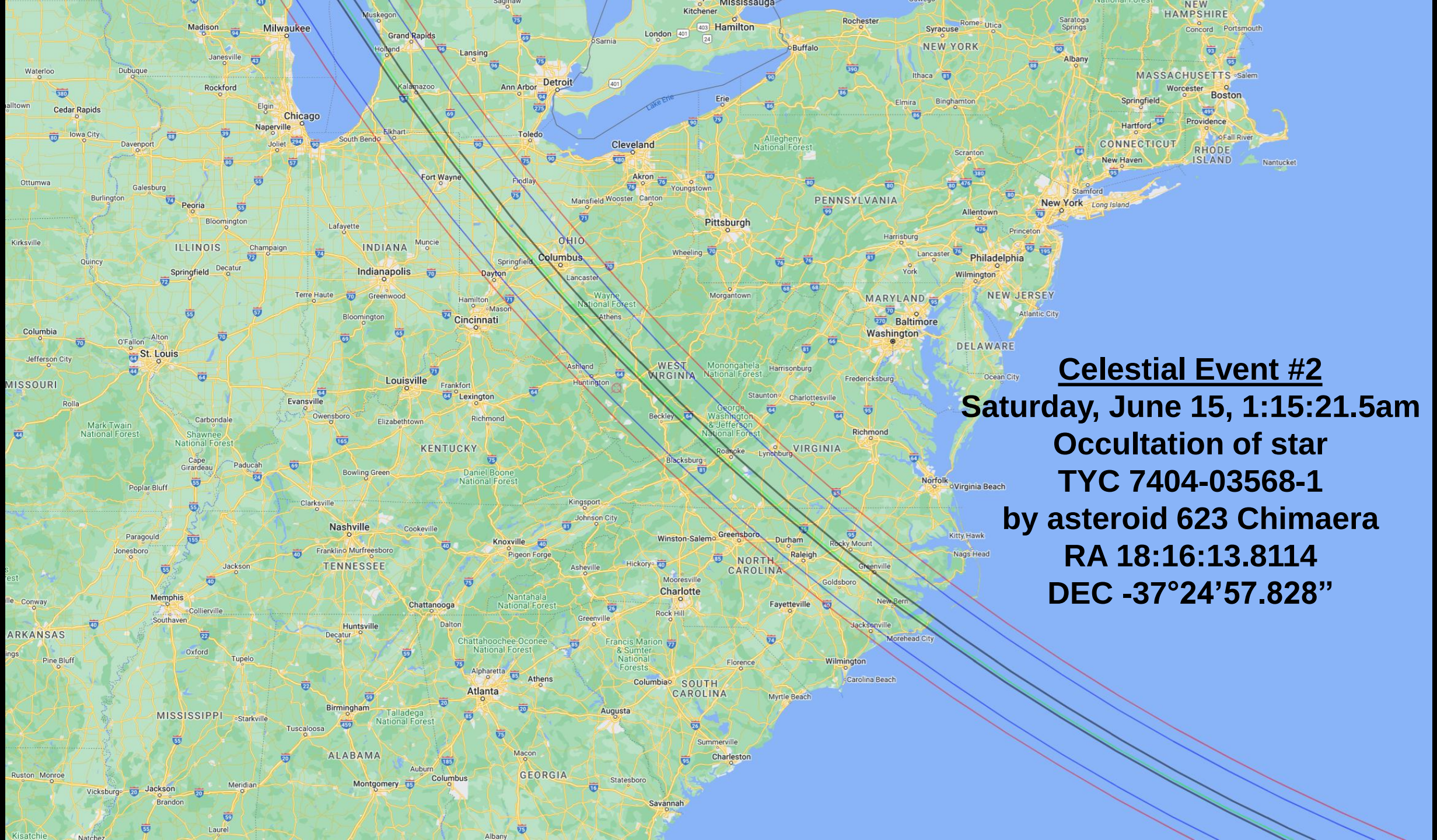
Rising at 01:44



	End of Night	End of Astronomical Twilight	End of Nautical Twilight	Sunrise	Sunset	Beginning of Nautical Twilight	Beginning of Astronomical Twilight	Beginning of Night
June 1	4:10am	4:52am	5:30am	6:00am	8:34pm	9:05pm	9:43pm	10:25pm
June 10	4:06am	4:49am	5:28am	5:58am	8:40pm	9:10pm	9:49pm	10:32pm
June 20	4:06am	4:49am	5:28am	5:59am	8:43pm	9:14pm	9:53pm	10:37pm
June 30	4:10am	4:53am	5:31am	6:02am	8:44pm	9:15pm	9:53pm	10:36pm


