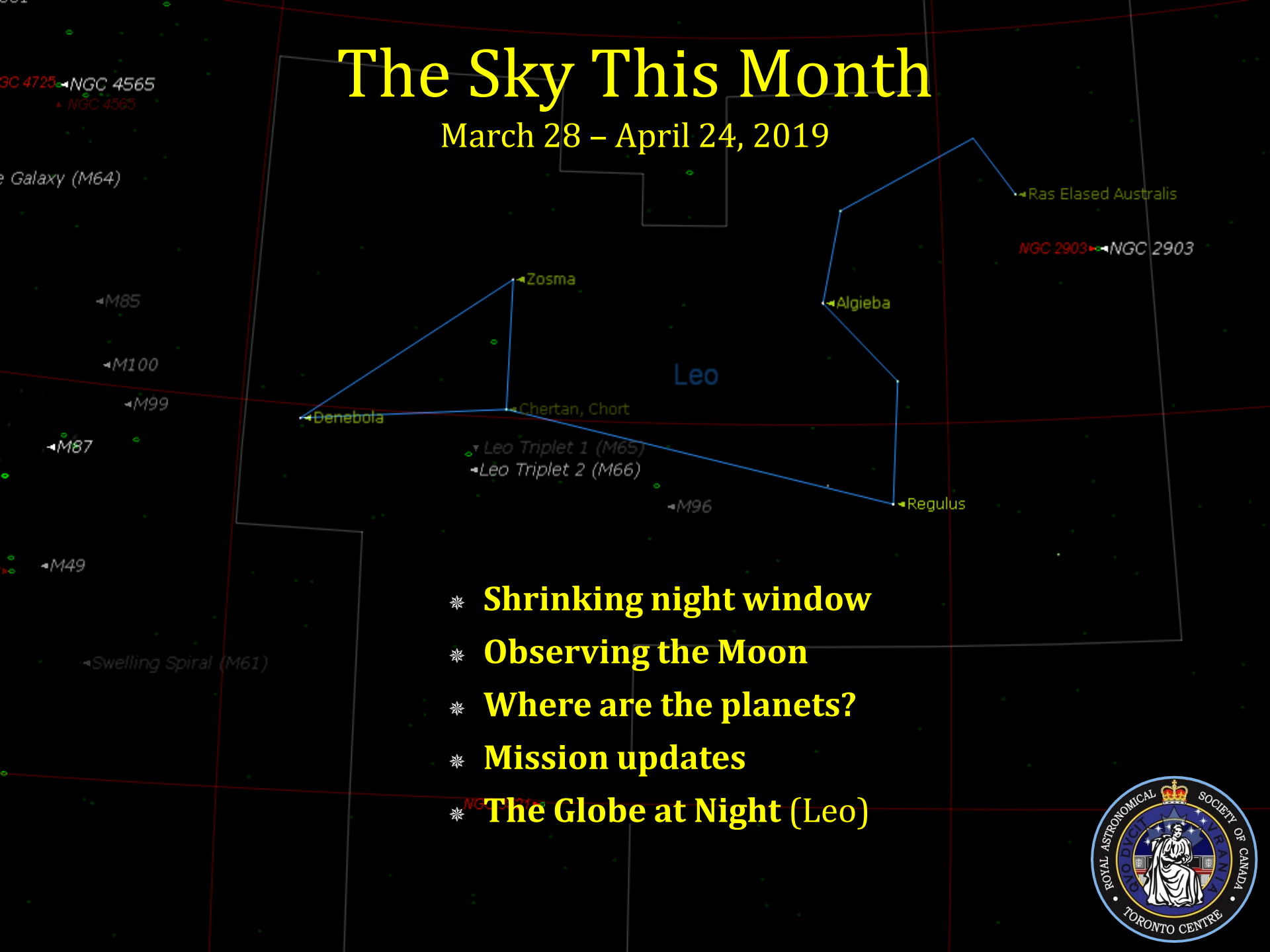
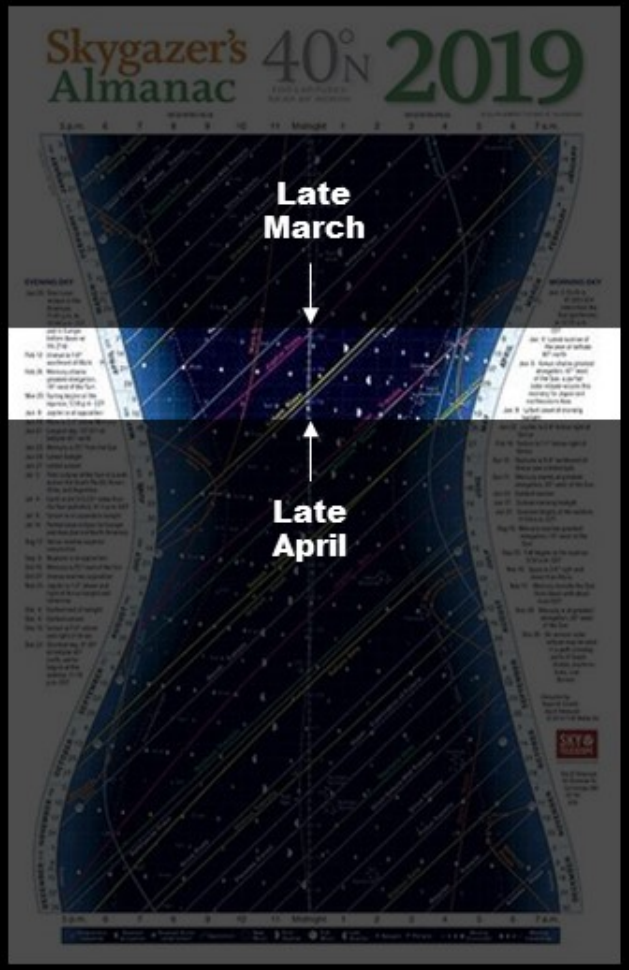
# The Sky This Month

March 28 – April 24, 2019




- **Shrinking night window**
- **Observing the Moon**
- **Where are the planets?**
- **Mission updates**
- **The Globe at Night** (Leo)

# Shrinking Night Window



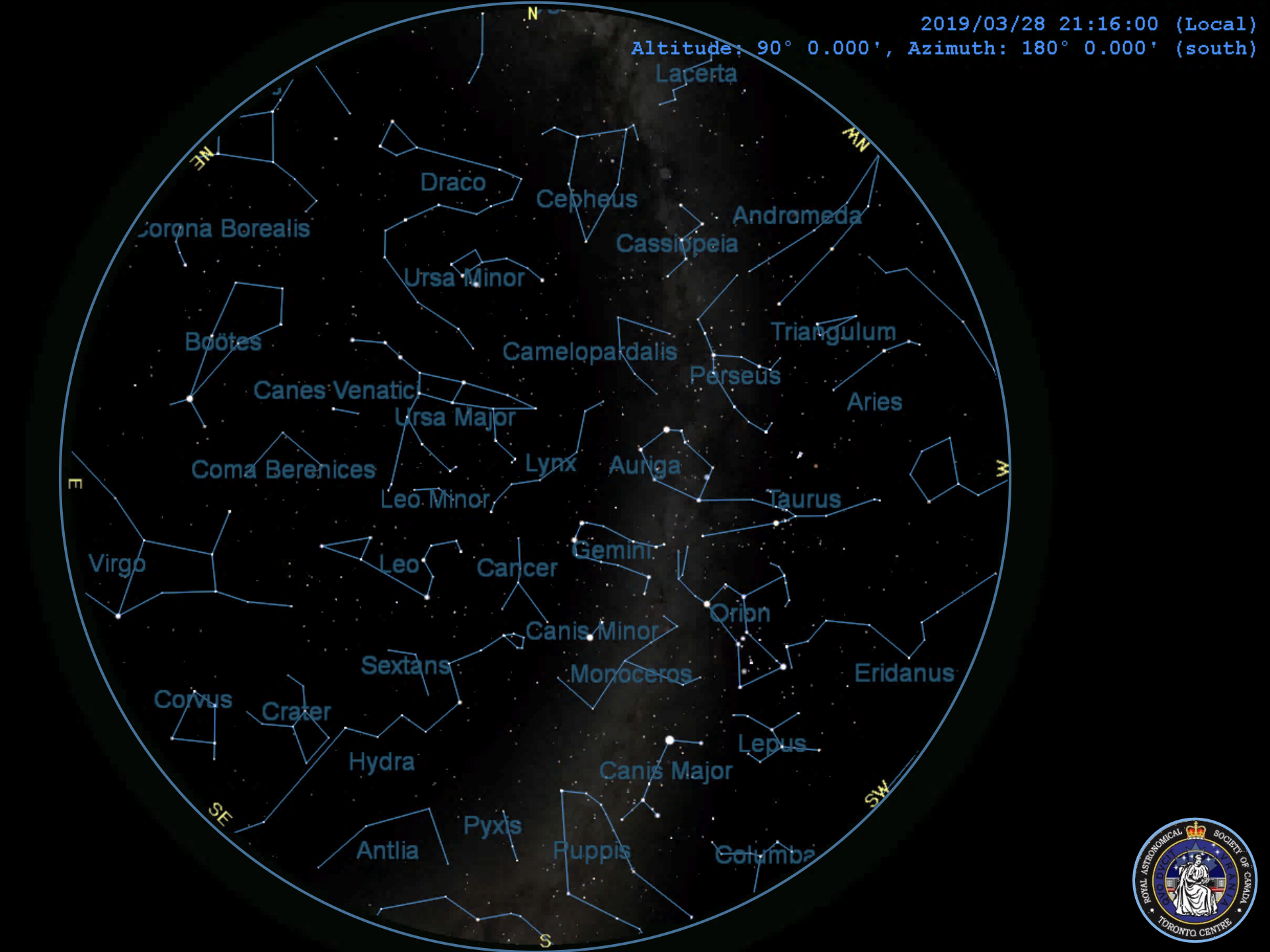

2019 Skygazer's Almanac by Sky & Telescope

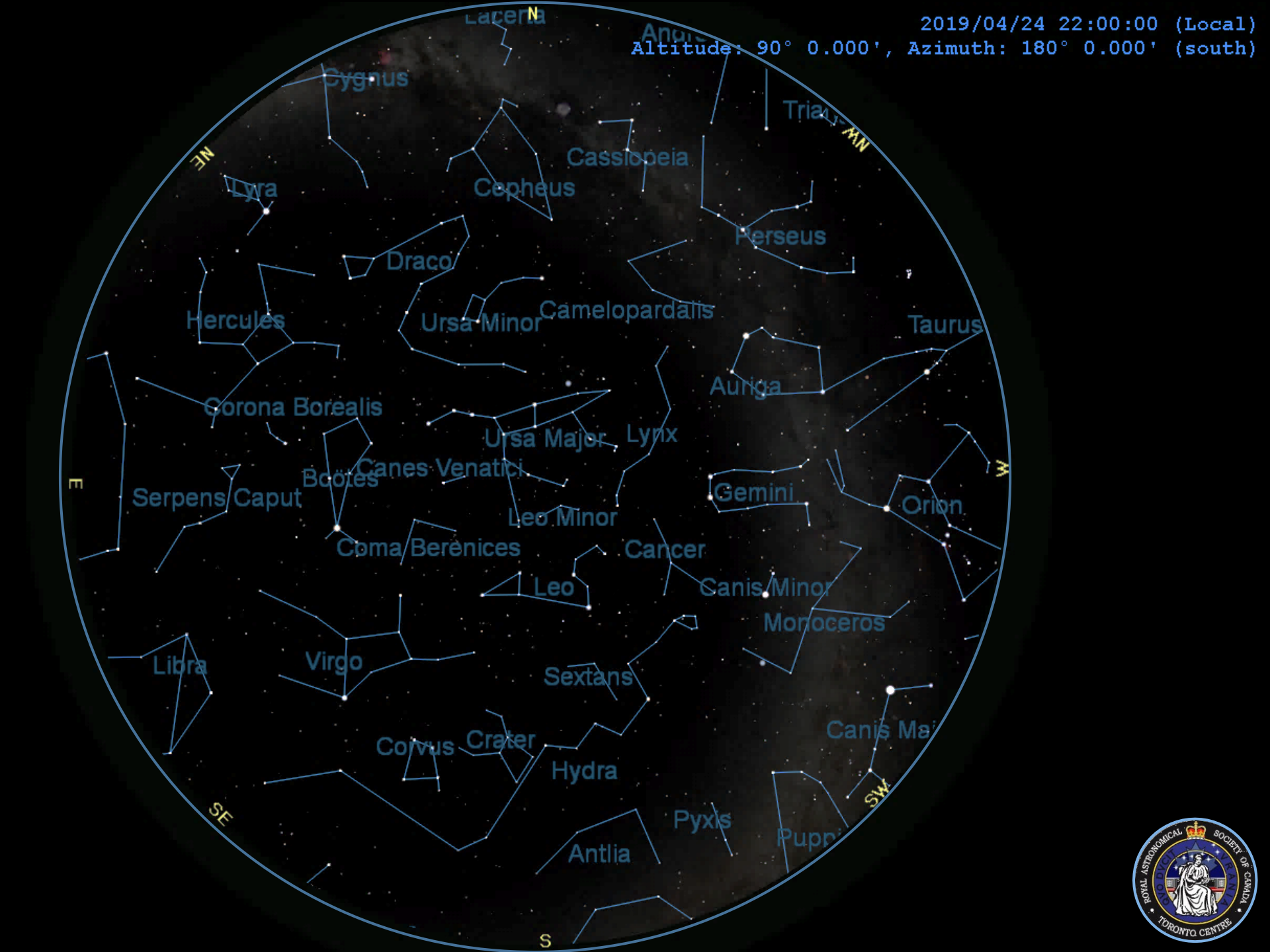

TimeAndDate.com

Night: When the Sun is 18° or more below the horizon

| Date | Night Begins | Night Ends | Duration |
|---|---|---|---|
| March 28 | 21:17 | 05:24 | 8 hr. 07 min. |
| April 24 | 22:00 | 04:27 | 6 hr. 27 min. |

Night shrinks by 1 hr. 40 min. over the next 28 days


2019/03/28 21:16:00 (Local)
Altitude: 90° 0.000', Azimuth: 180° 0.000' (south)
N
NE
NW
E
W
SE
SW
S
Lacerta
Draco
Cepheus
Andromeda
Corona Borealis
Cassiopeia
Ursa Minor
Triangulum
Boötes
Camelopardalis
Perseus
Canes Venatici
Aries
Ursa Major
Coma Berenices
Lynx
Auriga
Leo Minor
Taurus
Virgo
Leo
Cancer
Gemini
Orion
Canis Minor
Sextans
Monoceros
Eridanus
Corvus
Crater
Lepus
Hydra
Canis Major
Pyxis
Antlia
Puppis
Columba


2019/04/24 22:00:00 (Local)
Altitude: 90° 0.000', Azimuth: 180° 0.000' (south)
N
NE
E
SE
S
SW
W
NW
Lacerta
Cygnus
Lyra
Cepheus
Cassiopeia
Perseus
Draco
Camelopardalis
Ursa Minor
Hercules
Taurus
Auriga
Corona Borealis
Ursa Major
Lynx
Canes Venatici
Bootes
Serpens Caput
Gemini
Orion
Leo Minor
Coma Berenices
Cancer
Leo
Canis Minor
Monoceros
Libra
Virgo
Sextans
Corvus
Crater
Hydra
Pyxis
Antlia
Puppis
Canis Ma
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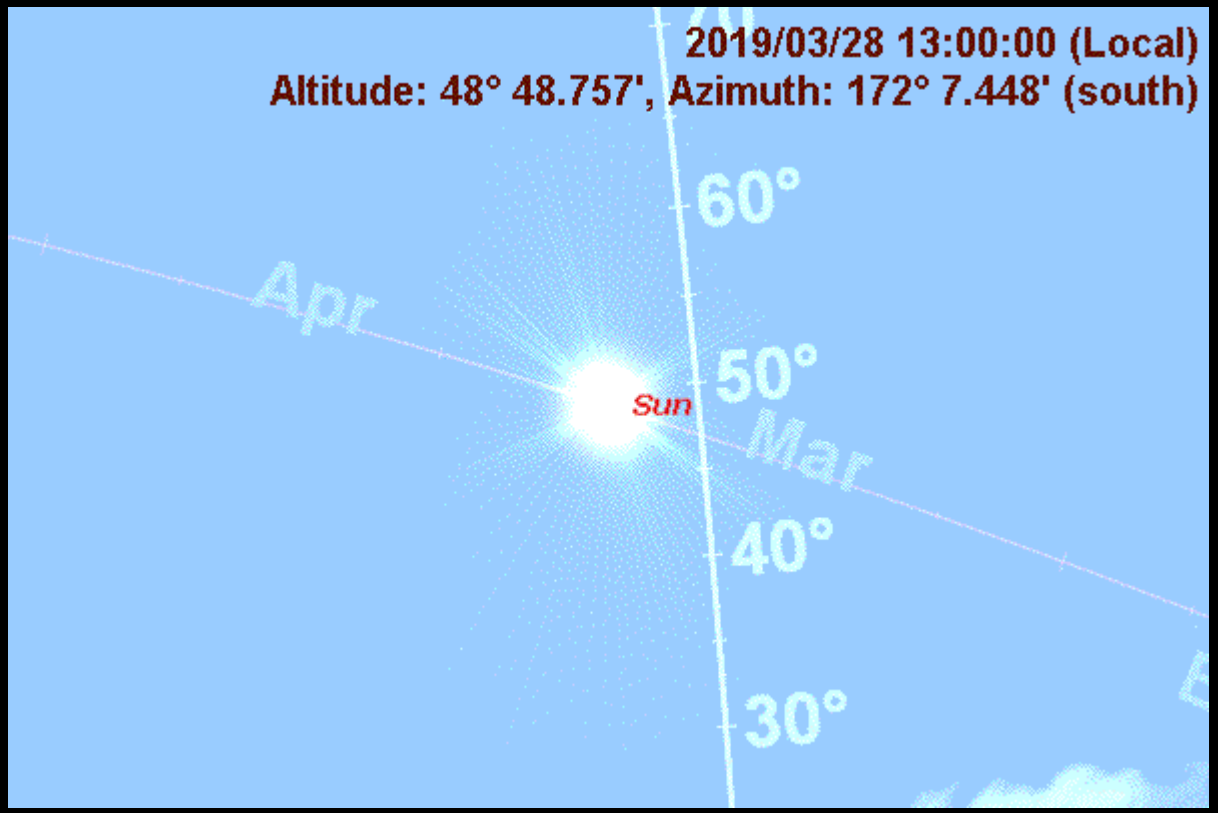
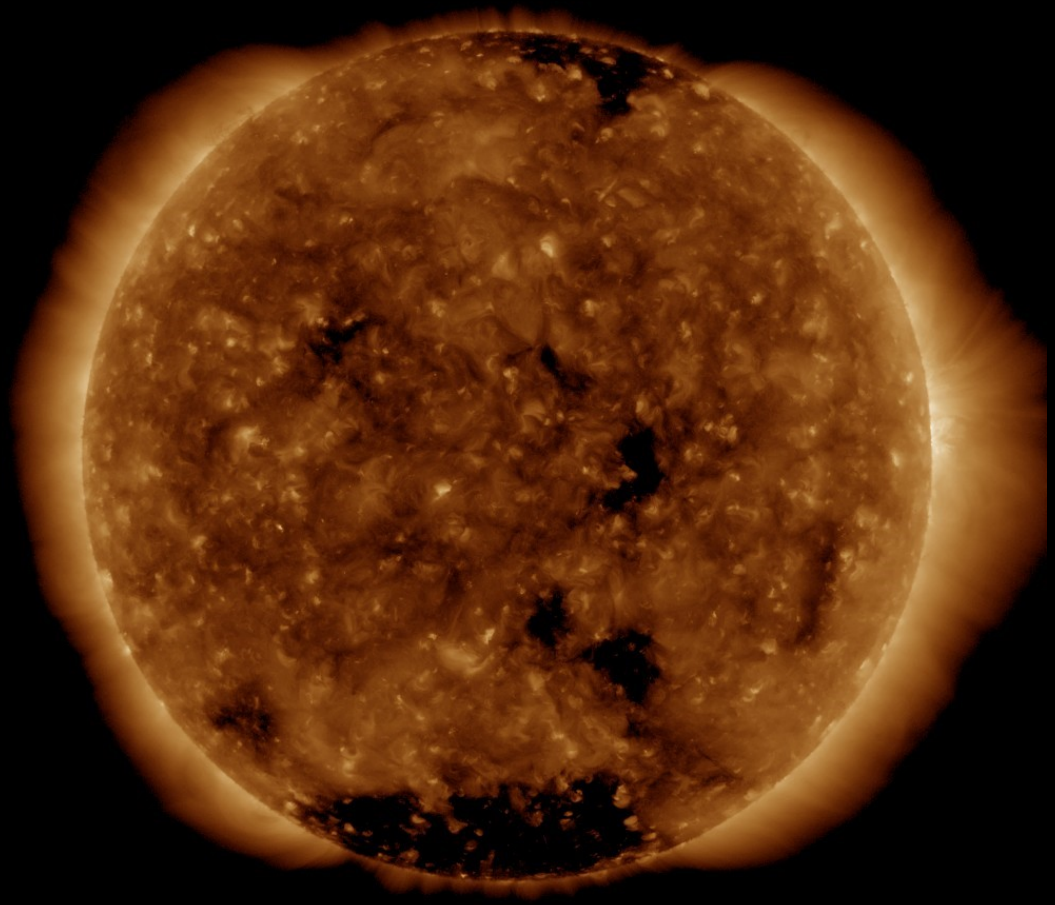
TORONTO CENTRE

