
Celebrate the Wonder
of the Night Sky!

Celebrate the Wonder of the Night Sky!

Objectives

Celebrate the Wonder of the Night Sky!

MY OBJECTIVES:

To introduce you to naked-eye astronomy.
To inspire you to view and appreciate the night sky whenever you get the opportunity.

Celebrate the Wonder of the Night Sky!

Intro

Celebrate the Wonder of the Night Sky!

Why Astronomy?

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Why Astronomy?

- Nature = beauty of the senses

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Why Astronomy?

- Nature = beauty of the senses
- Science = beauty of the mind

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Why Astronomy?

- Nature = beauty of the senses
- Science = beauty of the mind
- Astronomy is something that combines *both*, and is something that I can do *myself*

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Earth

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In the beginning God created the heavens and the earth. [Genesis 1:1 NLT]

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Earth

- Oblate spheroid (42 km wider at equator than poles)
- Average diameter 12742 km
- ~40000 km circumference *
- Rotates 1670 km/h at equator

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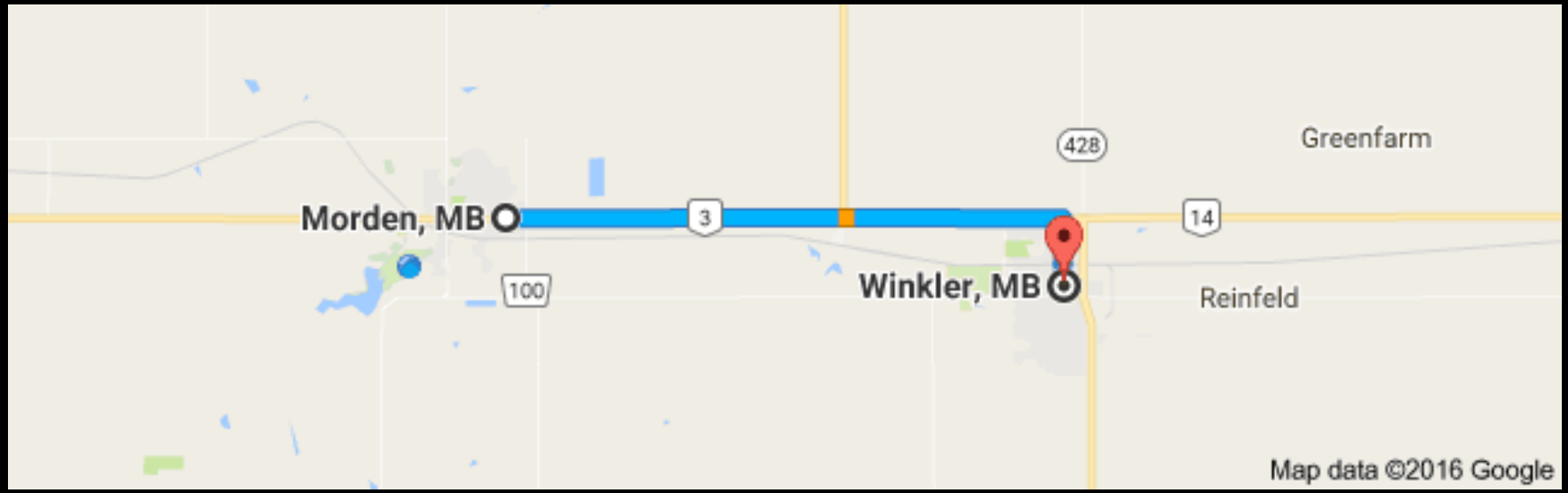
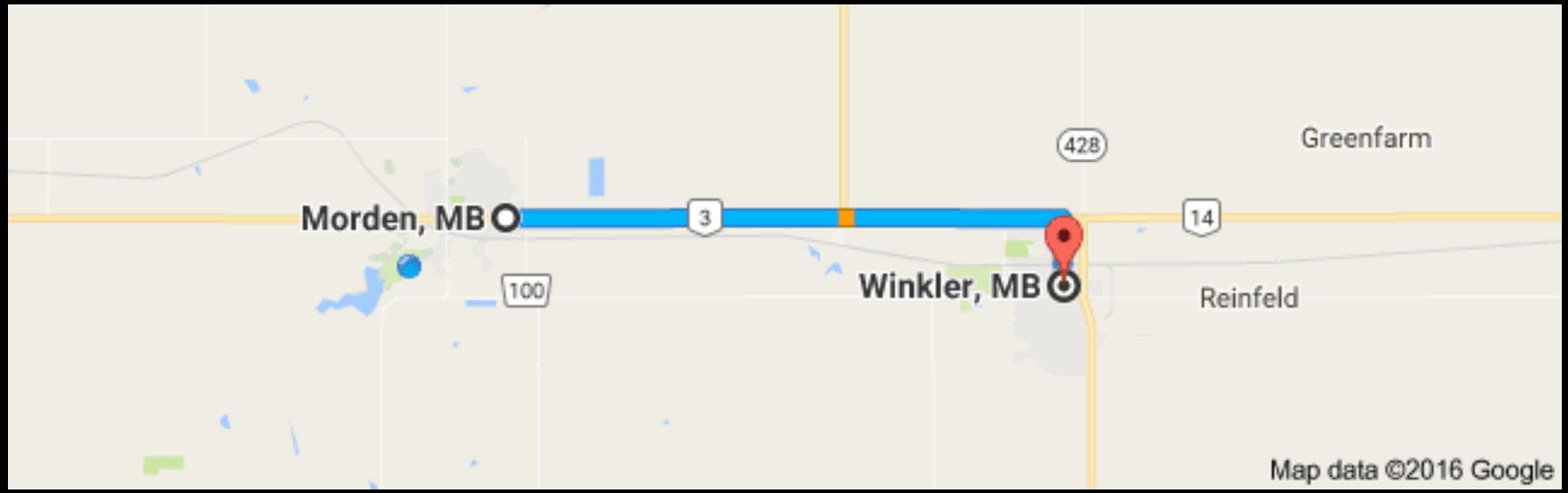
QUESTION: How fast does the Sun appear to move between Morden and Winkler?