June 15
10:30 p.m.
N
NE
NW
E
W
Moon
SE
SW
S


Celestial Event #1
Friday, June 7
“Daytime Arietids” meteor shower peak
The most active daytime meteor shower (60-200/hour)
Mirfak
Mars
Daytime Arietids
NE
E
Earth, Roanoke, 296 m
FOV 36.4°
32 FPS
2024-06-07 04:31:10 UTC-04:00

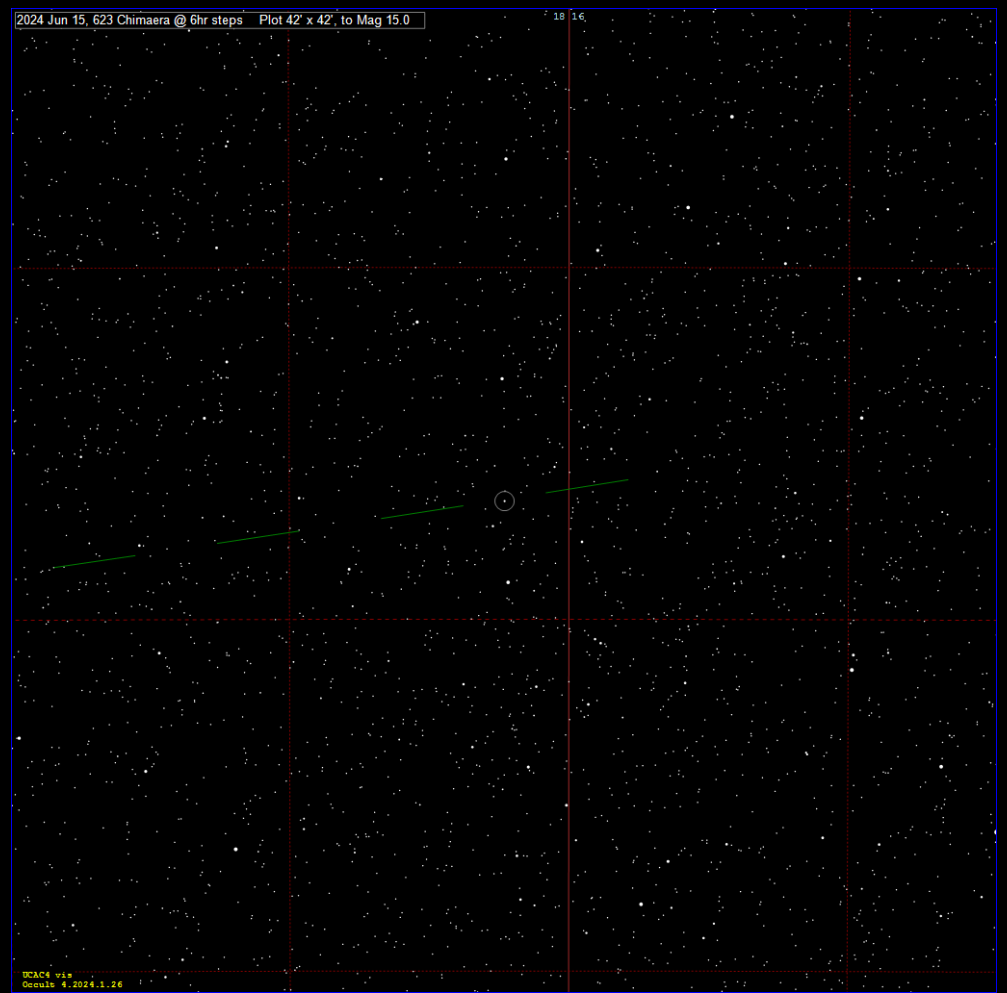

Celestial Event #2
Saturday, June 15, 1:15:21.5am
Occultation of star
TYC 7404-03568-1
by asteroid 623 Chimaera
RA 18:16:13.8114
DEC -37°24’57.828”