# The Climbing Sun




Sun climbs nearly 10° in 28 days

# Coronal Holes




SDO/AIA 193

# Moon Phases

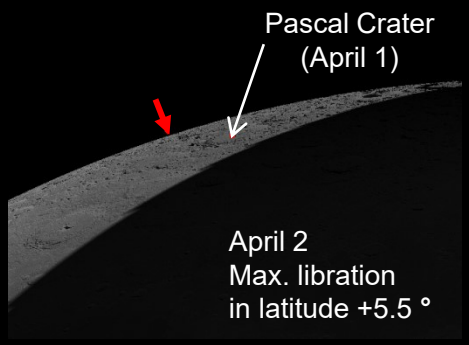
| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| Mar. 24 | 25 | 26 | 27 | 28  | 29 | 30 |
| 31 | April 1 | 2 | 3 | 4 | 5  | 6 |
| 7 | 8 | 9 | 10 | 11 | 12  LUNAR X @ 00:10 | 13 |
| 14 | 15 | 16 | 17 | 18 | 19  | 20 |
| 21 | 22 | 23 Lyrids | 24 | 25 | 26  | 27 |
| 28 | 29 | 30 | May 1 | 2 | 3 | 4  |

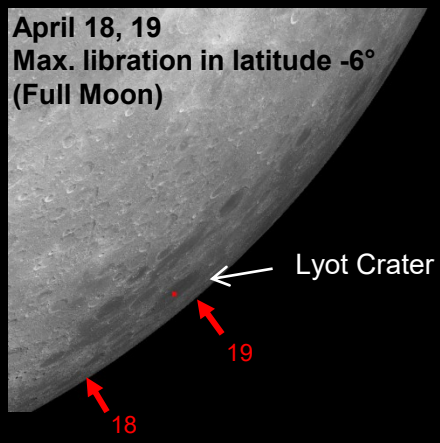
# Observing the Moon

## Lunar X & V


Apr. 12, 00:10 EDT

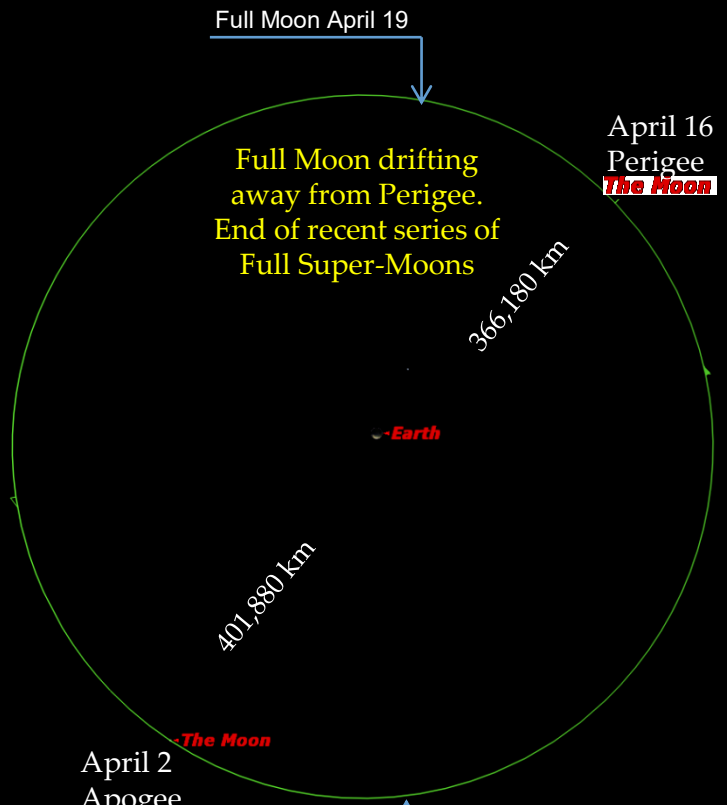
## Libration

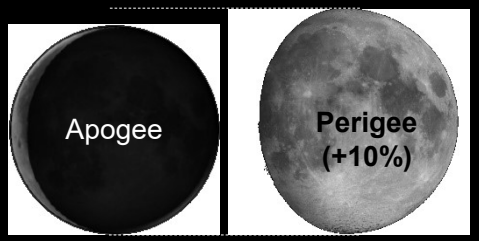



Tip:
Visit NASA's Scientific Visualization Studio (svs.gsfc.nasa.gov) and do a search on "libration 2019" (or whatever you wish) for more.

## Apogee / Perigee



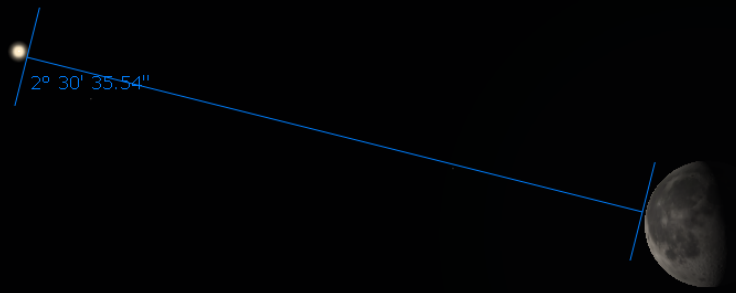



# Observing the Moon


Apr 23: Jupiter – Moon
less than 2° apart

SSE, before dawn

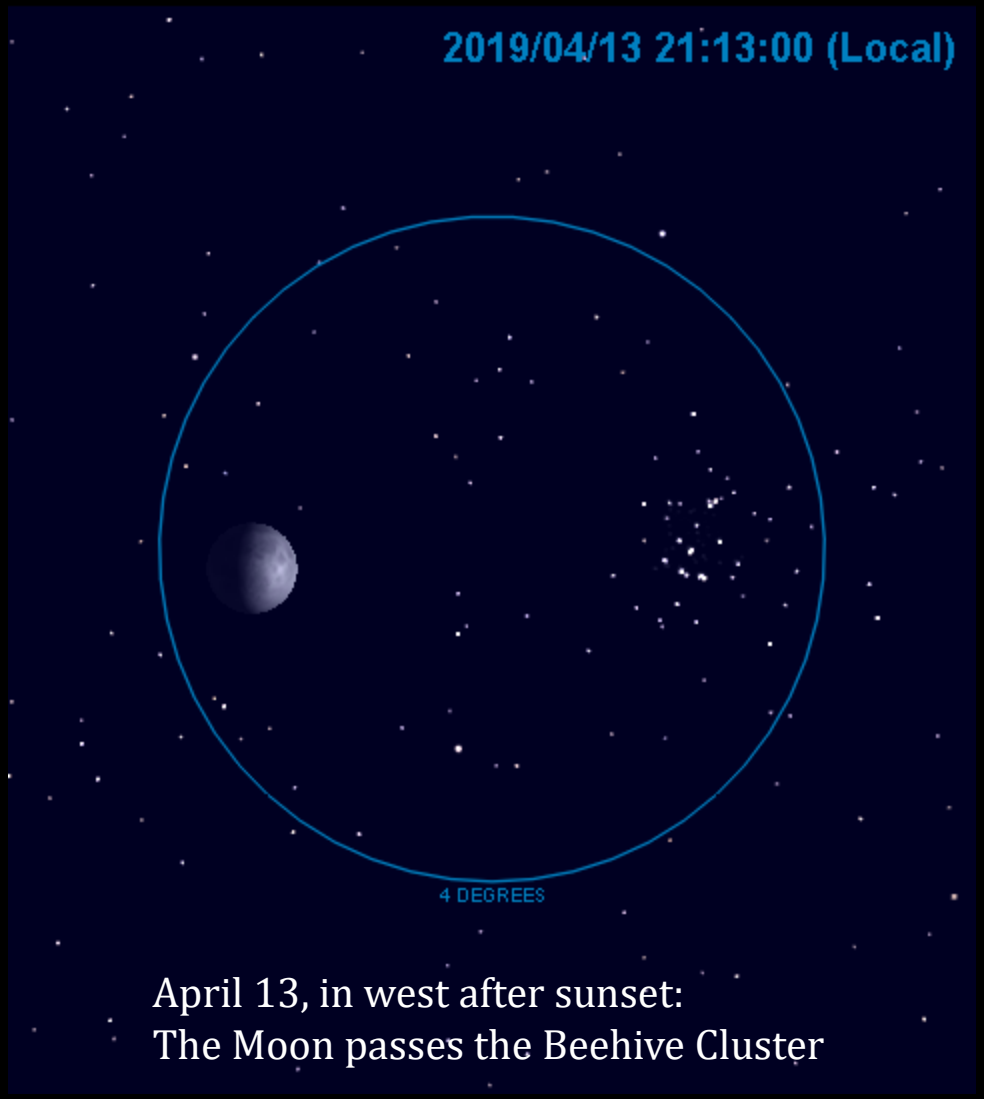
*(Remember this one for later…)*




Apr 25: Saturn – Moon
2.5° apart

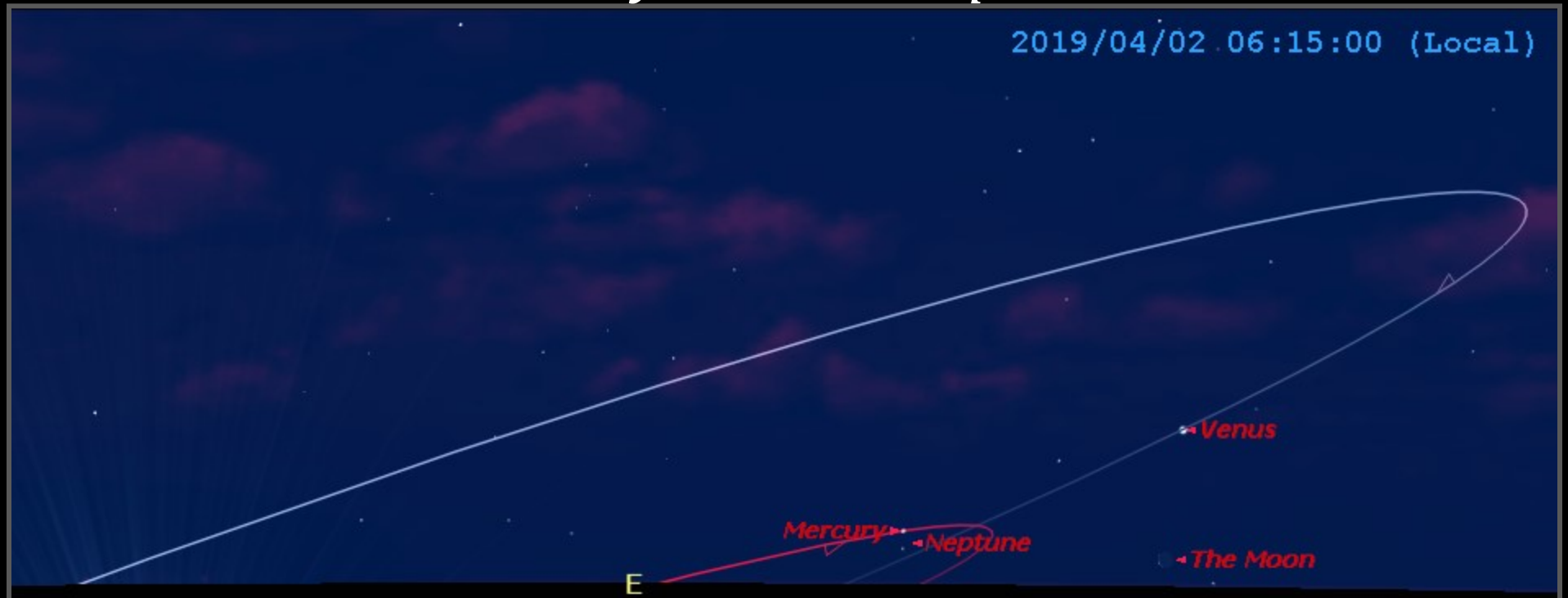
SE, before dawn

# Observing the Moon




April 13, in west after sunset:
The Moon passes the Beehive Cluster

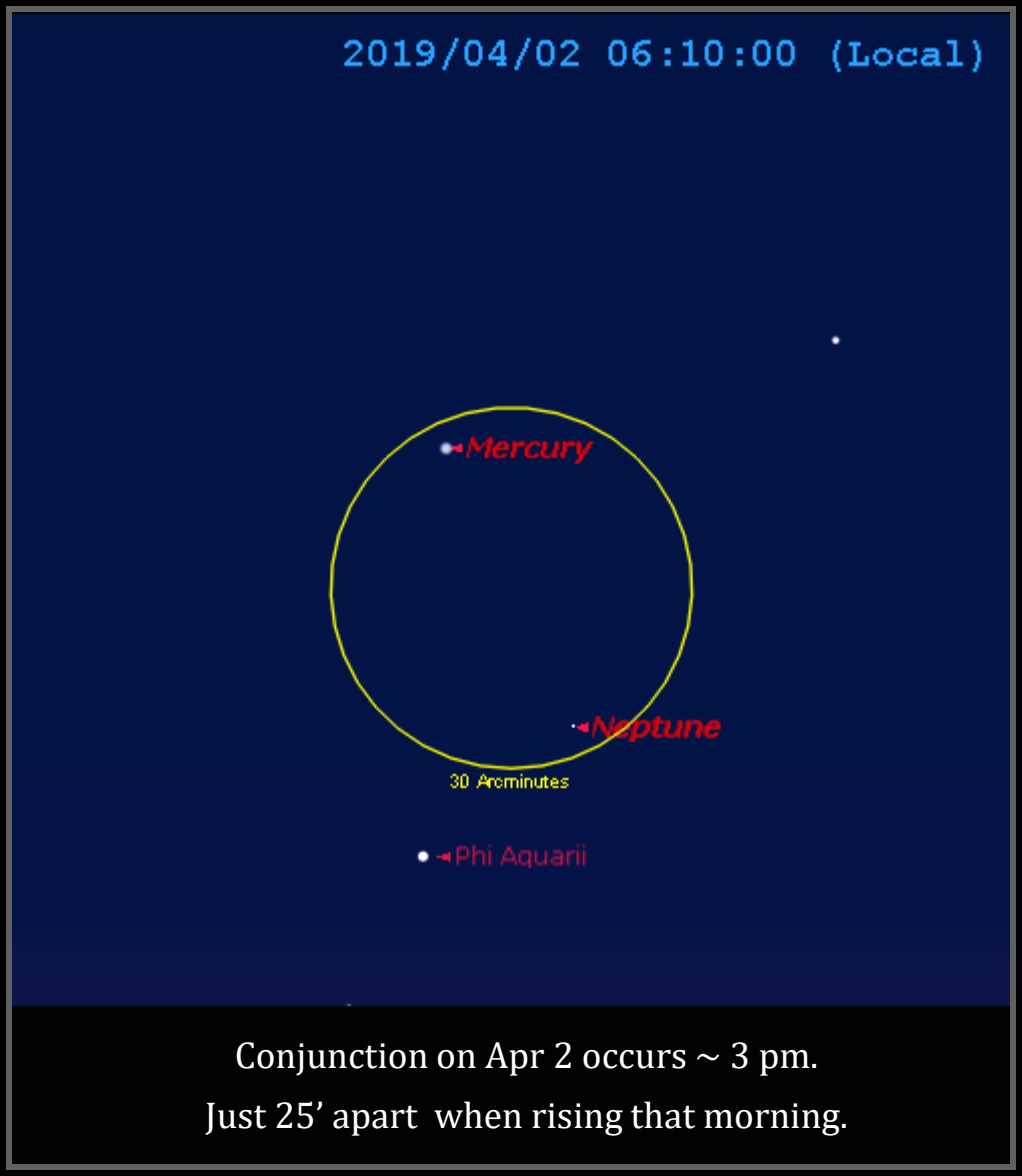
# Where are the planets?
## *Mercury, Venus & Neptune*




All three tightly bunched as April begins, rising low in the east before sunrise.
April 2 - slender crescent Moon (8% illuminated) joins the trio

- Mercury very low in Pisces due to shallow ecliptic on spring mornings.
  April 11 - GWE: 28° from the Sun, but only 8° high at sunrise, mag 0.9
- Venus 12” across, 88% illum., mag. -4. Spends time visiting Aqr, Psc
- Neptune in Aquarius, mag 7.95, 2.2”. Opposition in September.