Celebrate the Wonder of the Night Sky!

QUESTION: How fast does the Sun appear to move between Morden and Winkler?



ANSWER: About 1100 km/h – Winkler is 40 seconds ahead of Morden in Solar time

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Sun

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God made two great lights—the larger one to govern the day [Genesis 1:16a NLT]

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Sun

- G2V main sequence star (unusual!)
- ~ 1392000 km diameter (109x Earth) *
- ~ 333000 Earth masses
- ~ 150 million km from Earth (1 AU) *
- ~ 8m 20s for light to travel to Earth
- Rotates in 27 to 31 days

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VIDEO: Sun One Day Fisheye Timelapse

Fisheye 24 Hour Time Lapse

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QUESTION: When is twilight,
dusk, and dawn?

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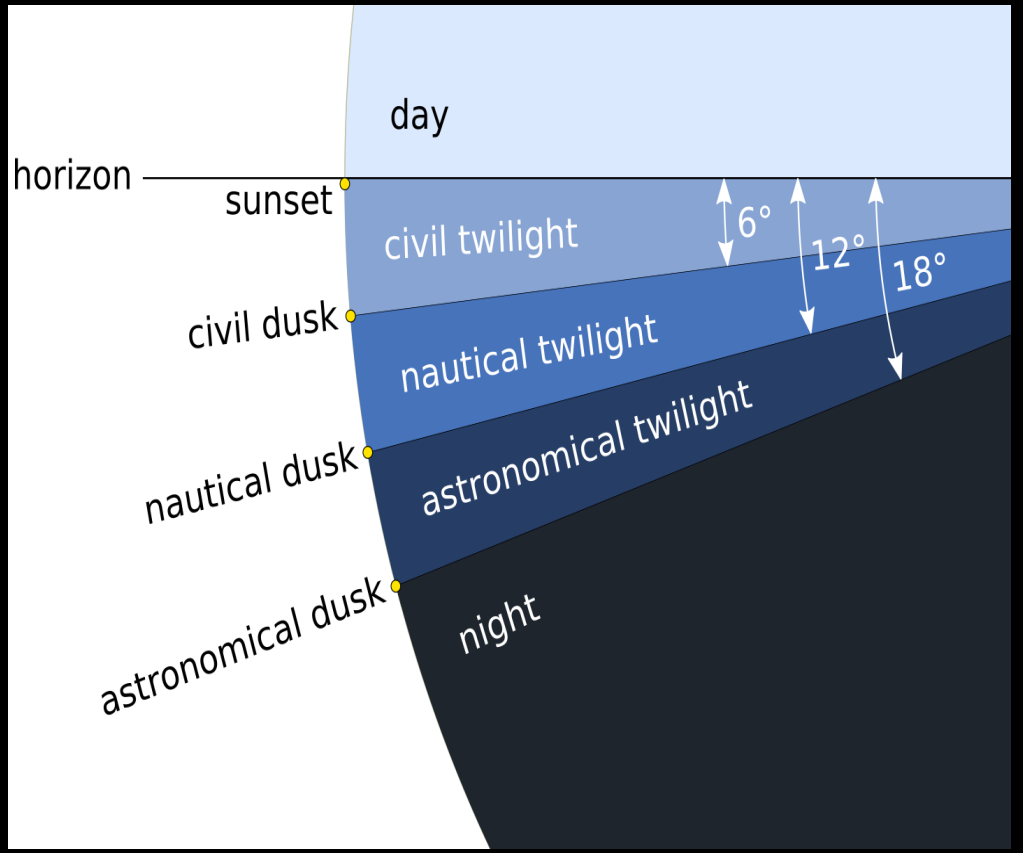
QUESTION: When is twilight, dusk, and dawn?