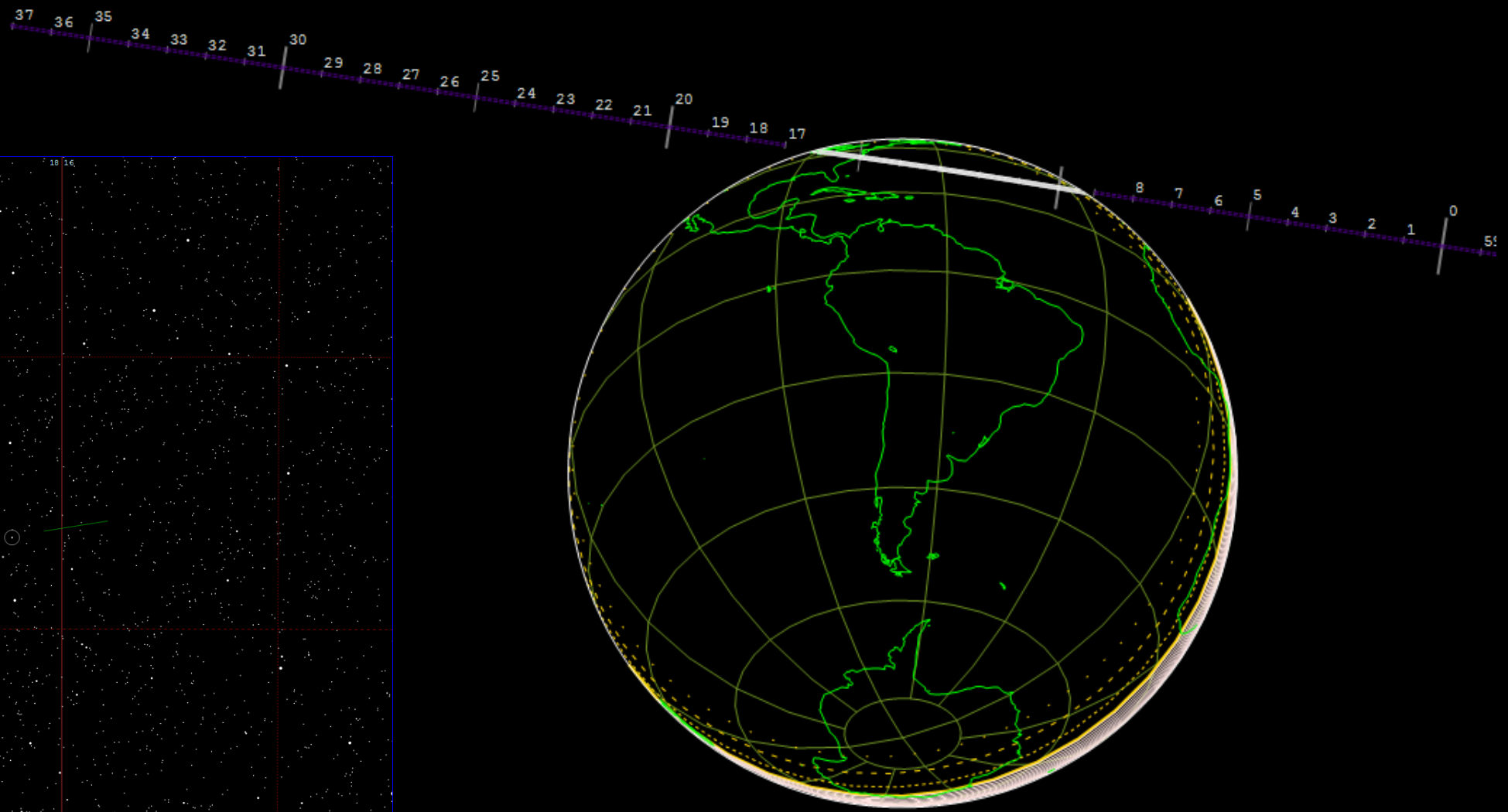
623 Chimaera occults TYC 7404-03568-1 on 2024 Jun 15 from 5h 9m to 5h 16m UT

Star: (Dia < 0.1 mas)
Mv 11.7; Mb 11.9; Mr 11.5
RA = 18 16 13.8114 (astrometric)
Dec = -37 24 57.828 ...
[of Date: 18 17 55, -37 24 28]
Prediction of 2023 Jul 14.4
Reliable 1.1 (good),

Durations: Max = 3.5 secs
1km = 0.081 secs, 1mas = 0.10 secs
Mag Drop: 3.1 [94%]v, 2.8 [92%]r
Sun : Dist = 163°
Moon: Dist = 88°, illum = 59%
1σ Err: ±(15.0 x 3.7) mas in PA 79°

Asteroid: (in DAMIT)
Mag = 14.6
Dia = 44 ±3km, 35 mas
Parallax = 5.070"
Hourly dRA =-2.950s
dDec = 5.42"
JPL#932023Apr24, Known errors