# Mercury – Neptune Conjunction

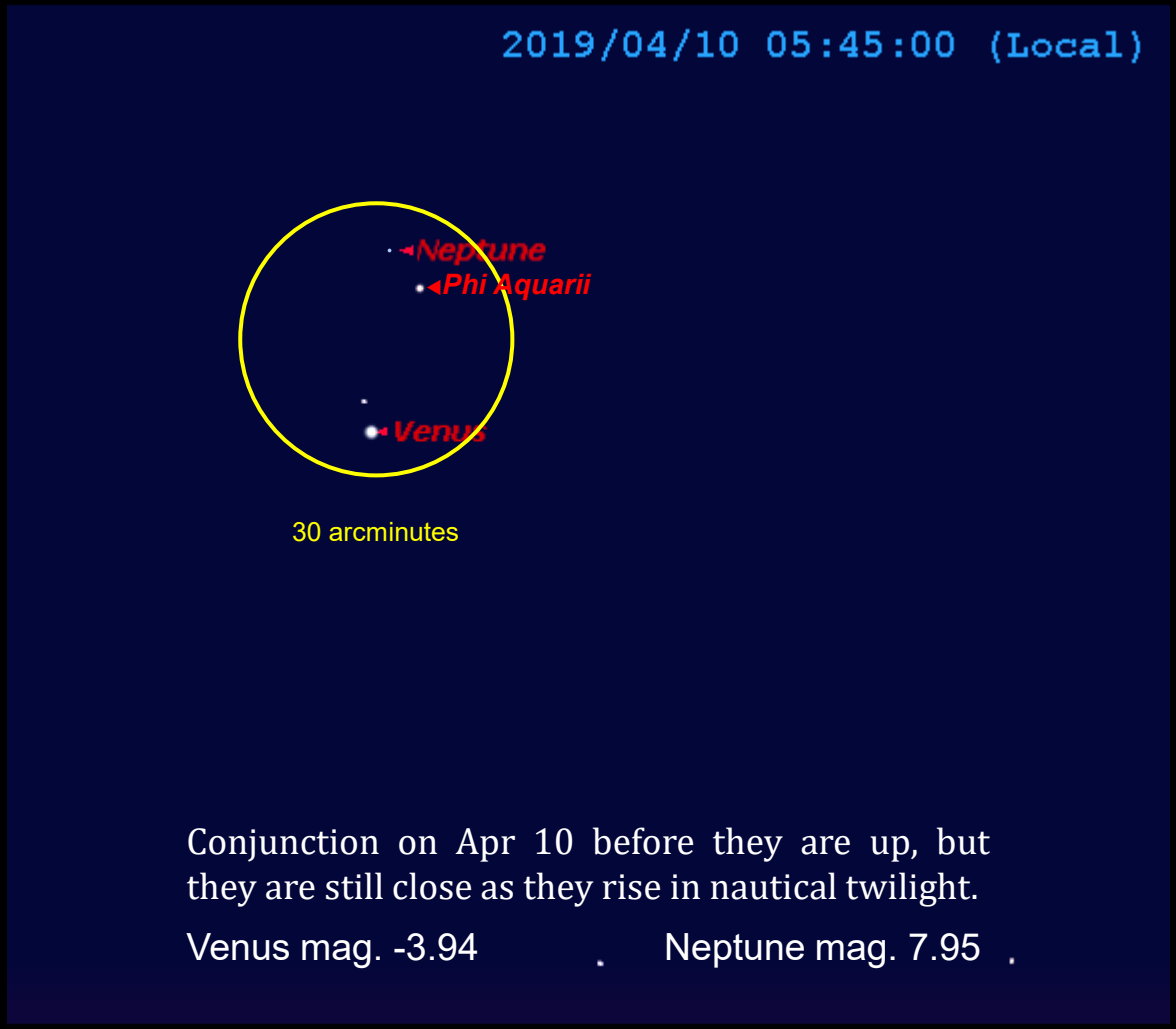



Conjunction on Apr 2 occurs ~ 3 pm.

Just 25' apart when rising that morning.

Mercury mag. 0.91 Neptune mag. 7.95

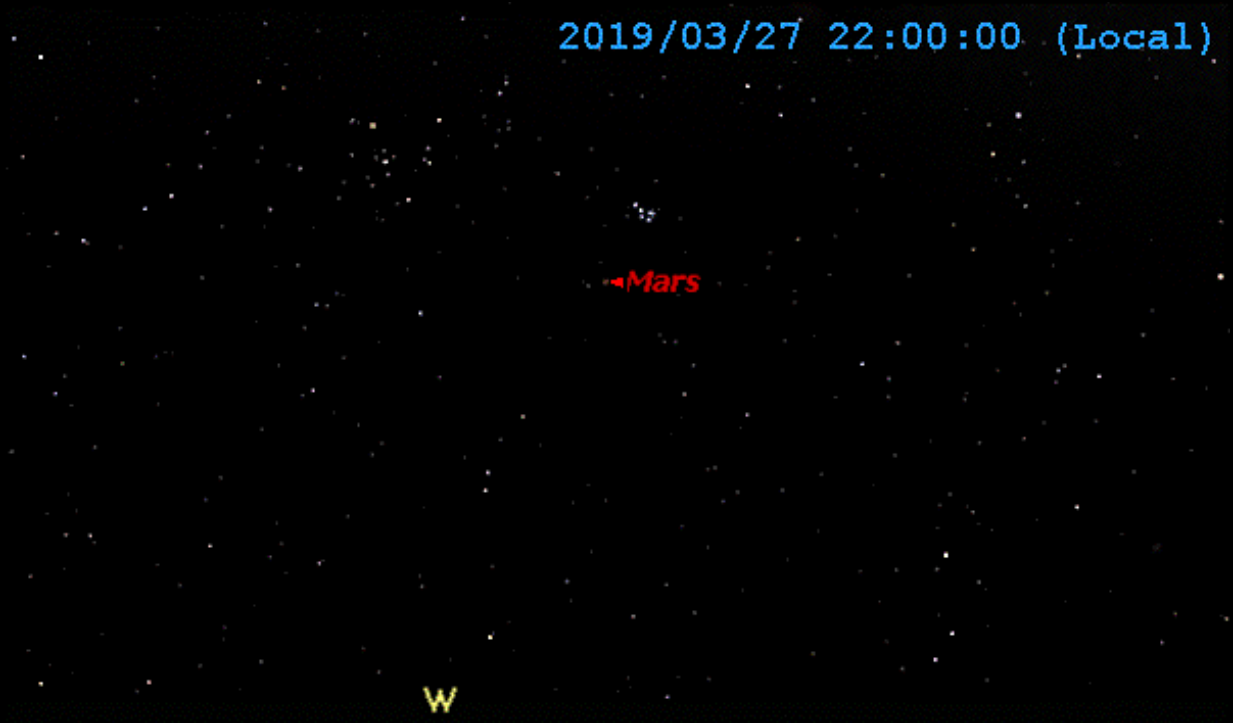
# Venus – Neptune Conjunction




Conjunction on Apr 10 before they are up, but they are still close as they rise in nautical twilight.

Venus mag. -3.94 . Neptune mag. 7.95 .

# Where are the planets?
## *Mars*

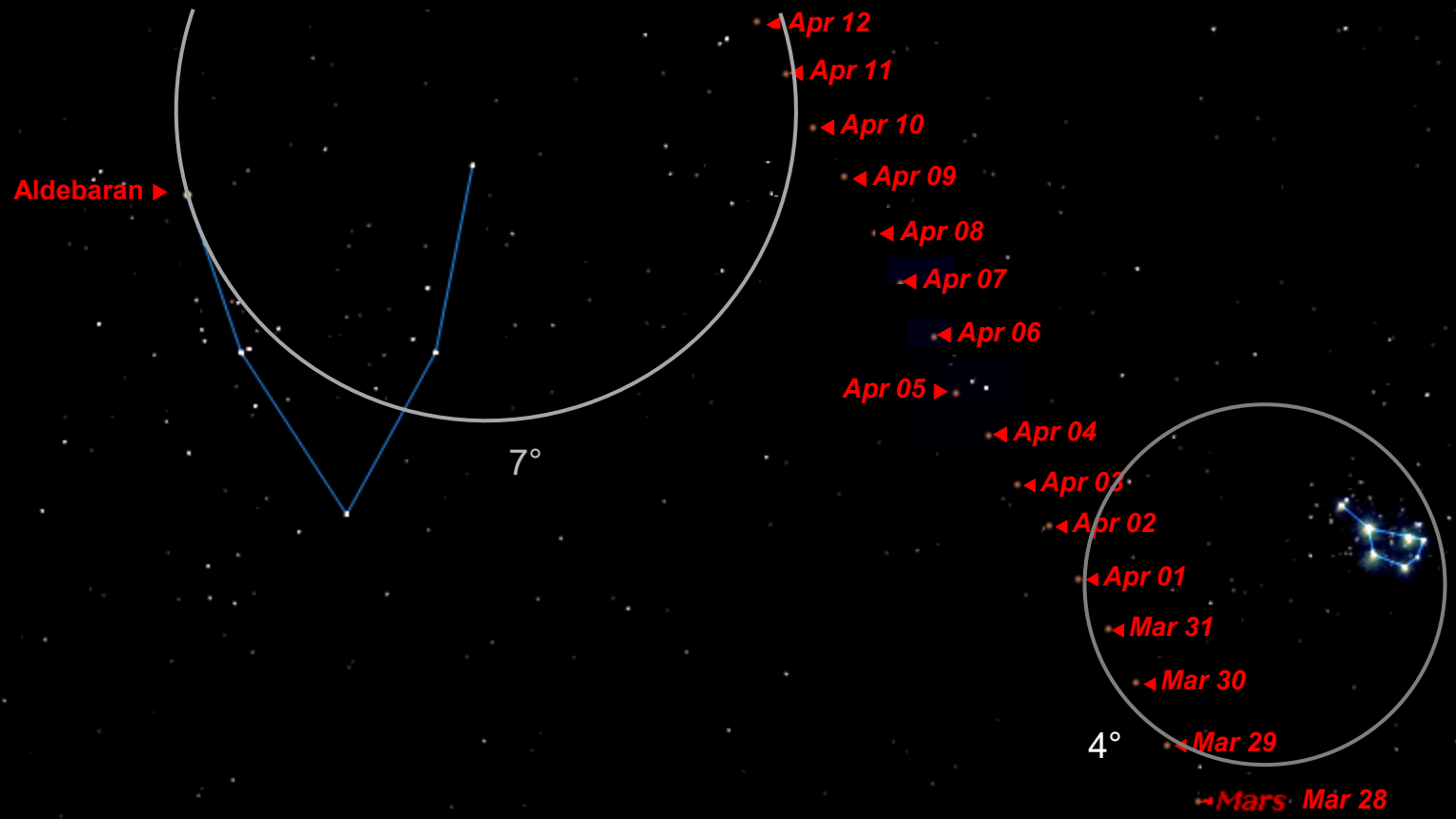



In Taurus, *slowly* drifting lower in the west

Mars continues to chase Earth since last July's opposition, causing it to linger for months in the western sky, slowly edging lower. (Mars will eventually slip behind the Sun on Sept. 1.)

Mid-month: magnitude +1.5, apparent diameter 4.4 arc-seconds

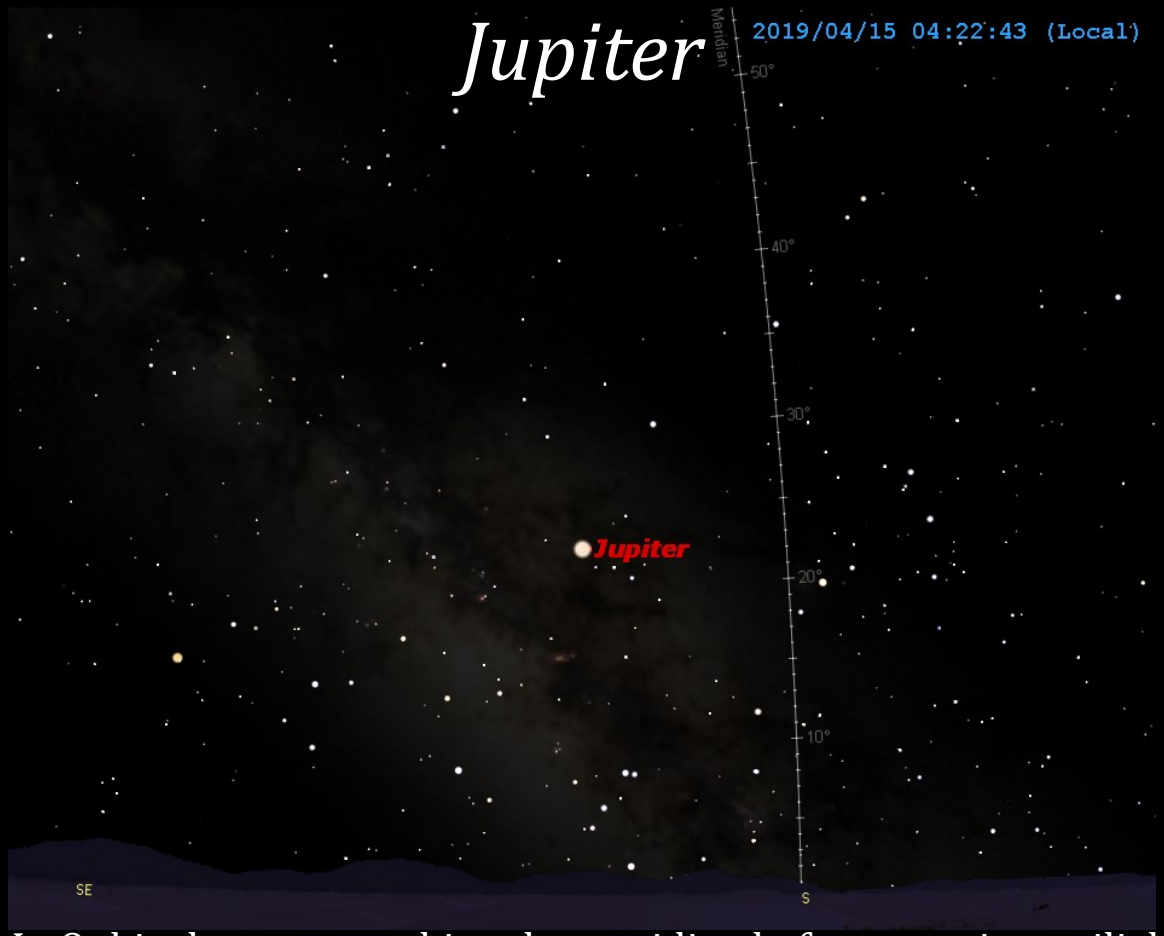
# Mars passes Pleiades & Hyades




| | | |
|---|---|---|
| Aldebaran | mag. 0.84 | Spectral Class K5 (orange) |
| Mars | mag. 1.52 | How does Mars's colour compare? |

# Where are the planets?

## *Jupiter*

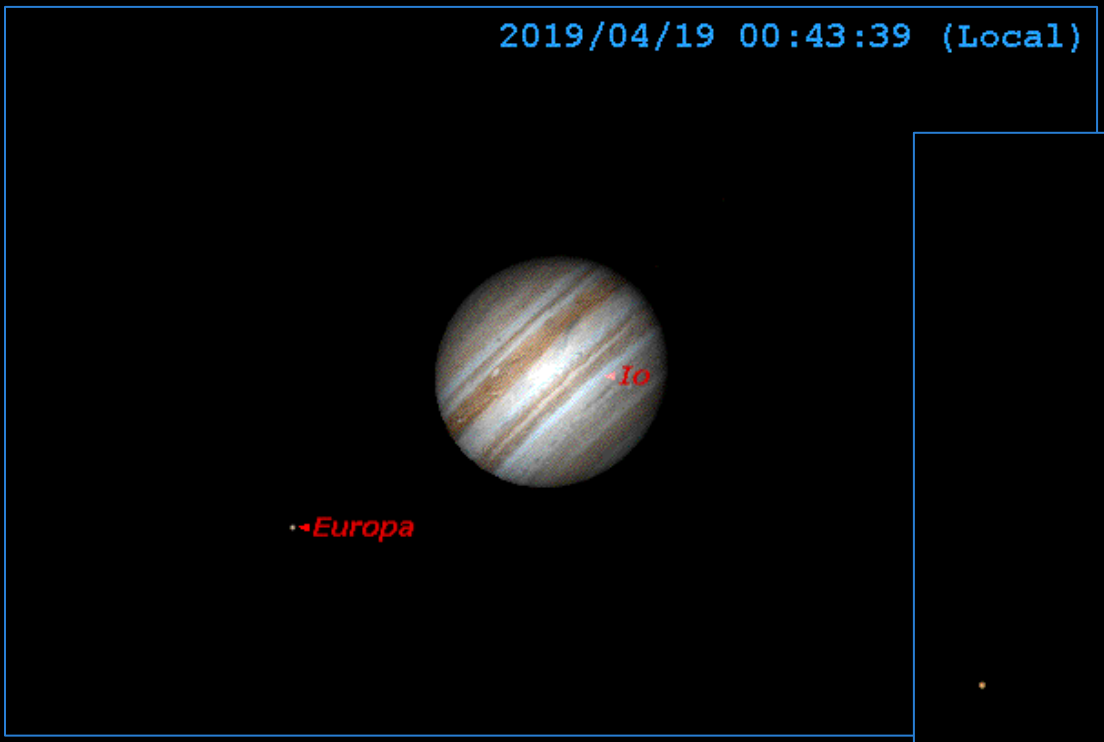


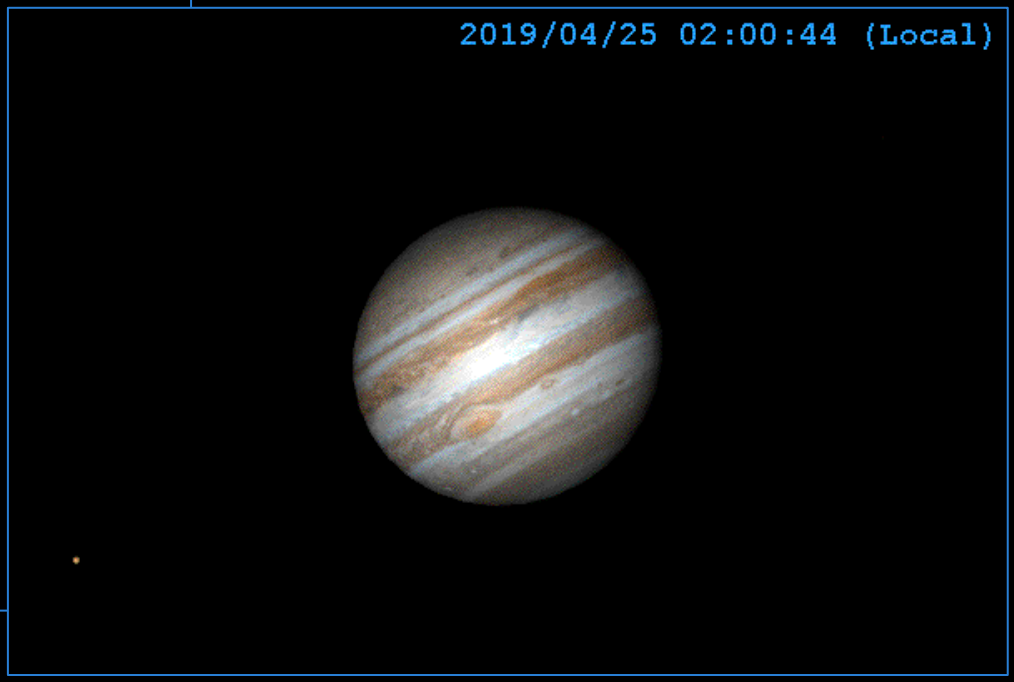

In Ophiuchus, approaching the meridian before morning twilight.

Excellent opportunity to view or photograph Jupiter in the pre-dawn calm.