Celestial Event #3

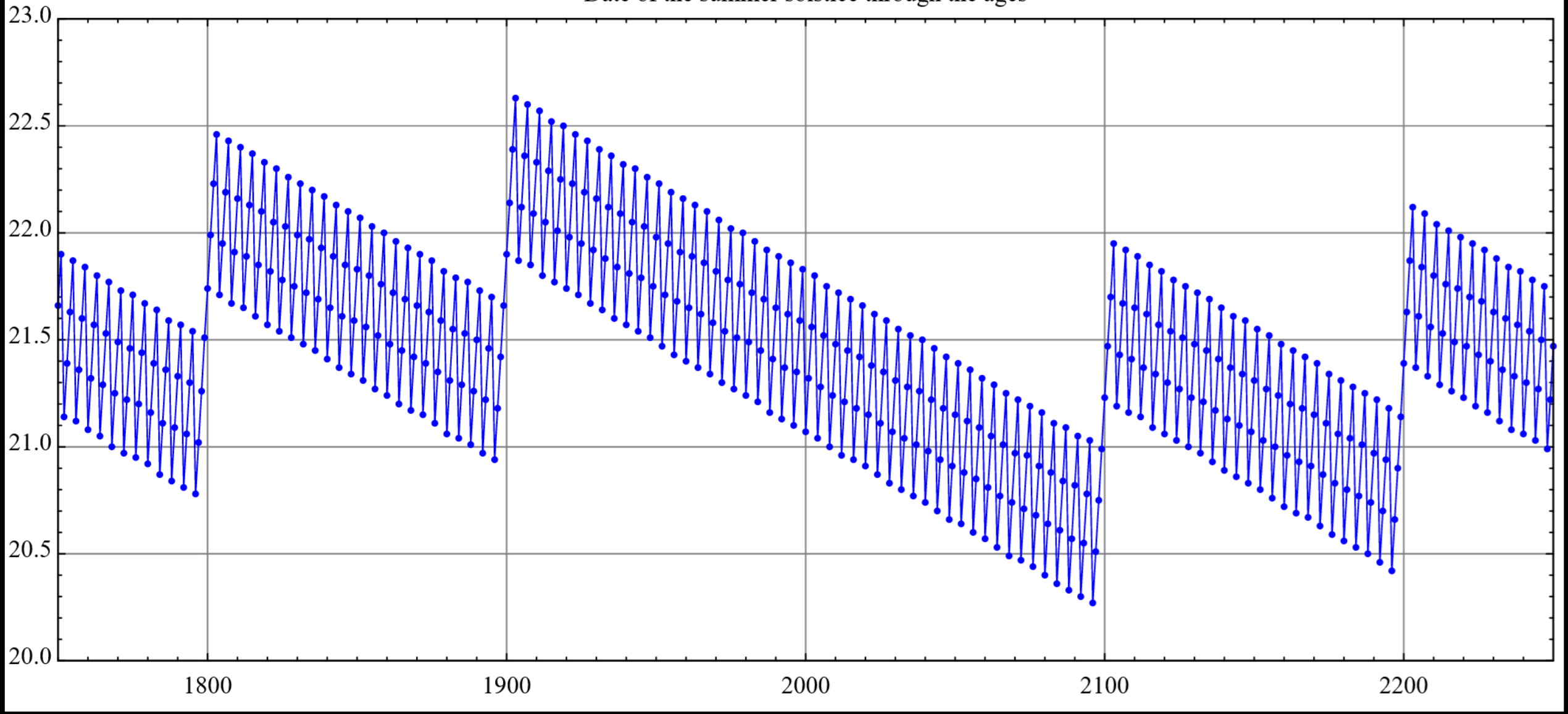
- Thursday, June 20: Solstice (4:51pm)
  - Earliest solstice since 1896
  - The next solstice earlier than 2024 will be in 2028, then 2032, etc.

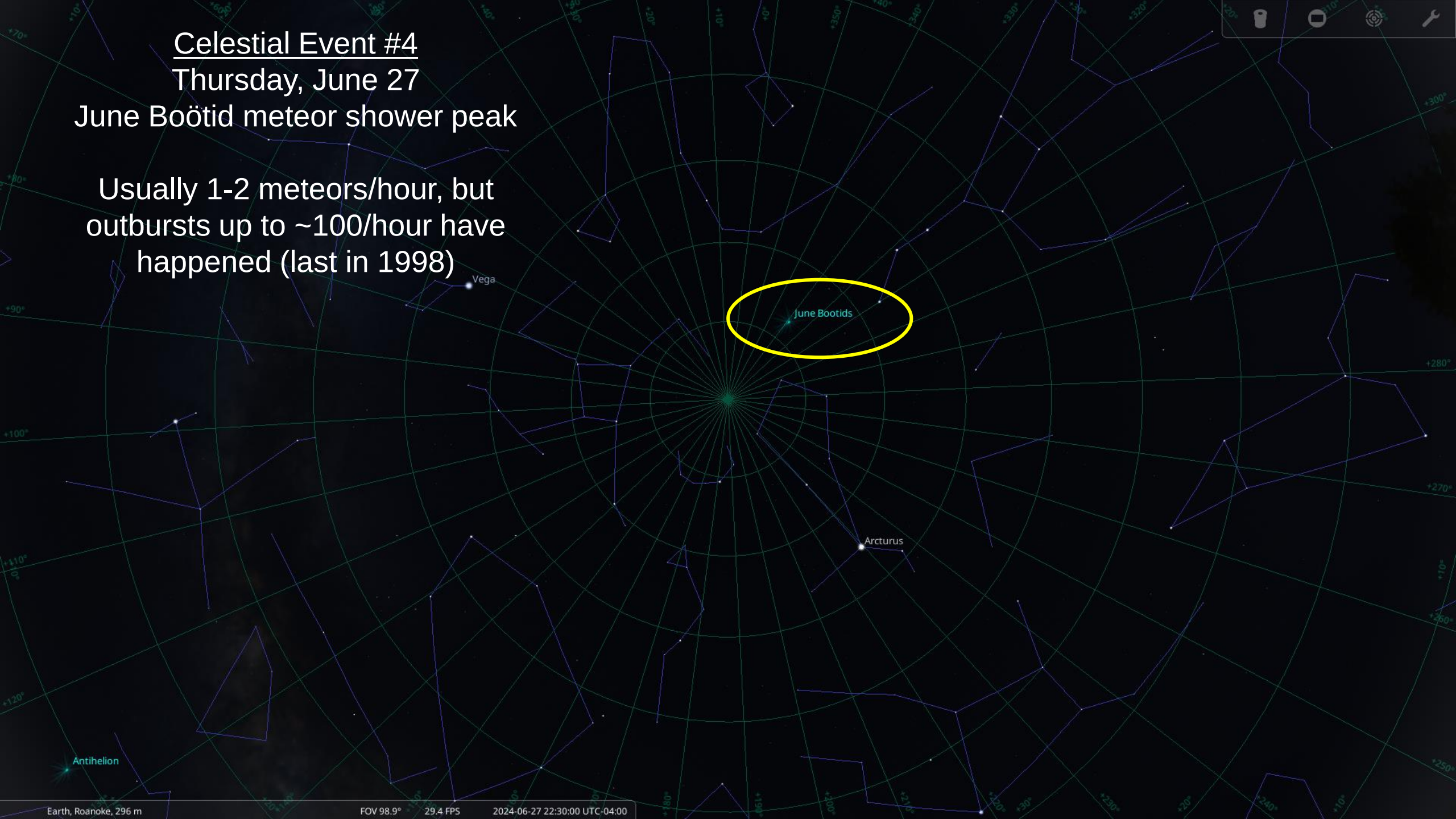
- 2020: 5:43pm
- **2024: 4:51pm**
- 1896: 4:28pm
- 2028: 4:02pm
- 2032: 3:09pm
- 2036: 2:31pm
- 2040: 1:46pm
- 2044: 12:50pm
- 2048: 11:54am
- 2052: 11:16am

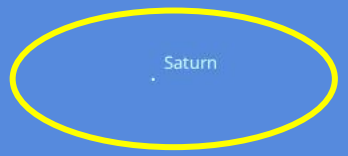
- 2020: 5:43pm
- 2021: 11:32pm
- 2022: 5:14am*
- 2023: 10:58am*
- **2024: 4:51pm**
- 2025: 10:42pm
- 2026: 4:25am*
- 2027: 10:11am*
- 2028: 4:02pm
- 2029: 9:48pm

Leap shifting of the gregorian calender

Date of the summer solstice through the ages




Celestial Event #4
Thursday, June 27
June Boötid meteor shower peak
Usually 1-2 meteors/hour, but outbursts up to ~100/hour have happened (last in 1998)
Vega
June Bootids
Arcturus
Antihelion
Earth, Roanoke, 296 m
FOV 98.9°
29.4 FPS
2024-06-27 22:30:00 UTC-04:00