Apr. 10: begins retrograde motion

Mid to late April: 23° high at start of twilight, mag -2.4, 42” wide




April 19

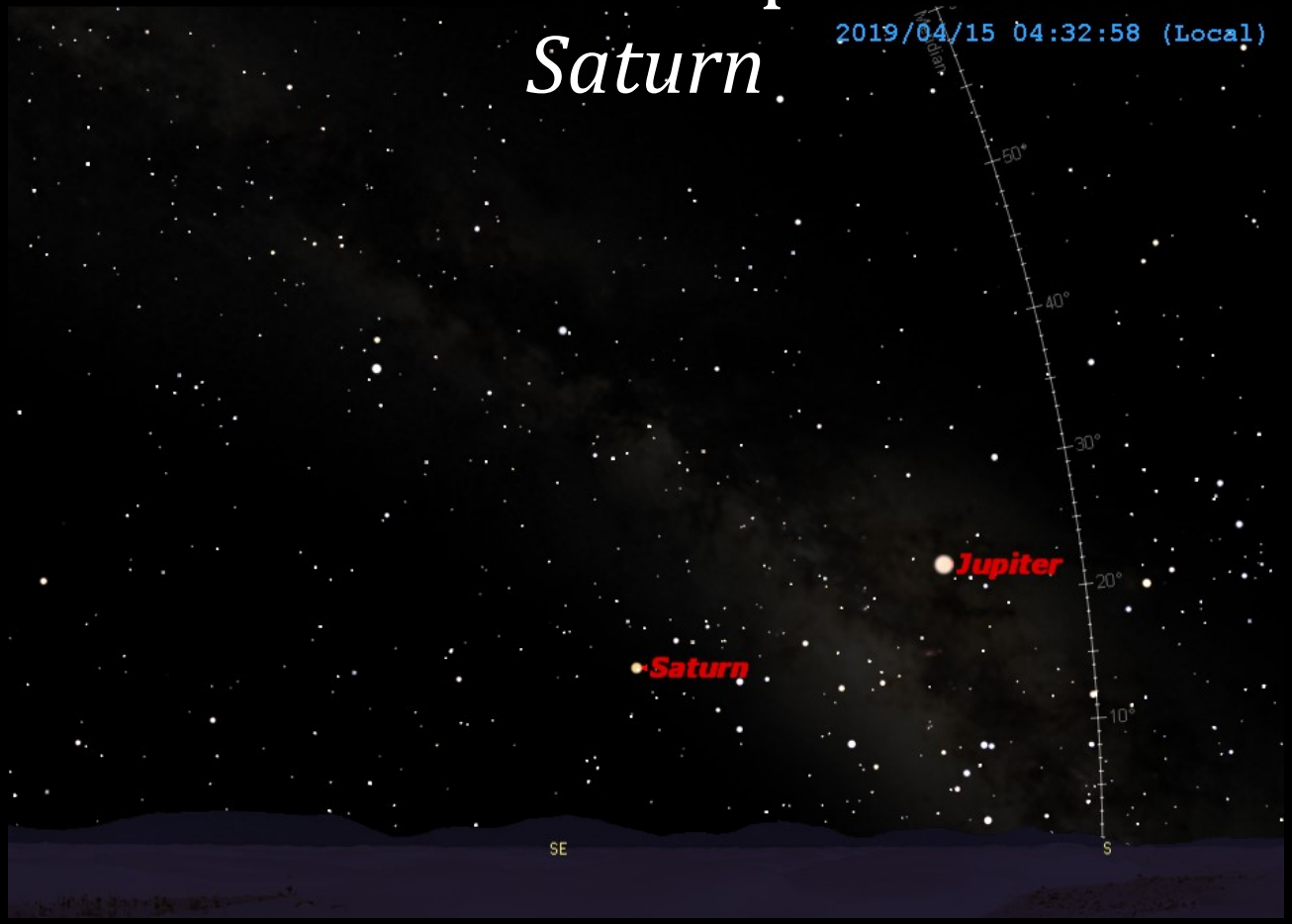
- Europa shadow transit
- Io exits occultation
- Europa transit

April 25

- GRS transit est. 03:35
  (movie is about an hour “fast”)
- Io shadow transit

# Where are the planets?

## *Saturn*




Trailing 26° behind (east) of Jupiter, in Sagittarius

Saturn's rings remain highly tilted with south pole still hidden.

Mid to late April: ~16° high at start of twilight, mag 0.5, 17" wide

Saturn will begin retrograde motion April 29.

2019/04/06 04:53:21 (Local)

Reflector

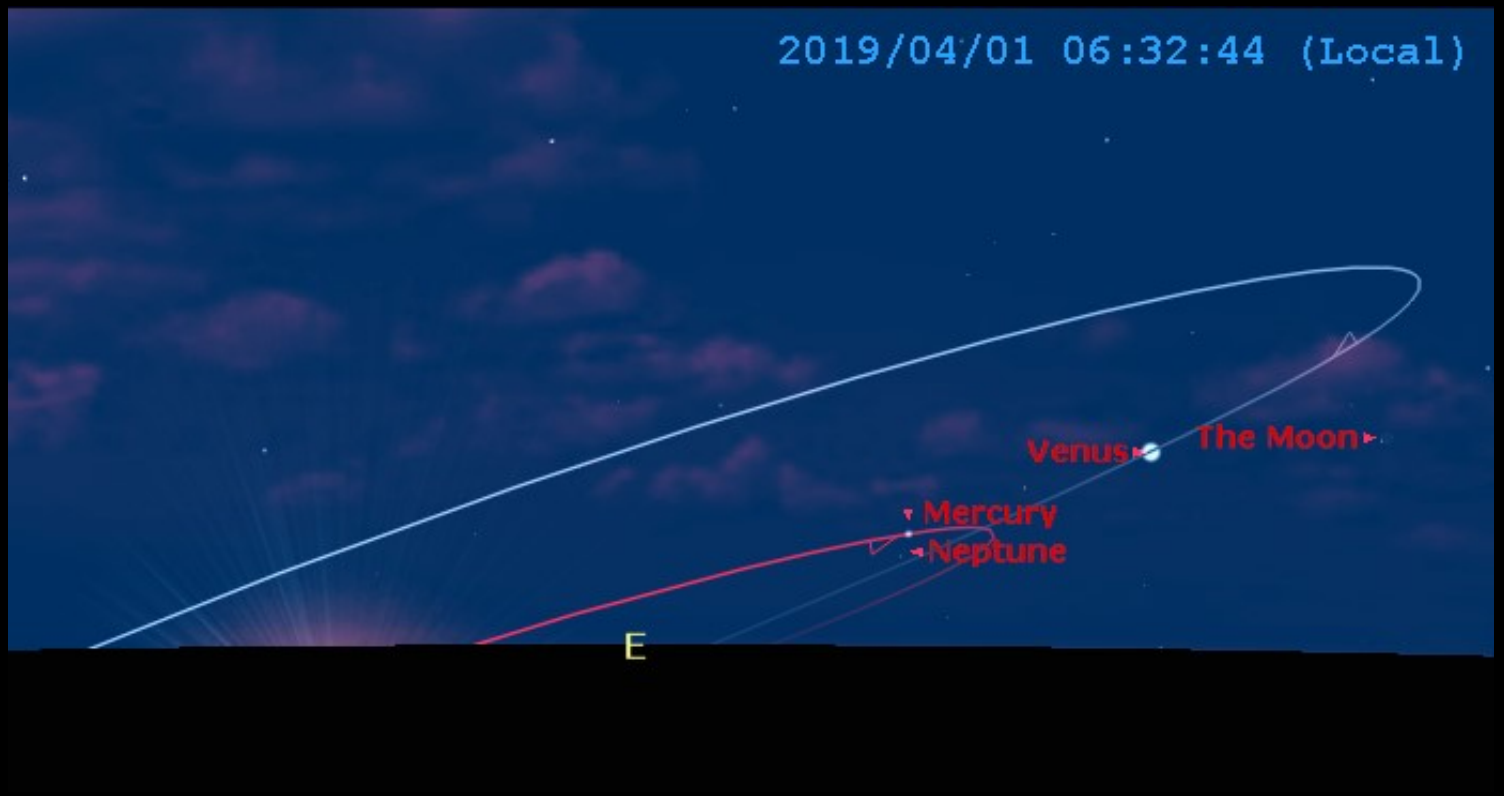
# Where are the planets?
# *Uranus*


In Aries, with the Sun.

April 22: Conjunction

Returns to the morning sky in the summer.

# Where are the planets?
## *Neptune*



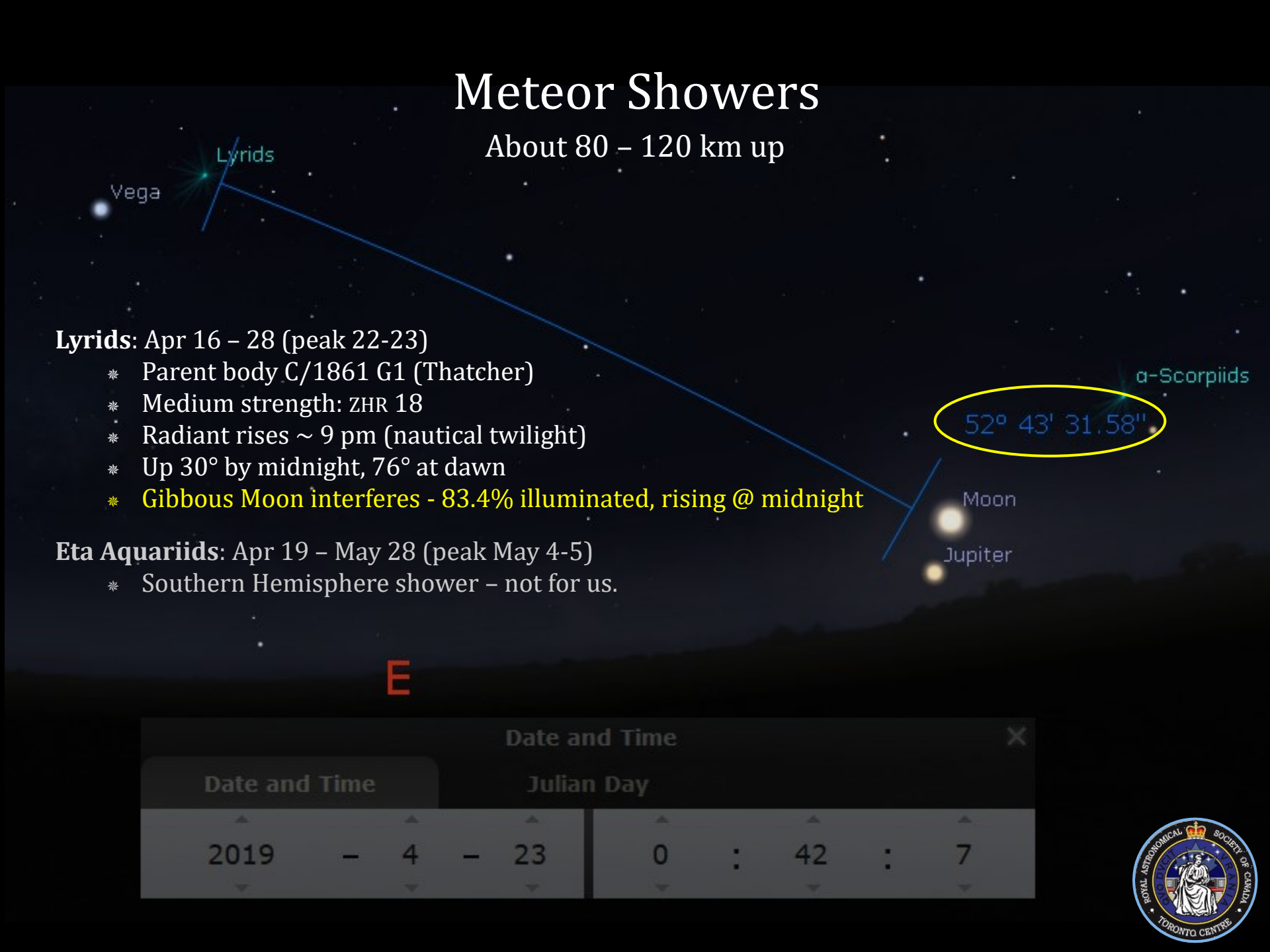

Hanging out with Mercury and Venus.

# Zodiacal Light


Still possible to catch the Zodiacal Light at the onset of night (next 9 nights).
Dark site a must, with no Moon interference.

# Meteor Showers

About 80 – 120 km up




**Lyrids**: Apr 16 – 28 (peak 22-23)

- Parent body C/1861 G1 (Thatcher)
- Medium strength: ZHR 18
- Radiant rises ~ 9 pm (nautical twilight)
- Up 30° by midnight, 76° at dawn
- Gibbous Moon interferes - 83.4% illuminated, rising @ midnight

**Eta Aquariids**: Apr 19 – May 28 (peak May 4-5)

- Southern Hemisphere shower – not for us.

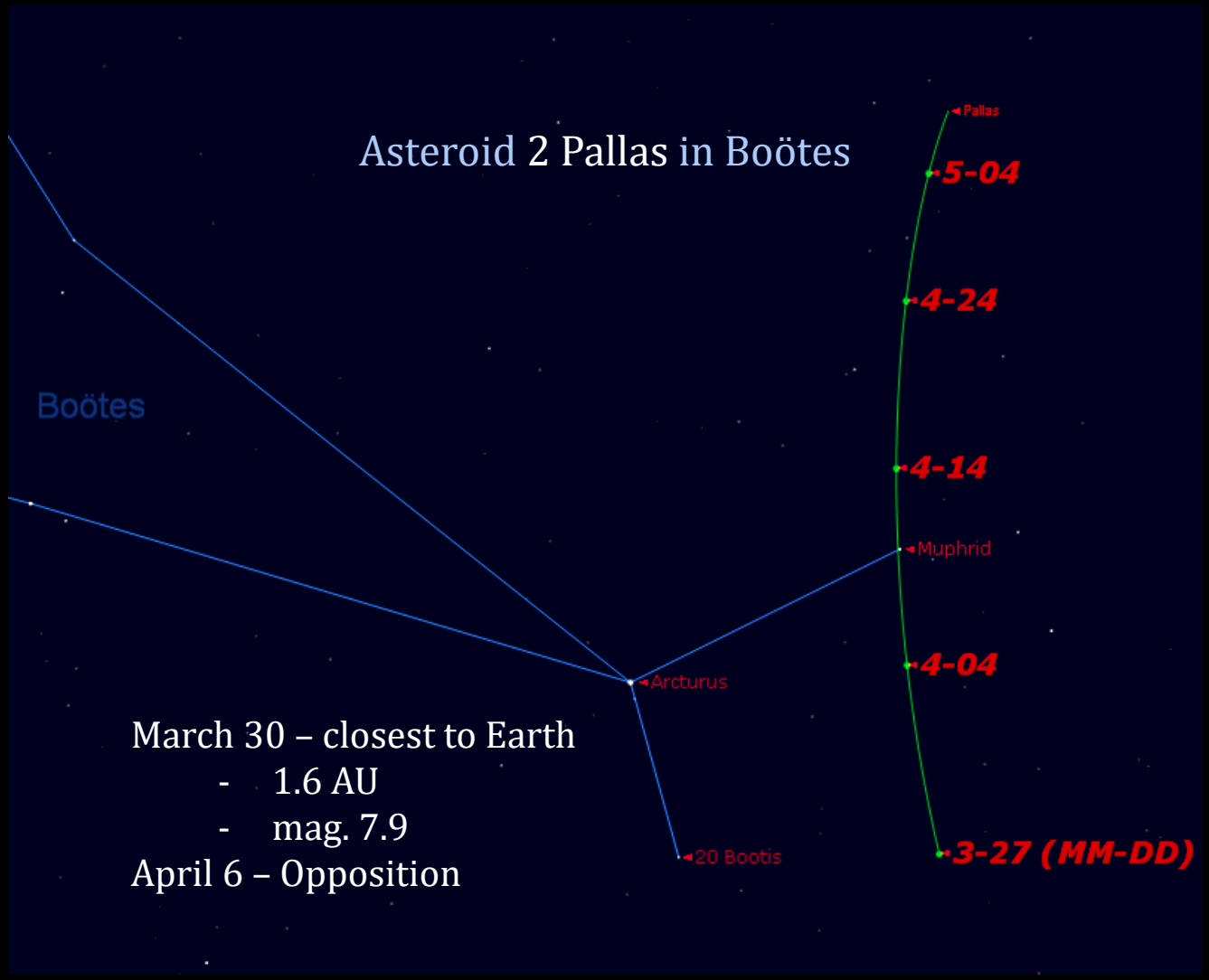
# Auroras

About 90 – 400 km up

- Solar minimum
  - Few or no sunspots, magnetic loops, CMEs
  - Chance if coronal hole returns to Earth-facing side
- Space weather reports, forecasts:
  - SpaceWeatherWoman.com
  - auroraforecast.com

From movie by Ian Wheelband

# Asteroids




March 30 – closest to Earth
- 1.6 AU
- mag. 7.9

April 6 – Opposition

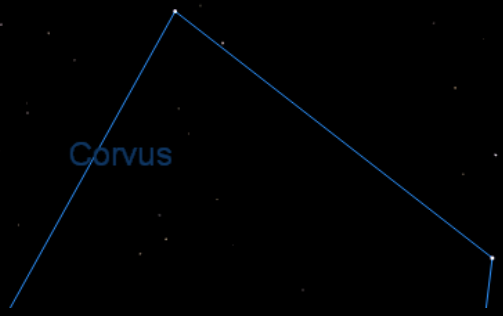
# Asteroids


Asteroid 7 Iris in Corvus

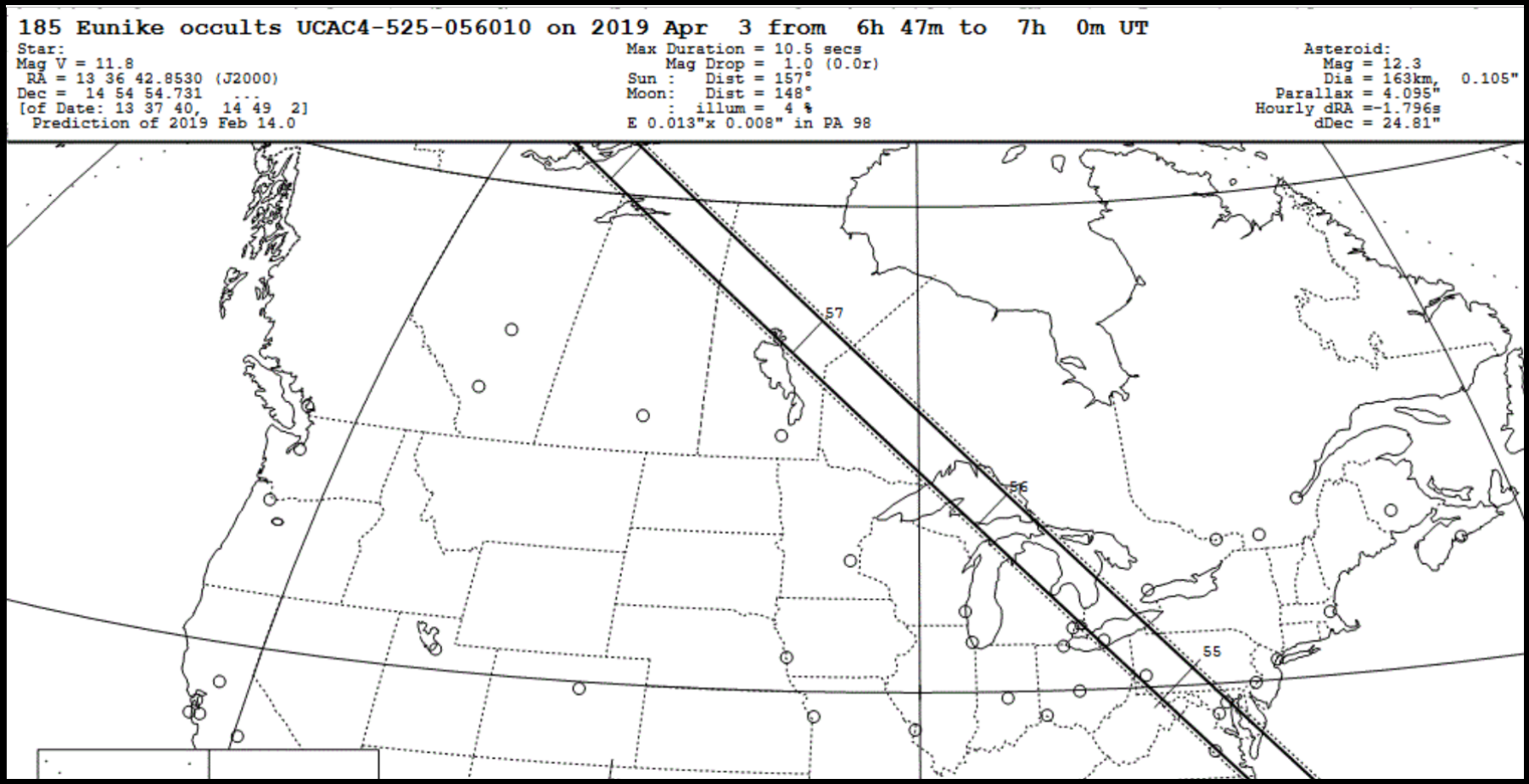
April 5: opposition
- Magnitude 9.07
- 1.8 AU away