<u>Celestial Event #5</u>

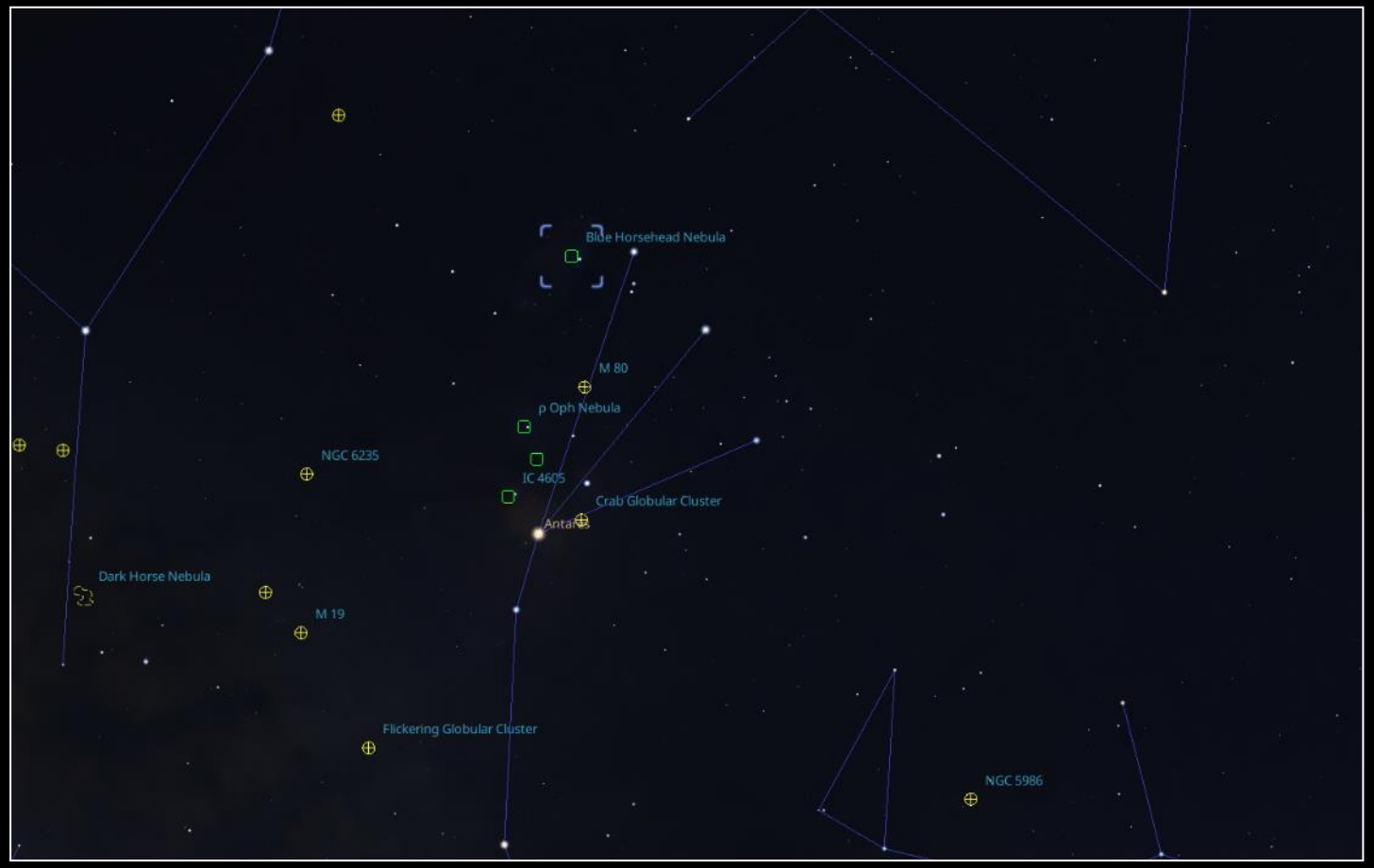
Thursday, June 27, 9:00am

Try to spot Saturn during the day!