April 10: Iris 1° from Sombrero Galaxy (M104)

April 17: moves into Virgo



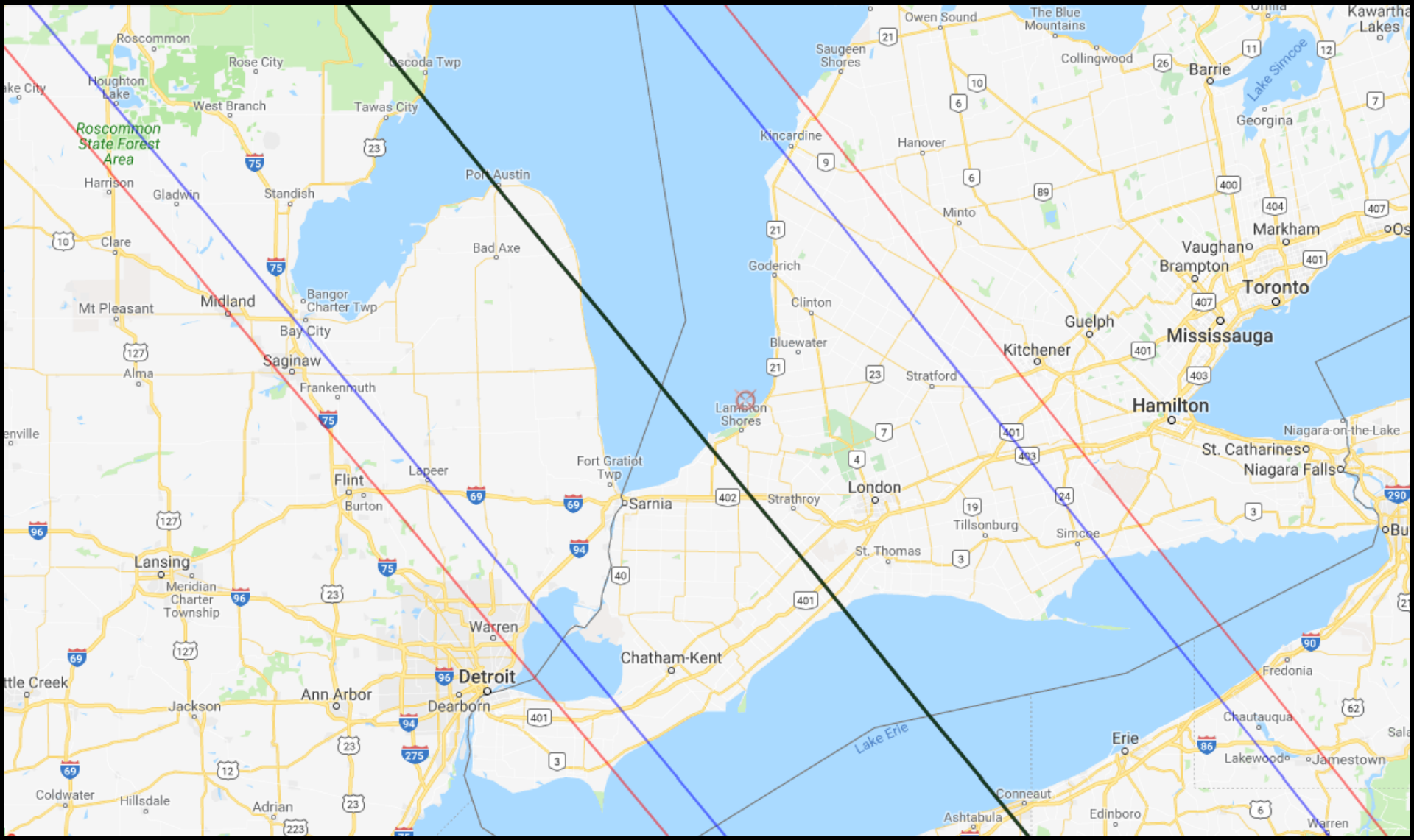
# Asteroid Occultation




April 3 – 02:55 EDT

Mag. 12.3 asteroid 185 Eunike occults mag. 11.8 star for 10.5 seconds

Visible from south-western Ontario




Visit www.poyntsource.com for more

# Lunar Occultation of Xi Ophiuchi


April 23 – Lunar occultation of Xi Ophiuchi (mag. 4.35)
00:43 – Occultation (from Toronto)
01:29 – Reappears

*Xi Ophiuchi is a multiple star system*
Primary magnitude 4.4
Component B magnitude 8.9, separation 3.5“
Component C magnitude 13.7, separation 10.8"

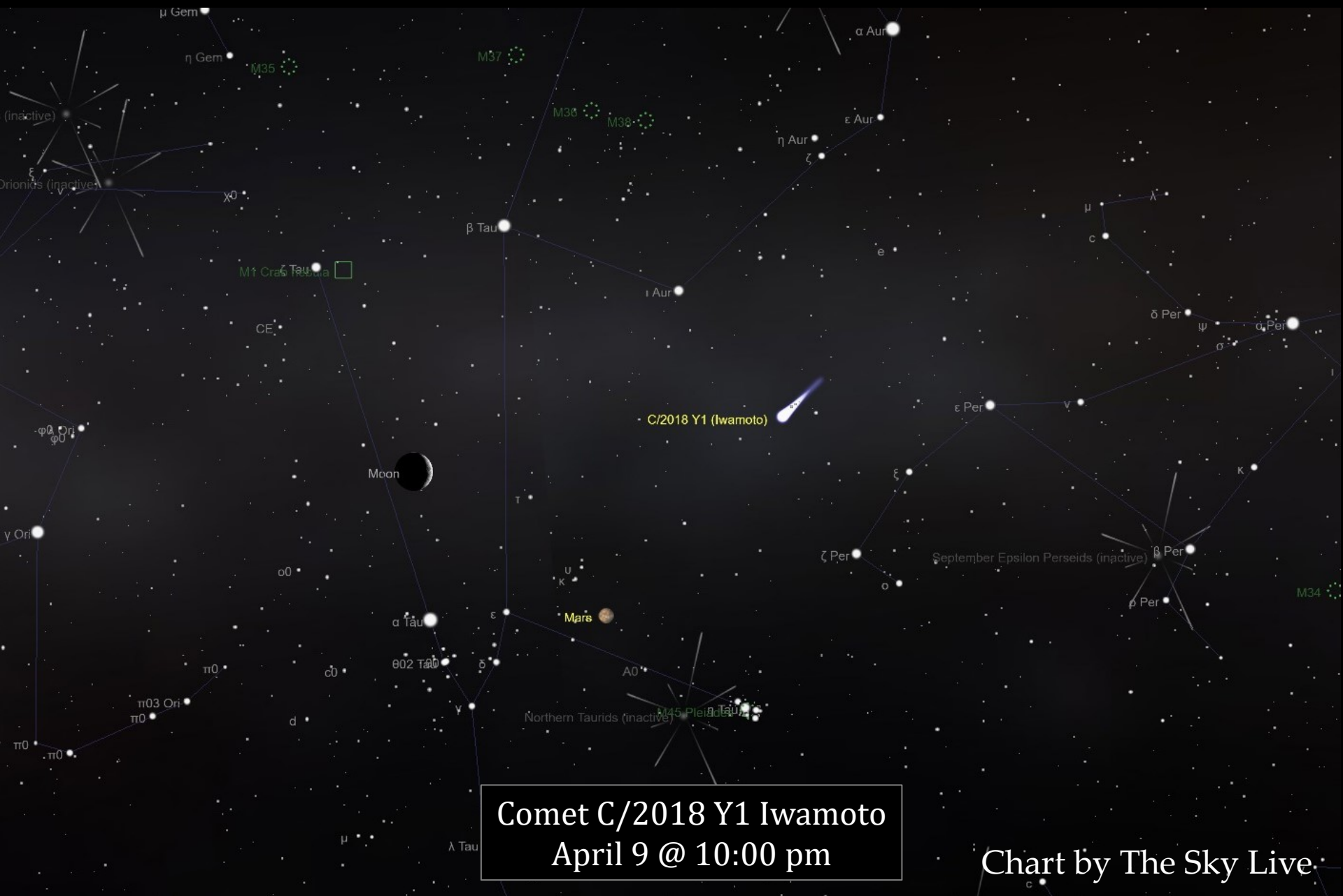
International Occultation Timing Association:
Observations are highly desired

# Comets


Chart by Seiichi Yoshida

## Comet C/2018 Y1 Iwamoto

# Comets

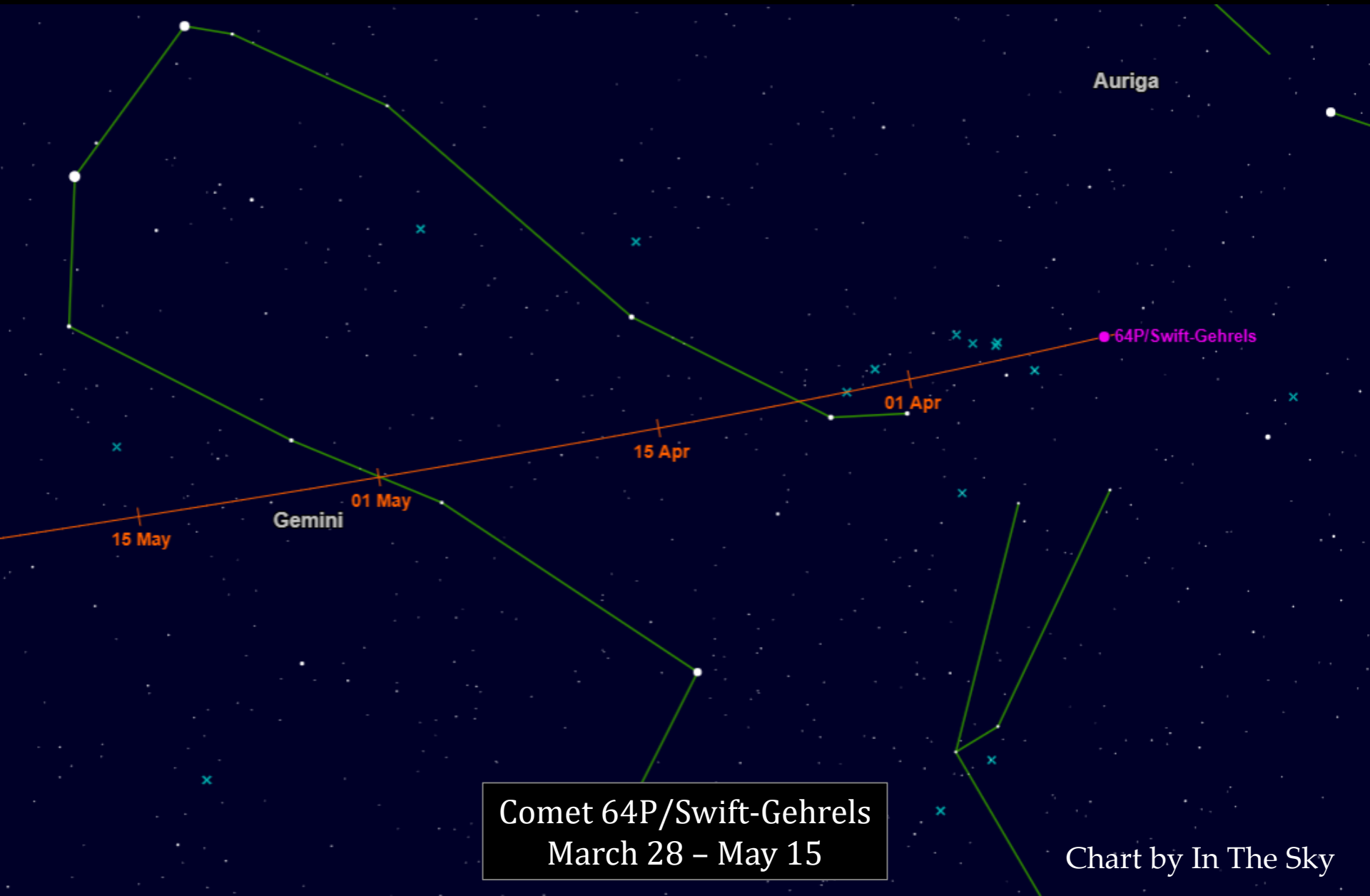



Comet C/2018 Y1 Iwamoto
April 9 @ 10:00 pm

Chart by The Sky Live


Opening frame of video by Doug Nan Jiang (on our Forum)