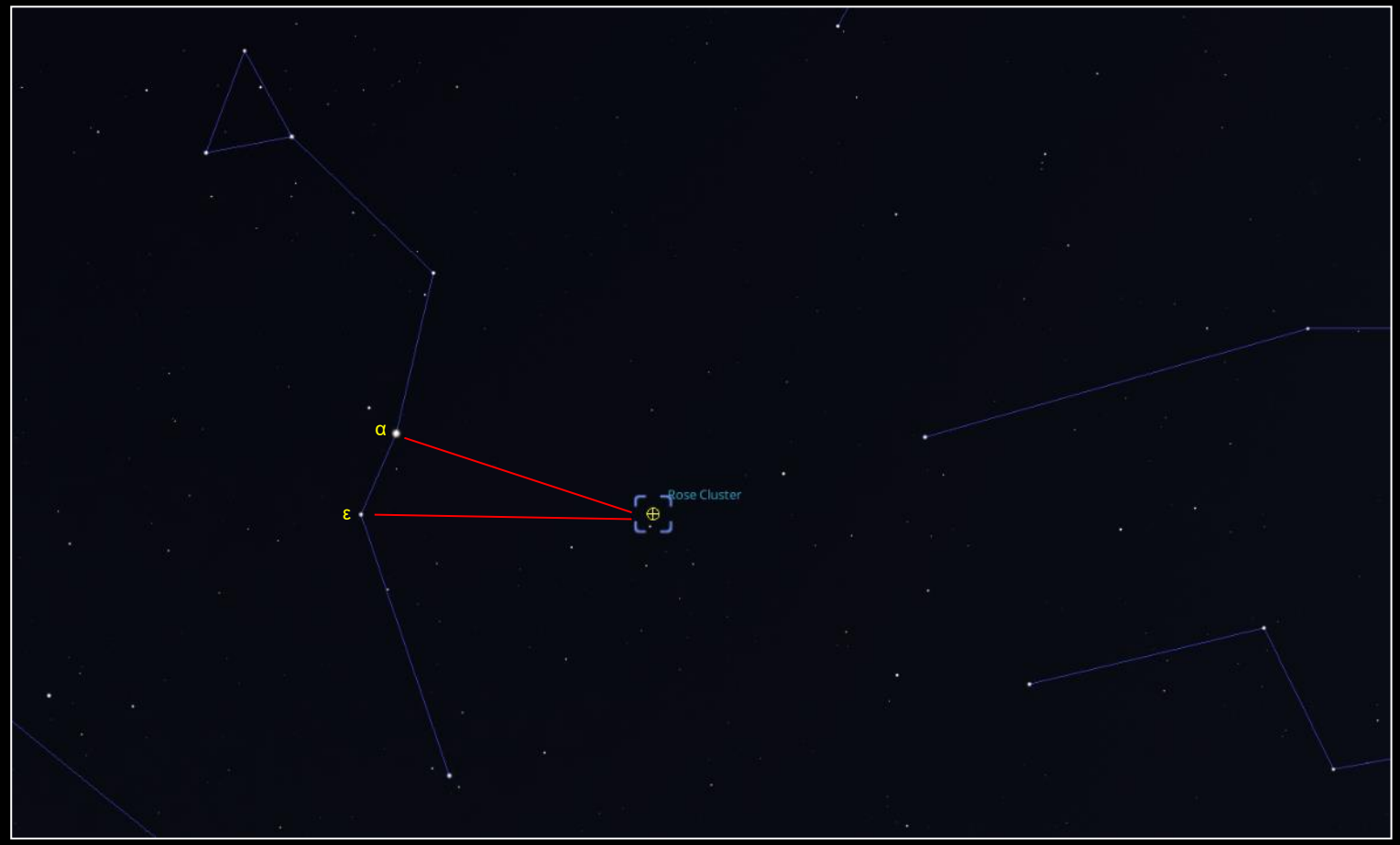
Astronomical League Lunar Program

- Objects to observe with naked eye (18), binoculars (46), and telescopes (36)
  - Certificate available for completing only the naked eye and binocular portion
- 100 observations required
  - 100 “standard” items on the list, plus 10 “optional activities” that each count as two observations (6 naked eye, 2 binocular, 2 telescope)
- Both visual and imaging permitted
- Some observations must be completed only at certain lunar phases
- 2” minimum telescope recommendation
- Manual observations only, no remote telescopes or GoTo systems permitted

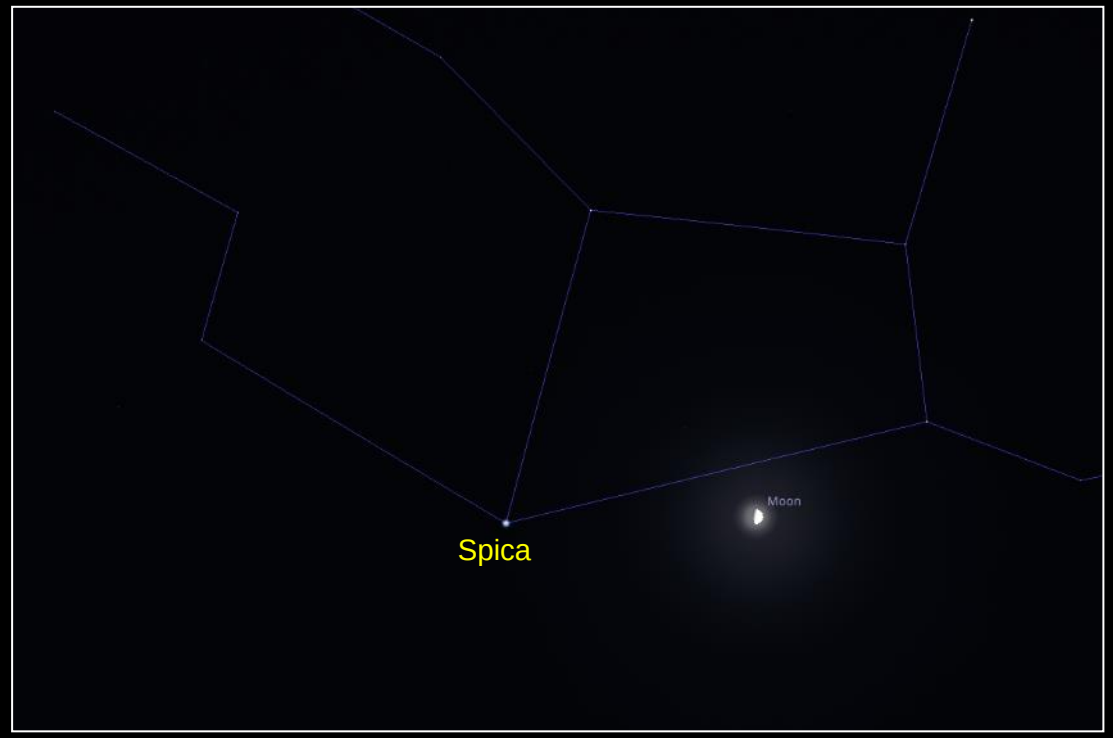
Monthly Telescope Target:
IC 4592 (Blue Horsehead Nebula)



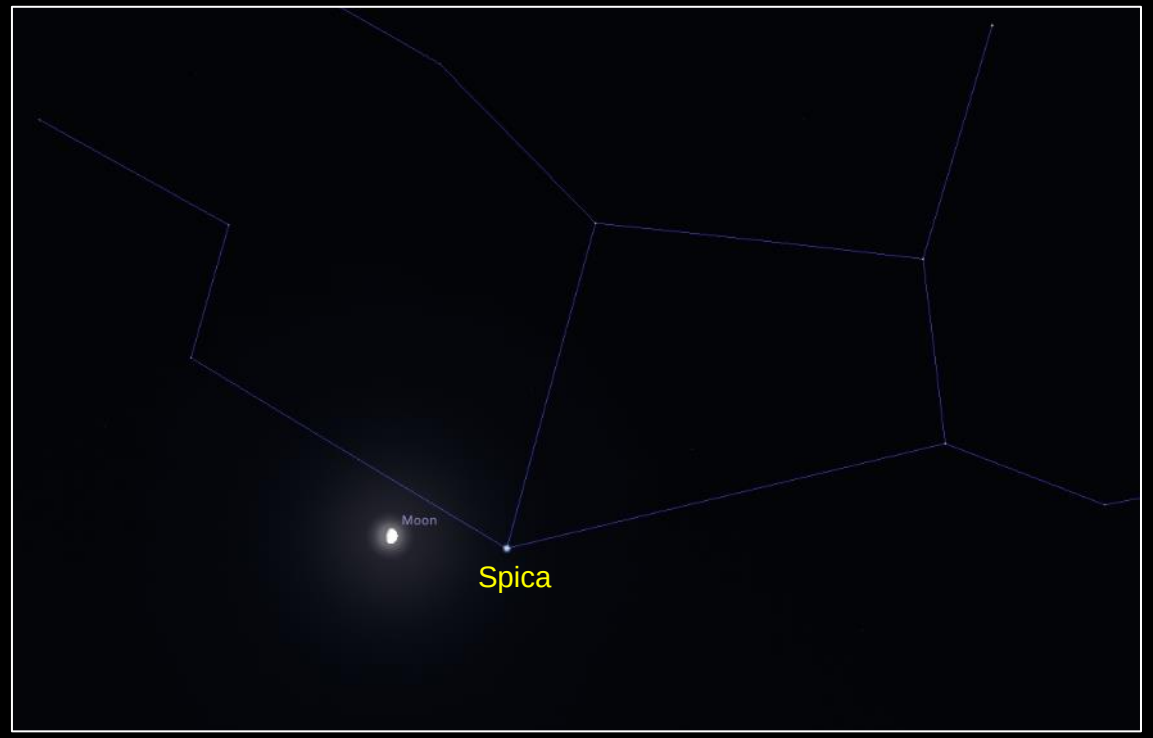
Monthly Binocular Target:
M5 (Rose Cluster)



Monthly Naked Eye Target:
Watch the Moon Switch Sides of Spica



June 15, 10:30pm



June 16, 10:30pm

Image Credits

- Lunar phases: Screenshots from Stellarium
- Evection text: H. Godfray: *Elementary Treatise on the Lunar Theory*, 1859. Hosted on the Internet archive: https://archive.org/details/anelementarytre02godfgoog/page/n82/mode/2up
- Apsidal precession: Wikipedia user Phoenix7777, using data from the HORIZONS system / JPL / NASA
- Nodal precession: Wikipedia user SuperManu, modifying an older image from Tom Ruen
- Original planet images:
  - Mercury: NASA / JHUAPL / Carnegie Institution of Washington
  - Venus: Kevin M. Gill / DARTS / ISAS / JAXA
  - Mars: NASA / JPL
  - Jupiter: NASA / ESA / A. Simon (GSFC) / M.H. Wong (UC Berkeley)
  - Saturn: NASA / JPL-Caltech / SSI
  - Uranus: NASA (modified by Wikipedia user Jcpag2012)
  - Neptune: NASA / JPL-Caltech
- Sun rise/set bar: timeanddate.com
- All-sky view, Arietid radiant, Bootid radiant, and Moon-Saturn conjunction: Screenshots from Stellarium
- 623 Chimaera occultation visualizations and path generated by https://www.poyntsource.com/
- Leap shifting of the Gregorian calendar: Wikipedia user Baszoetekouw, using data generated by Astrolabe (astrolabe.sourceforge.net)
- Moon rising over forest art: NASA
- Monthly sky target charts: Screenshots from Stellarium
- IC4592 image: Giuseppe Donatiello
- M5 image: Adam Block / Mount Lemmon SkyCenter / University of Arizona

Questions
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