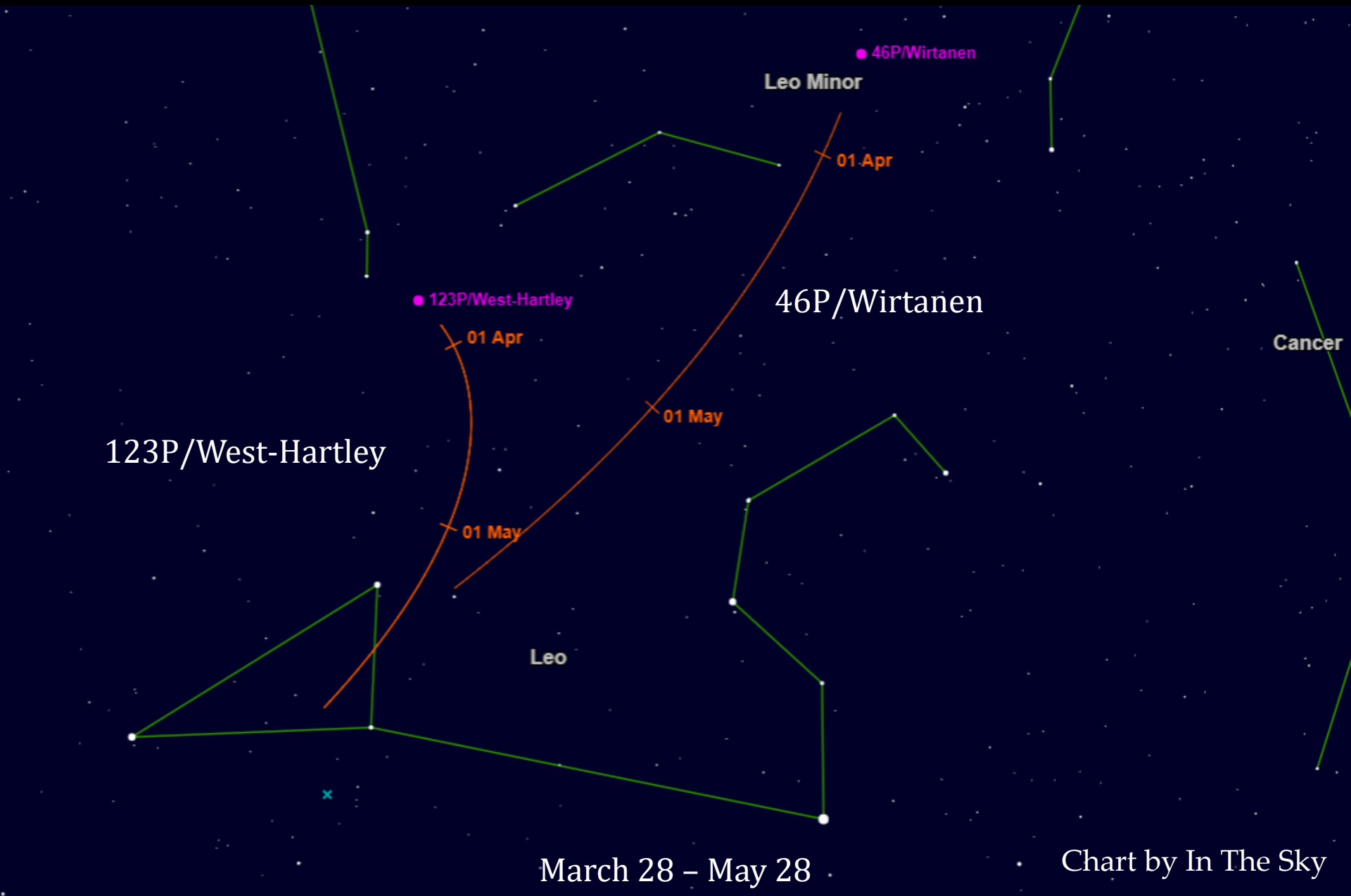
# Comets




Comet 64P/Swift-Gehrels
March 28 – May 15

Chart by In The Sky

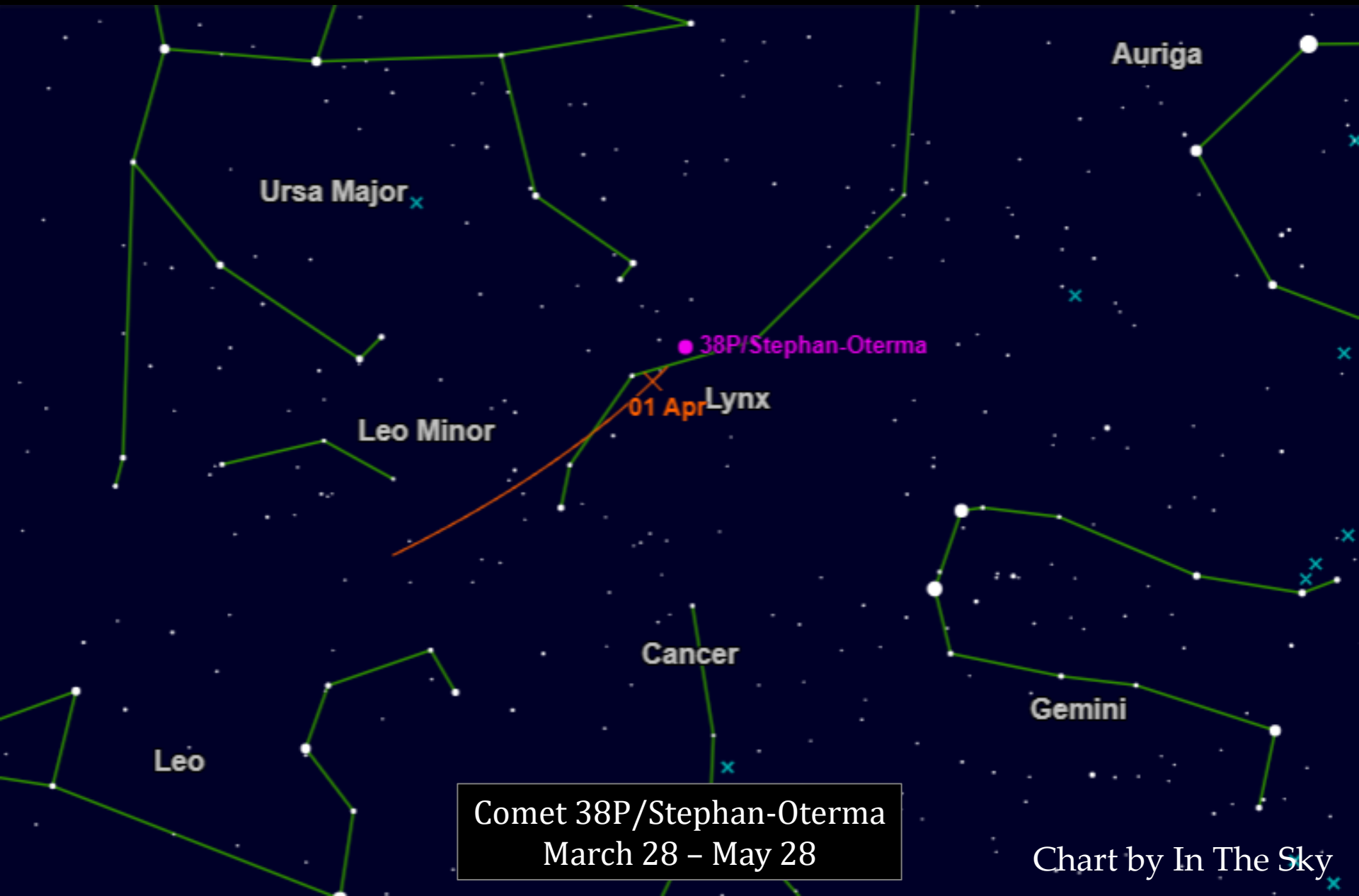
# Comets




March 28 – May 28

Chart by In The Sky

# Comets

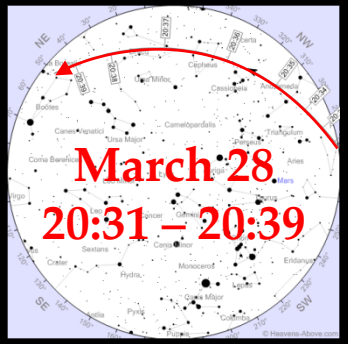


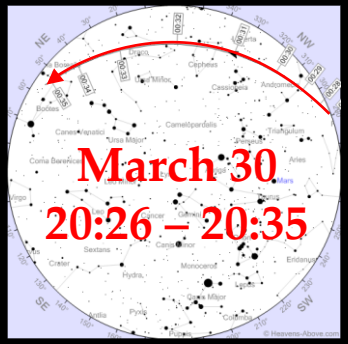

Comet 38P/Stephan-Oterma
March 28 – May 28

Chart by In The Sky

# ISS – Visible Passes

Now through April 8 – nightly visible passes in early evening



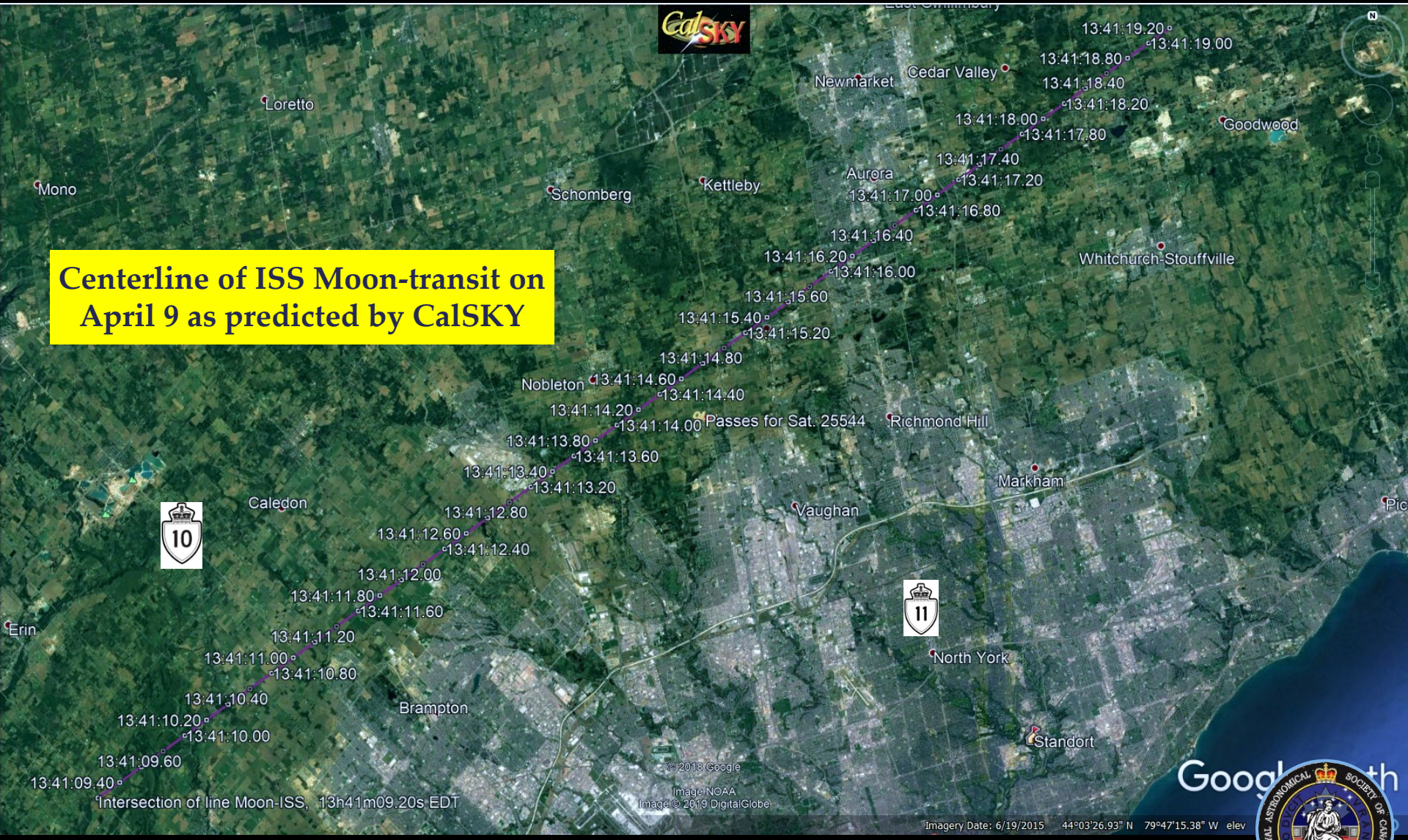




April 9 through April 27 – no visible passes (daytime)

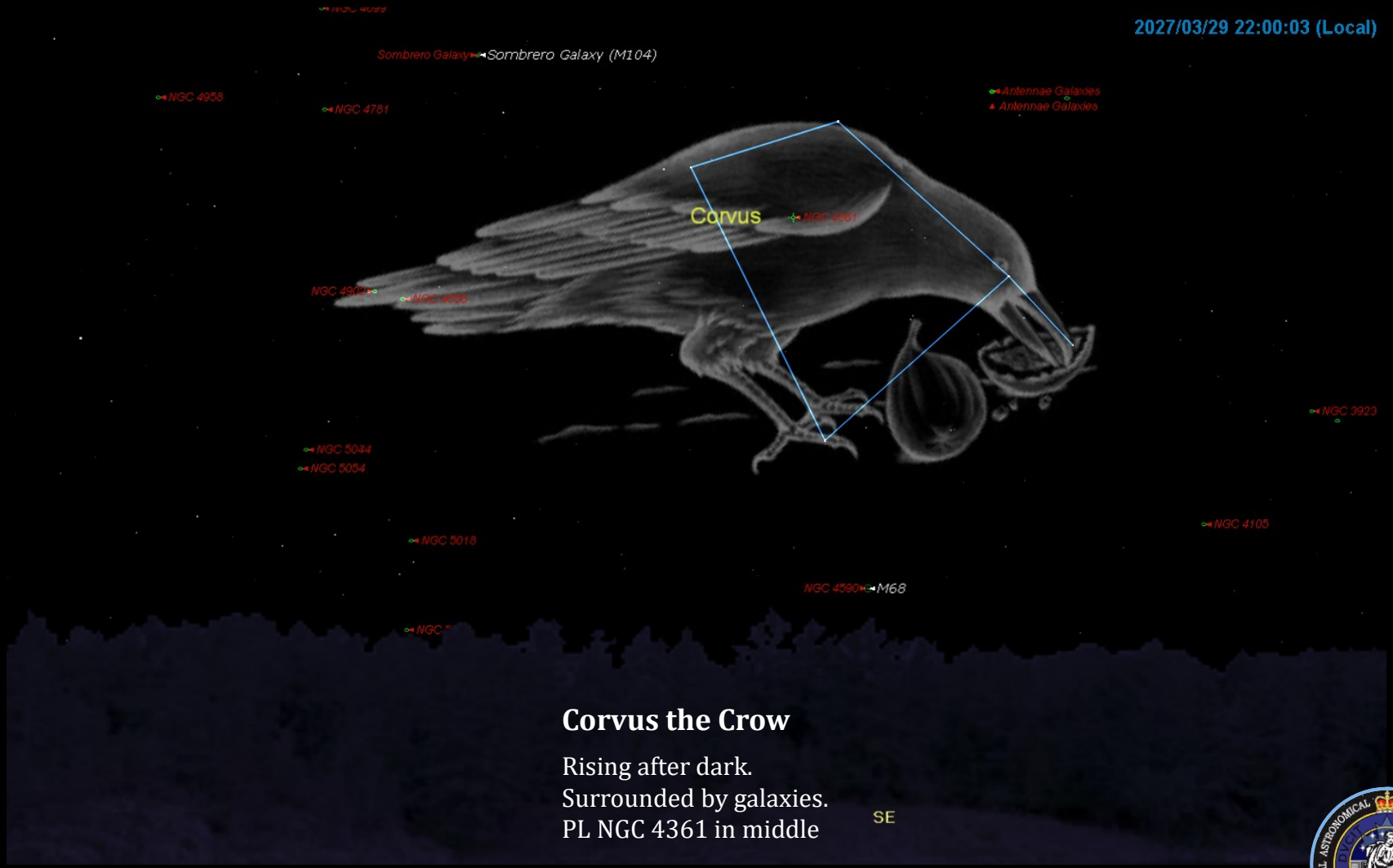
Visible passes resume on April 28, pre-dawn.

# ISS Moon-transit



# ISS Solar-transit

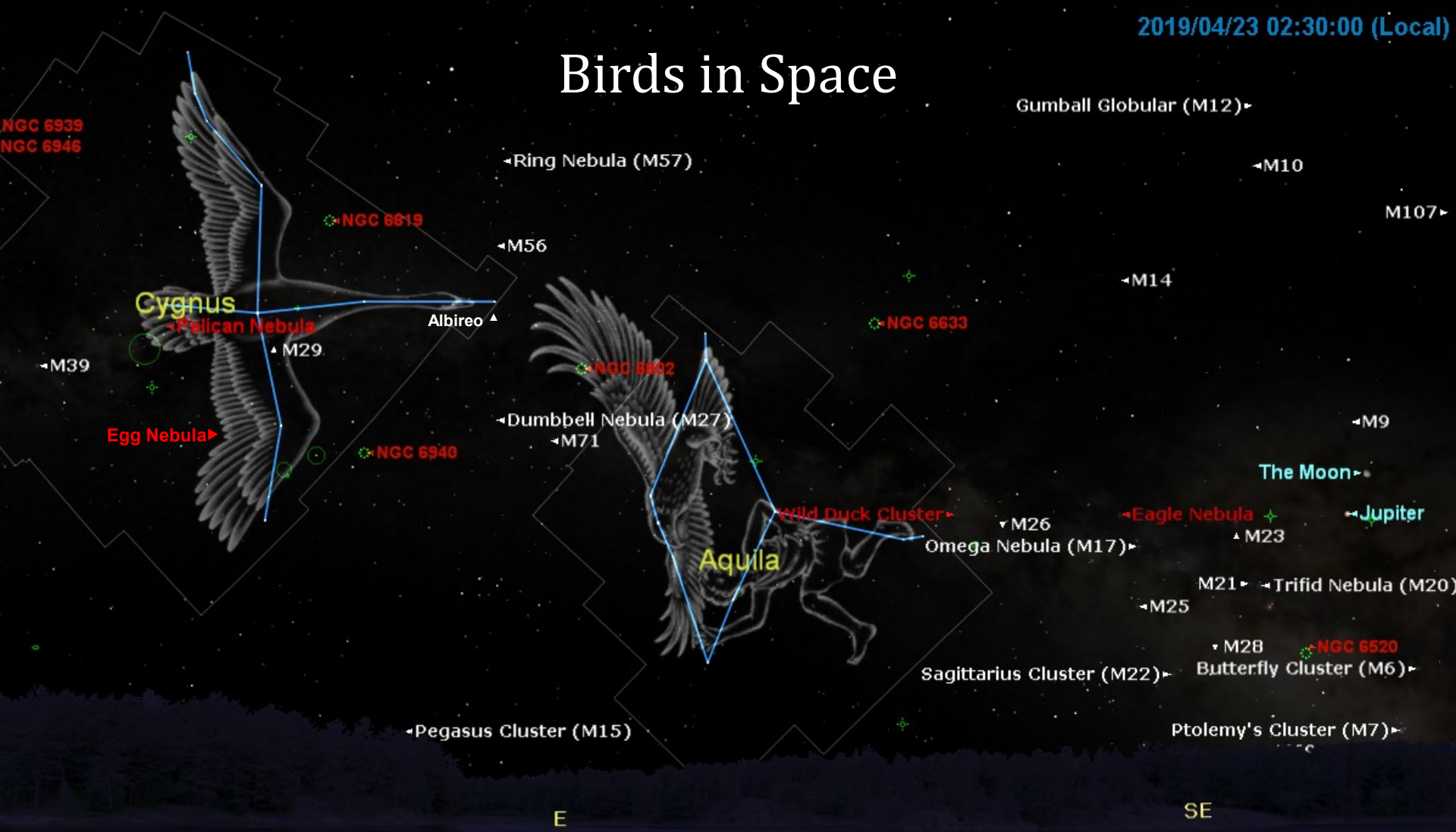
# Birds in Space




**Corvus the Crow**

Rising after dark.
Surrounded by galaxies.
PL NGC 4361 in middle

# Birds in Space




**Cygnus the Swan**

Contains the **Pelican** Nebula (IC 5070)
and the **Egg** Nebula

**Aquila the Eagle**

In neighboring Scutum: Wild **Duck** Cluster (M11)
In neighboring Serpens Cauda: **Eagle** Nebula (M16)

Rising in pre-dawn (e.g. the Apr. 23 morning Moon-Jupiter conjunction)

Pelican Nebula (circled) in image by Kevin Watson
(Detail from *Cygnus Milky Way - 20160807*)

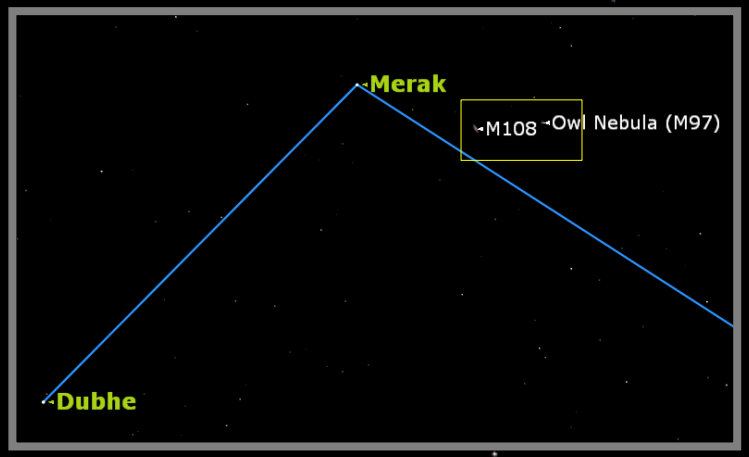
2019/03/28 22:45:00 (Local)

# Birds in Space

Galaxy M108

**The Owl Nebula (M97)**

Planetary Nebula
Magnitude 12
Angular size 4.7 ’
48’ from Galaxy M108

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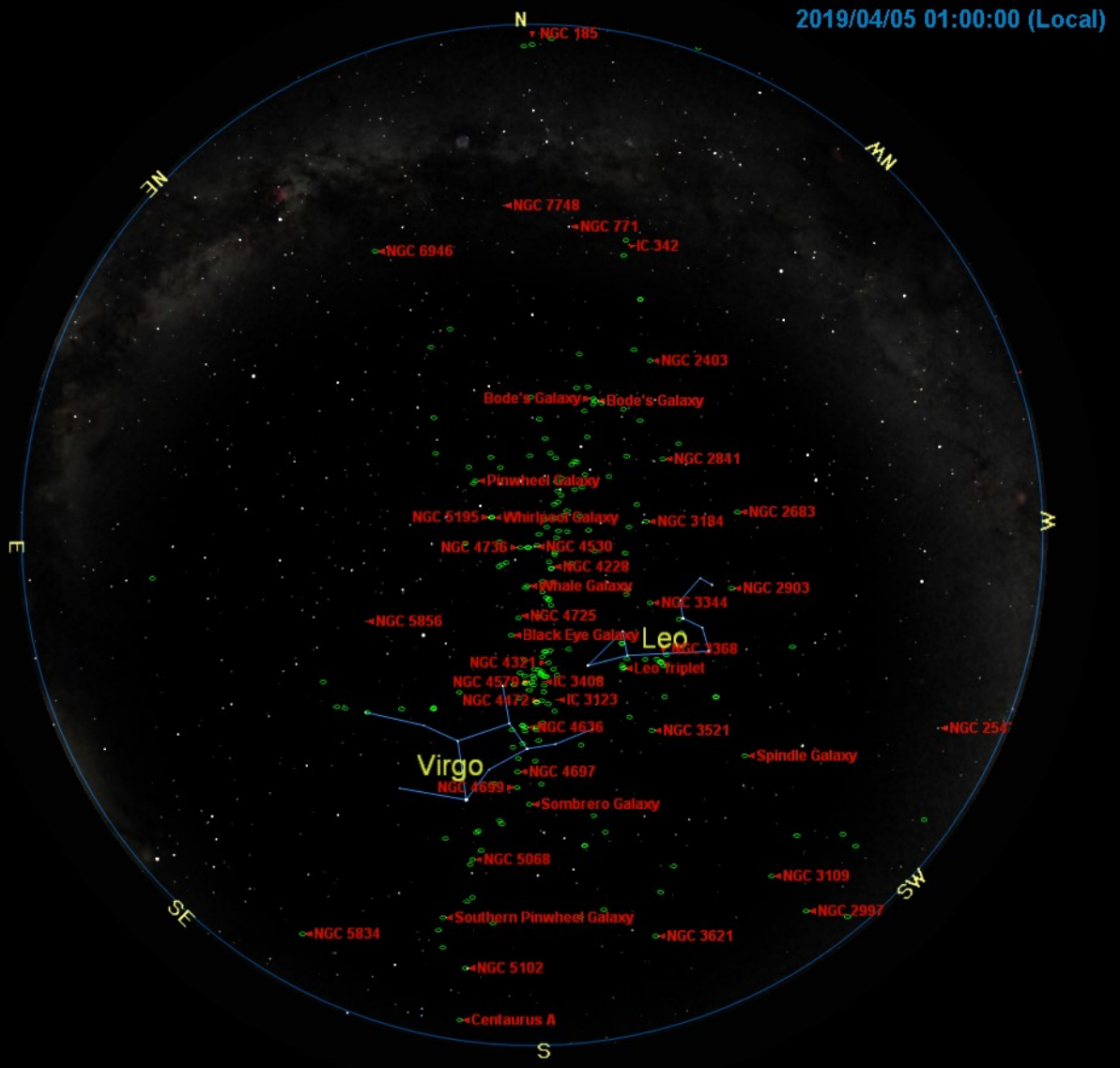
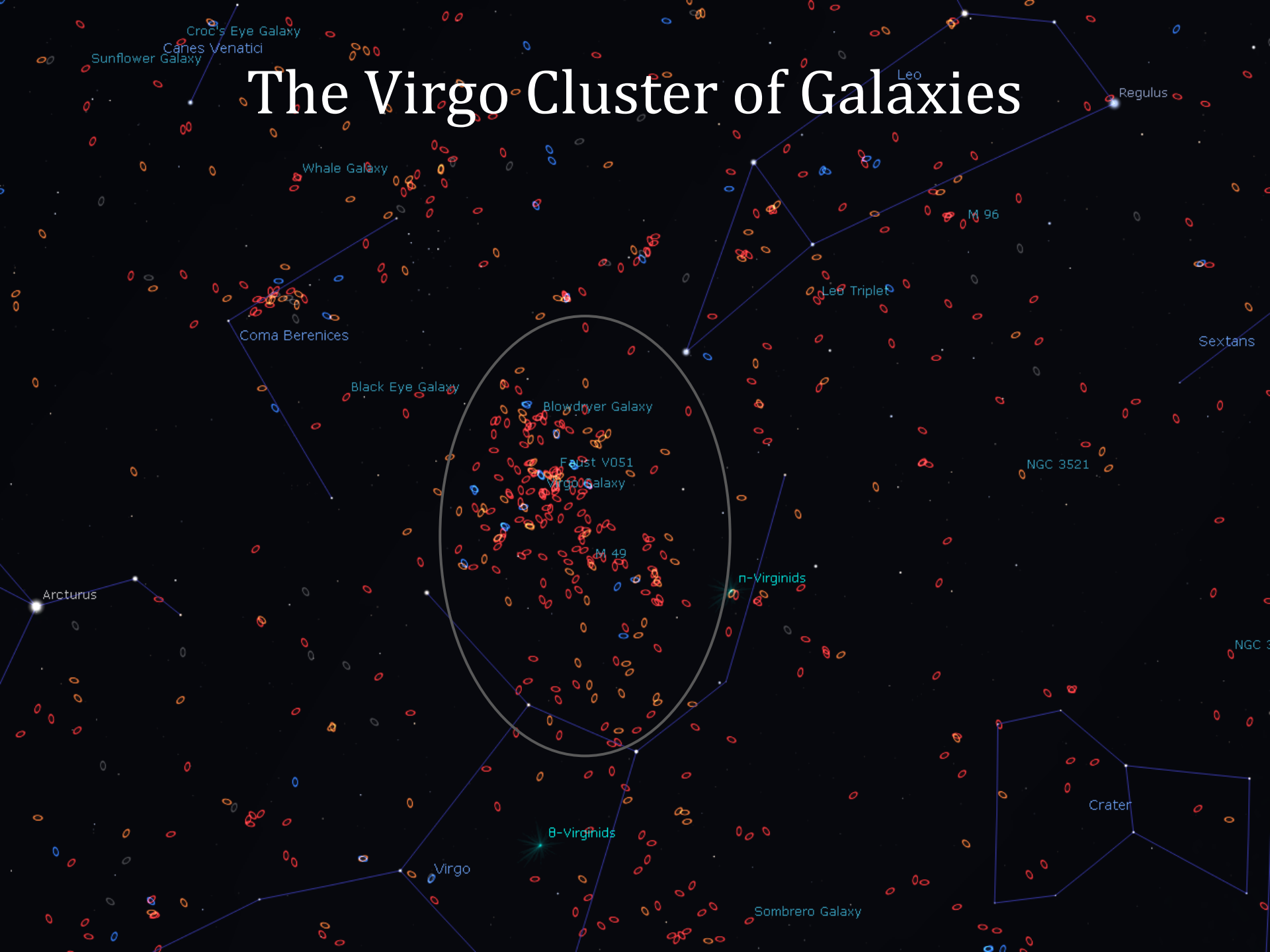
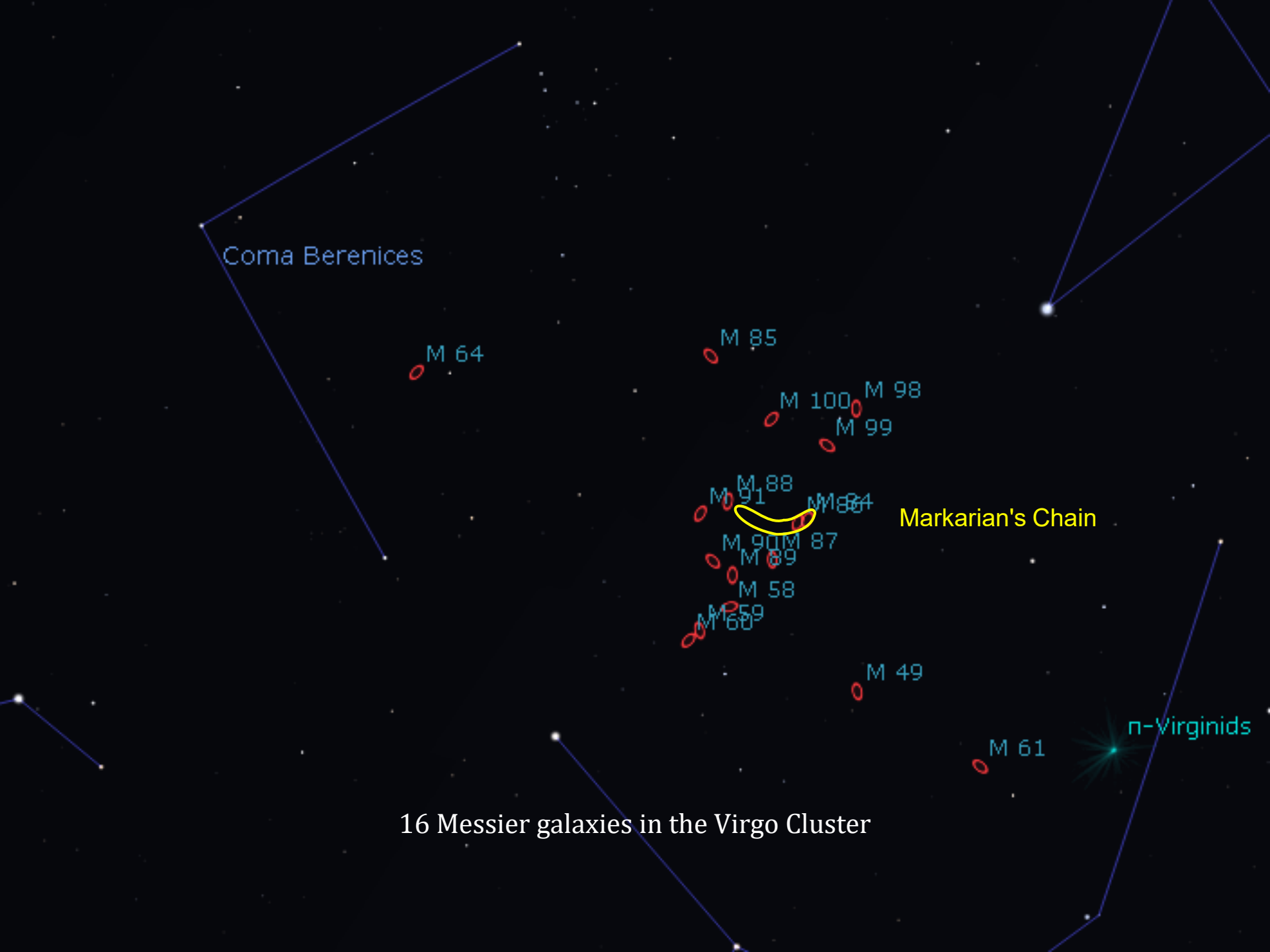
TORONTO CENTRE

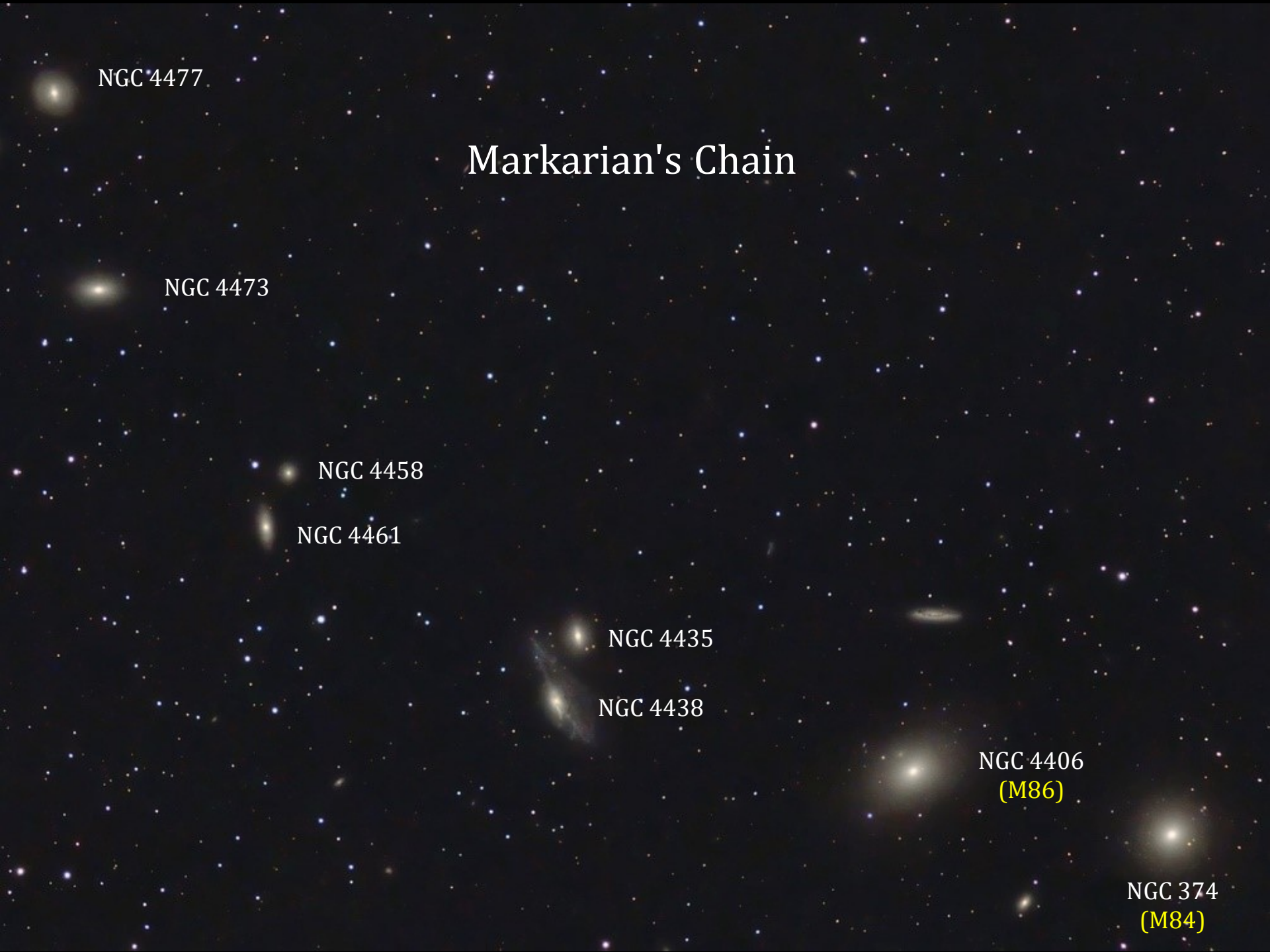
# Spring aperture fever

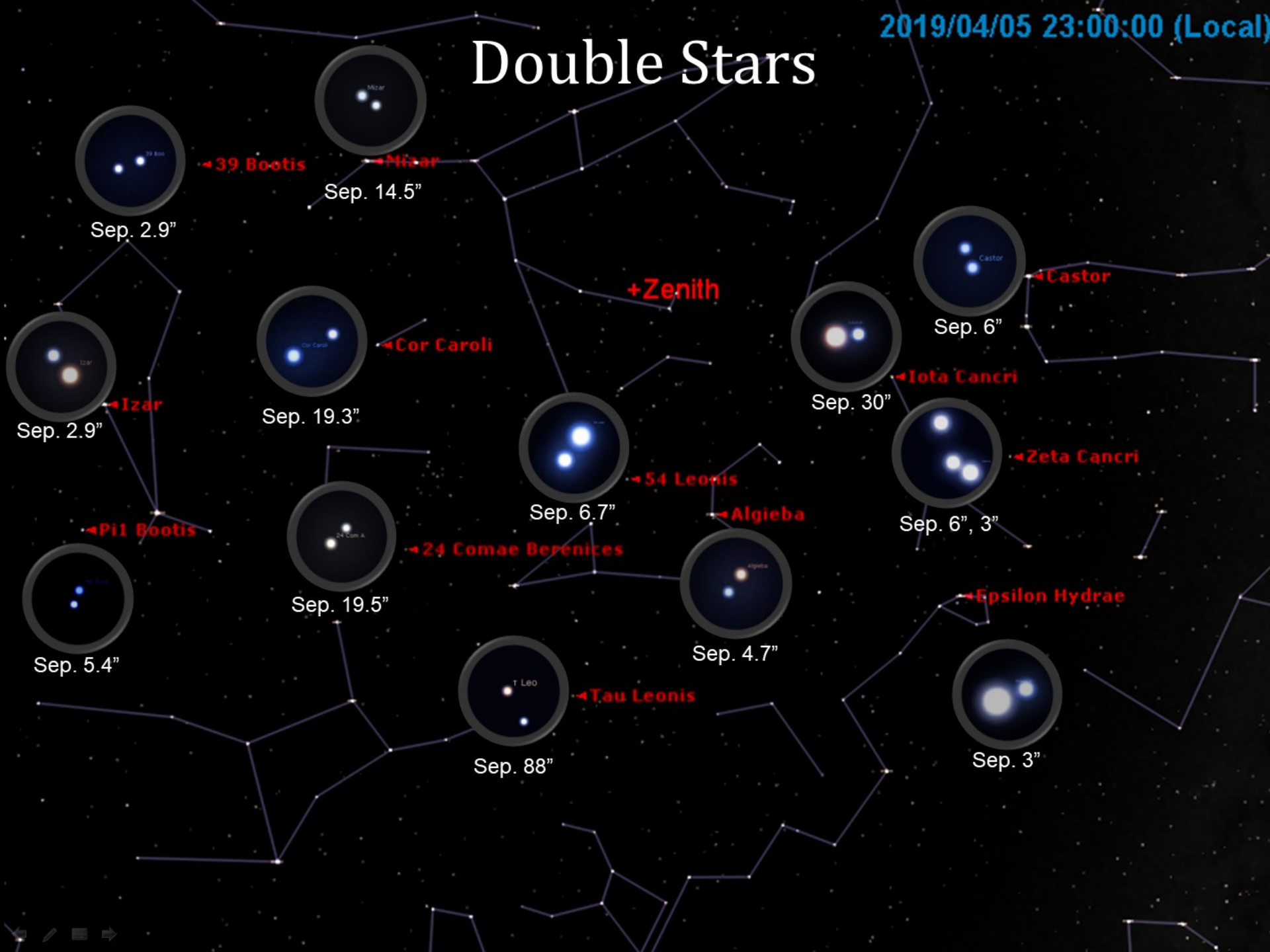



The Virgo Cluster of Galaxies
Croc's Eye Galaxy
Canes Venatici
Sunflower Galaxy
Leo
Regulus
Whale Galaxy
M 96
Leo Triplet
Coma Berenices
Sextans
Black Eye Galaxy
Blowdryer Galaxy
Faint V051
Virgo Galaxy
NGC 3521
M 49
n-Virginids
Arcturus
Crater
θ-Virginids
Virgo
Sombrero Galaxy




16 Messier galaxies in the Virgo Cluster


NGC 4477
Markarian's Chain
NGC 4473
NGC 4458
NGC 4461
NGC 4435
NGC 4438
NGC 4406
(M86)
NGC 374
(M84)


2019/04/05 23:00:00 (Local)
Double Stars
39 Bootis
Sep. 2.9”
Mizar
Sep. 14.5”
+Zenith
Castor
Sep. 6”
Cor Caroli
Sep. 19.3”
Izar
Sep. 2.9”
Iota Cancri
Sep. 30”
Zeta Cancri
Sep. 6”, 3”
54 Leonis
Sep. 6.7”
Algieba
Pi1 Bootis
24 Comae Berenices
Sep. 19.5”
Sep. 5.4”
Sep. 4.7”
Epsilon Hydrae
T Leo
Tau Leonis
Sep. 88”
Sep. 3”

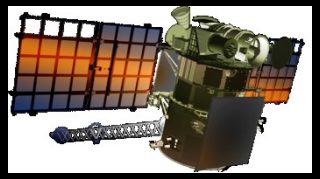
# Space Mission Updates

# Current Solar Missions (6)

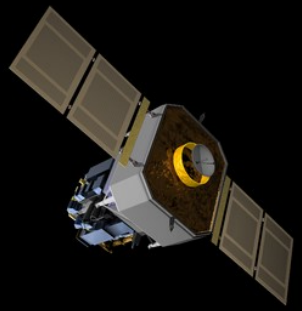
5

1

**WIND**
Study the Sun's wind



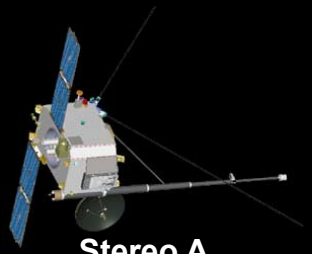
**DSCOVR**
Wind and CME monitoring



**SOHO**
Study Sun in multiple wavelengths

**Advanced Composition Explorer (ACE)**
Study the Sun's wind

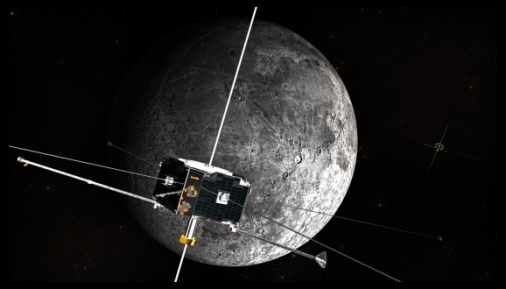
**Parker Solar Probe**
(*enroute)*
Study corona



**Stereo A**
Observe the Sun from side/back

# Current Moon Missions (9)

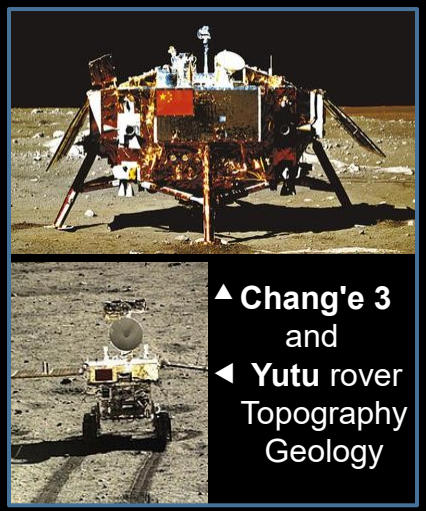
3



**ARTEMIS P1 & P2**
Study Moon's interaction w/ Sun

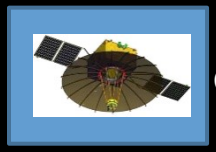
**Lunar Reconnaissance Orbiter**

5

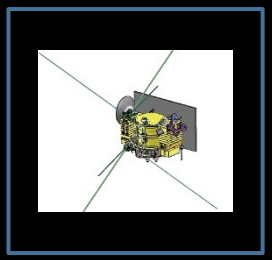


▲ **Chang'e 3** and
◀ **Yutu** rover
Topography
Geology

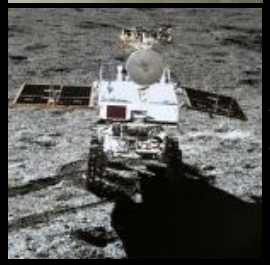
**Chang'e 5 T1**
Lunar flyby and Earth reentry. Test for **C' 5** sample return mission



**Queqiao**
Communication relay



**Longjiang-2**
Micro satellite
Obs. sky (not Moon) in low frequencies: 300 to 10 m wavelengths



**Chang'e 4 and Yutu 2 rover**

Same as C' 3 and Yutu 1, but placed *on far side of the Moon.*
Communicates via Queqiao

1


**Beresheet**

Currently enroute.

Feb 22: launched atop SpX Falcon 9

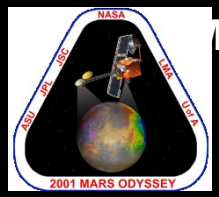
Apr. 4: lunar orbit
Apr. 11: soft landing

Private lander technology demonstration; measure local magnetism

# Current Mars Missions (8)

5

2




## Mars Odyssey

Orbiter. Detects water / ice in soil, below surface

April 2001: Launched. Oct. 2001: Orbit
2025: estimated fuel life


## Mars Reconnaissance Orbiter (MRO)

Analyze minerals, stratigraphy, landforms, and ice of Mars

Aug. 2005: Launched. March 2006: Orbit
2030's: estimated fuel life

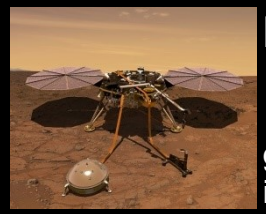
## Mars Science Laboratory (MSL) or Curiosity Rover

Acquires rock, soil, air samples for onboard analysis
Nov. 2011: Launched.
Aug. 2012: Landed
Operate for 6 – 15 years?


## MAVEN

Orbiter.
Study how Mars looses its water and atmosphere

Nov. 2003: Launch Sep. 14: Orbit
Mission extended indefinitely



## InSight Lander

Seismology, precession, geodesy, weather, interior heat

May 2018: Launch Nov. '18: Landed
Mission duration: 1 ♂ yr. (~2 ⊕ yrs)

## Mars Express (ESA)

Orbiter
Search for sub-surface water.

June 2003: Launch Dec. '03: Orbit
Mission extended to Dec. 2020

## ExoMars Trace Gas Orbiter (ESA & Roscosmos)

Orbiter
Search for methane, other trace gases
Mar. 2016: Launch Oct. '16: Orbit
Mission duration: 7 years

1


## Mars Orbiter Mission (MOM) (Indian Space Research Organization)

Orbiter
Technology demonstration.
Study morphology, topography and mineralogy
Nov. 2013: Launch Sept. 2014: Orbit
Mission to last as long as possible.

# Current Mercury Mission

1

**BepiColombo**

European Space Agency

Currently enroute.

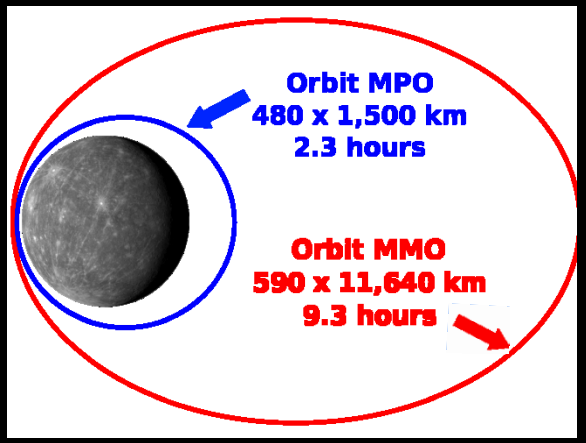
Oct 2018: launched atop Ariane 5

Dec 2025: orbital insertion

Two orbiters:

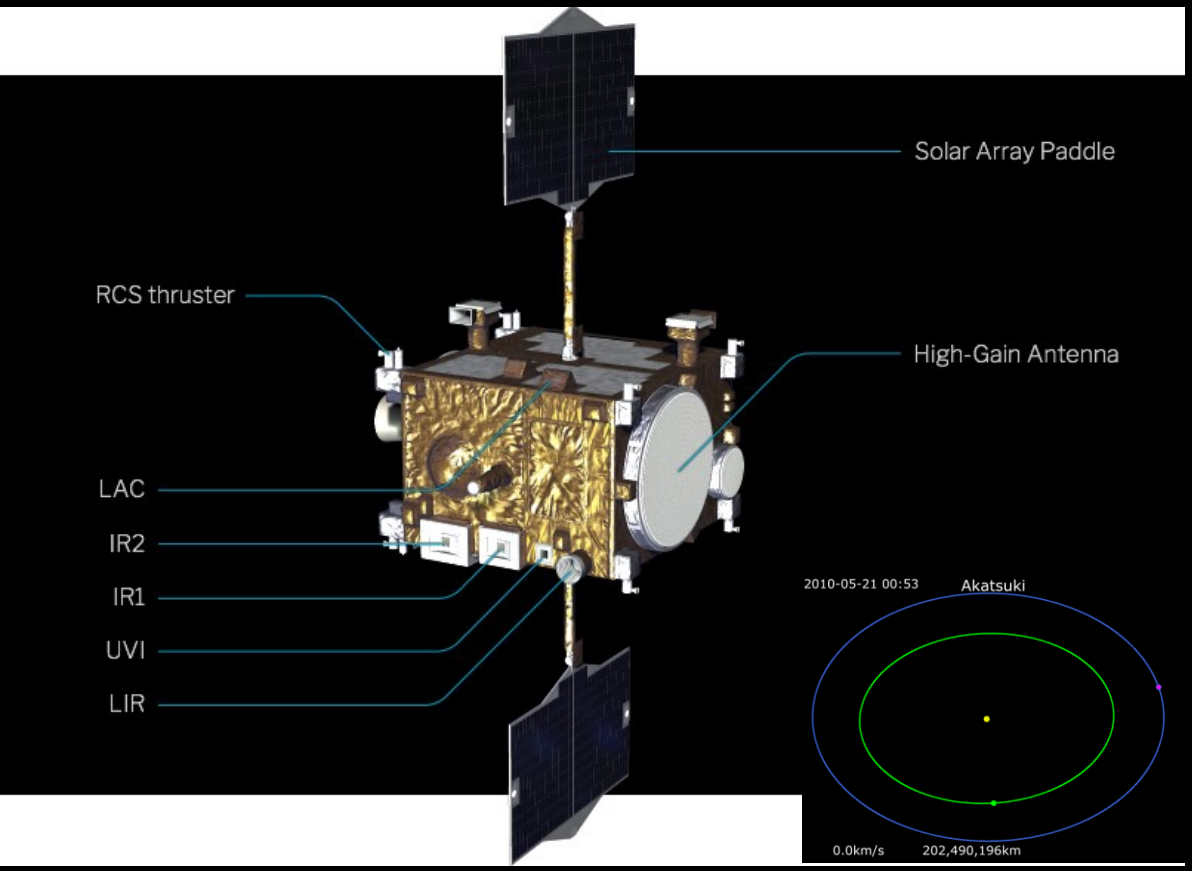
**MPO** Mercury Planetary Orbiter

**MMO** Mercury Magnetospheric Orbiter



# Current Venus Mission

1




**Akatsuki** - Venus Climate Orbiter

Japanese Space Agency (JAXA)

Study the atmosphere of Venus

May 2010: Launched atop H-IIA 202

Dec 2015: Orbital Insertion

# Current Jupiter Mission (1)

1

**Juno** Orbiter Seismology, precession, geodesy, weather, interior heat
August 2011 – Launch
July 2016 – Orbital Insertion
July 2021 – Planned deorbit into Jupiter's atmosphere

Roman god Jupiter, his wife Juno and Galileo Galilei hitched a ride aboard Juno in a collaboration between NASA and the LEGO Group to inspire children to explore science, technology, engineering, and mathematics

# Current Asteroid Missions (2)

1

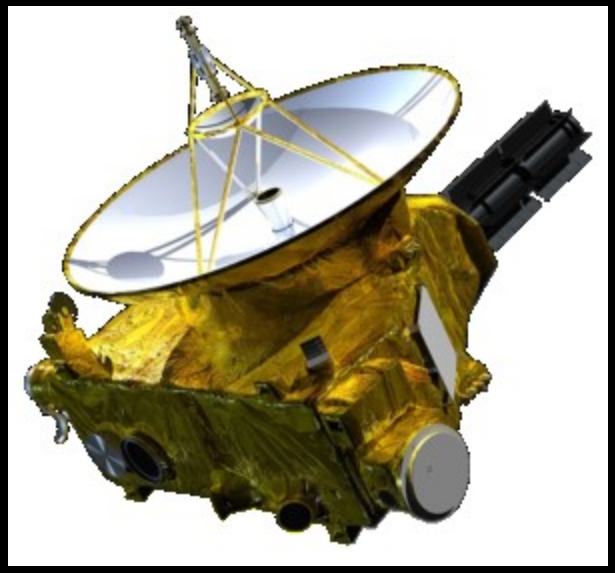
1

**Hayabusa2**
Sample return in 2020
from near-Earth asteroid
162173 Ryugu

**OSIRIS-Rex**
Sample return in 2023
from near-Earth asteroid
101955 Bennu

# Current Kuiper Belt Mission (1)

1



**New Horizons**

Flew past Pluto/Charon and 2014 $MU_{69}$ (Ultima Thule)
May fly past another Kuiper Belt body (TBD)

Download of $MU_{69}$ data will take another 18 months.
Current mission extended to April 2021.
Will eventually leave Solar System

# Current Deep Space Missions (11)

## Traveling through or studying deep space

 8

- **Hubble Space Telescope** / NASA, ESA / 1990 / Visible, UV, Near-IR / Deep Space Objects
- **Transiting Exoplanet Survey Satellite (TESS)**/ NASA / 2018 / Visible / Exoplanet detection
- **ChandraX-ray Observa**tory / NASA / 1999 / X-ray / Various
- **Spitzer Space Telescope** / NASA / 2003 / IR / Distant and Nearby Objects
- **Fermi Gamma-ray Space Telescope** / NASA / 2008 / Gamma-ray / Various
- **Swift Gamma Ray Burst Explorer** / NASA / 2004 / Gamma ray, X-ray, UV, Visible /Various
- **Voyagers 1 & 2** / NASA / 1977 / Outer Solar System Planet tour, heliosphere / Visible

 1

- Herschel Space Observatory / ESA & NASA / 2009 / Far-IR / Various

 2

- Planck Observatory / ESA / 2009 / Microwave / Cosmic Microwave Background
- INTEGRAL/ ESA / 2002 / Gamma ray, X-ray, Visible / Various

# Human Space Flight Returning to U.S.

## 1. SpaceX Dragon 2


March 2019 – SPACEX Dragon 2 Demo-1 (unmanned) launched and docked with the ISS and returned to Earth via splashdown.

**July 2019 – First crewed flight**

# Human Space Flight Returning to U.S.

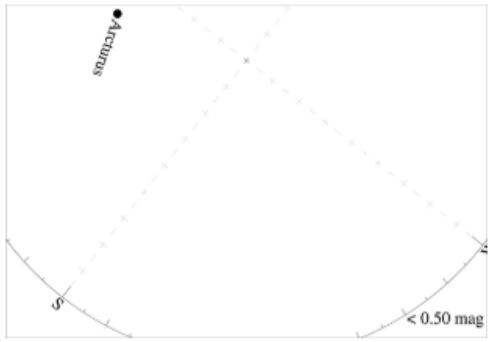
## 2. Boeing Starliner


**Initial demo flight in April has now been pushed-back to August due to safety concerns from NASA that will take Boeing 3 more months to address. If demo is successful, first crewed flight could be in November.**

Artist's rendering

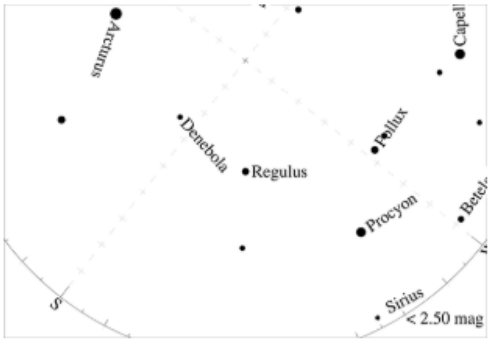

GLOBE at Night is an annual citizen-science campaign that encourages people all over the world to record the brightness of their night sky.

# April 2019 Campaign: Leo
## Mar 27 – Apr 5 and Apr 25 – May 4

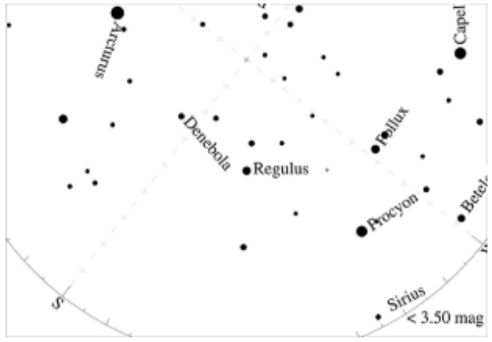


Magnitude 0/Cloudy Sky

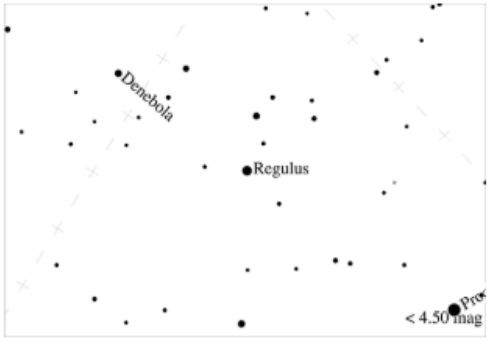
Magnitude 1 Chart



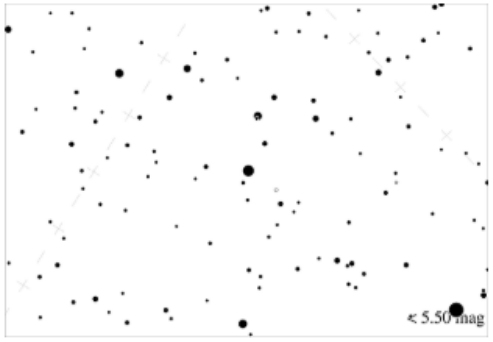
Magnitude 2 Chart



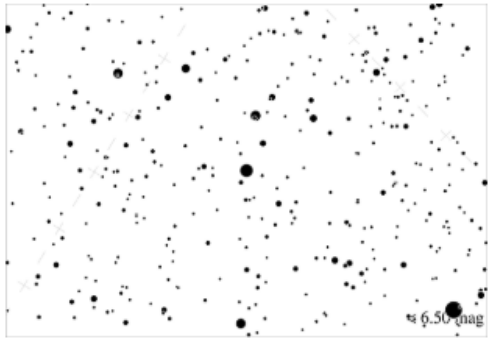
Magnitude 3 Chart



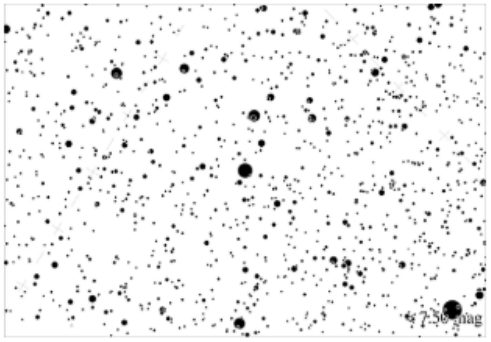
Magnitude 4 Chart



Magnitude 5 Chart



Magnitude 6 Chart



Magnitude 7 Chart

https://www.globeatnight.org/magcharts/leo

# Globe at Night

https://www.globeatnight.org/webapp/

## 1 When did you make your observations?

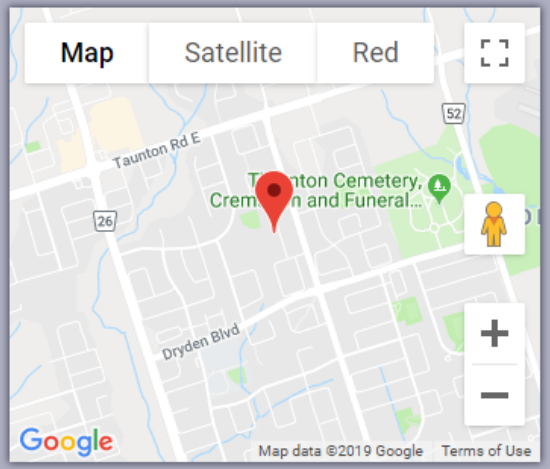
Observation Date (yyyy/mm/dd): 2019/03/27

Observation Time (24 hour time): 10:32

Switch to Nighttime version.

## 2 Where did you make your observations?

Map It!




Location correct:

Reset GPS

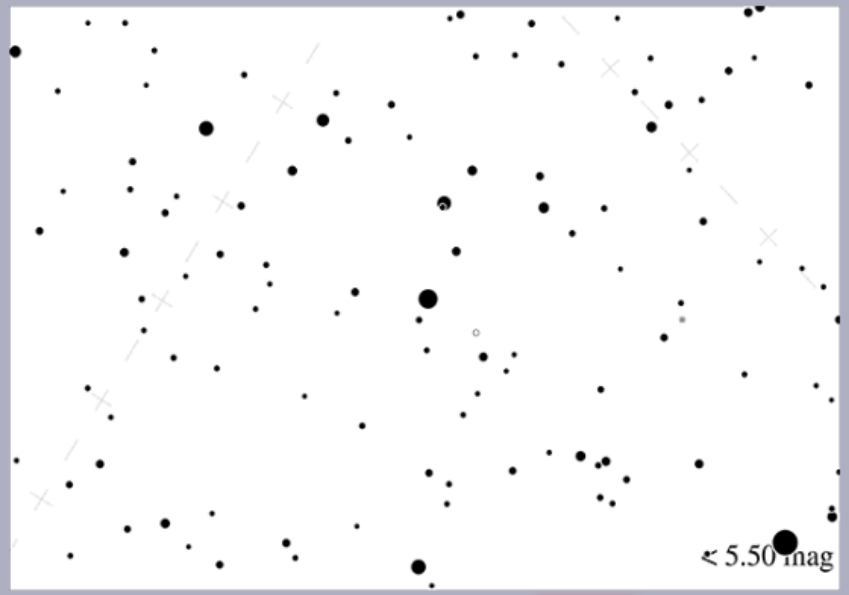
Latitude: 43.91918690000001
Longitude: -78.9176631
Elevation: 134.81 meters

Country: Canada

Location comments

*(E.g., Rural, suburban, or urban location; Snow cover? Number of streetlights, porchlights or other light sources (vending machines, etc.) in vicinity; Trees or structures in vicinity)*

## 3 How dark was the sky that night?





Constellation: Leo

## 4 What were sky conditions like that night?

Clear | ¼ of the sky | ½ of the sky | More than ½ of the sky

Sky condition comments

*(E.g., Haze – direction? Clouds – type, direction? Sky glow/light dome – direction?)*

# Credits

- Sky & Telescope
- Sky graphics:
  - Starry Night Pro
  - Stellarium
  - Virtual Moon Atlas
- www.timeanddate.com
- https://www.spaceweatherlive.com/en/solar-activity/coronal-holes
- https://rechneronline.de/log-scale/brightness.php
- www.asteroidoccultations.com
- www.poyntsource.com/New/Global.htm (for asteroid occultation)
- Pelican Nebula image by Kevin Watson
  - https://www.flickr.com/photos/82236048@N05/43515170325
- Comet Iwamoto by Doug Nan Jiang
  - https://forum.rascto.ca/t/the-passing-through-of-c2018-y1-iwamoto/1736
- Owl Nebula image by Emil Neata
  - http://www.nightskyinfo.com
- http://www.astronomytrek.com/nebula-named-after-birds/
- http://www.aerith.net/ (re: Seiichi Yoshida)
- https://theskylive.com
- https://in-the-sky.org
- https://commons.wikimedia.org/w/index.php?curid=4290651 (re: Markarian's Chain)
- https://lovethenightsky.com/virgo-galaxy-cluster-complete-guide/
- https://www.globeatnight.org/
- Slide show prepared by Arnold Brody