ANSWER: Sun's angle below the horizon for your current location and date. Astronomy good at *astronomical dusk*.

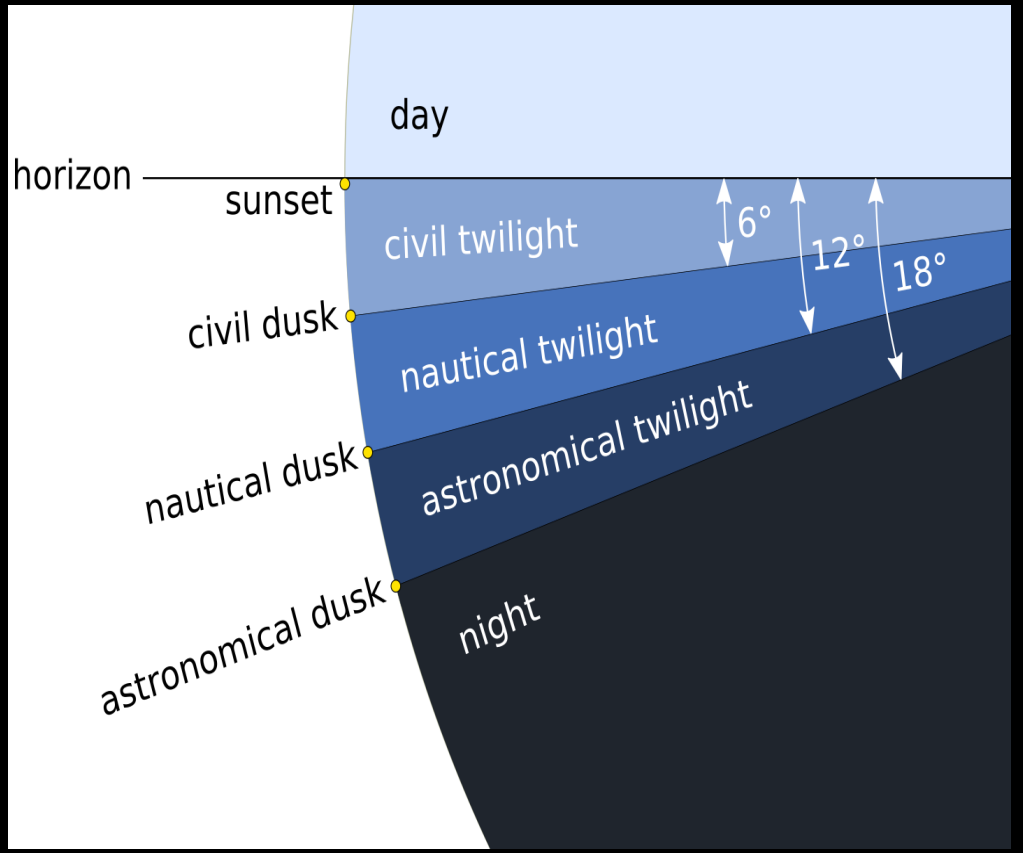


Celebrate the Wonder of the Night Sky!

QUESTION: When is twilight, dusk, and dawn?

ANSWER: Sun's angle below the horizon for your current location and date. Astronomy good at *astronomical dusk*.

BONUS: No ‘night’ in Morden from June 5th to July 5th!



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QUESTION: When is the shortest and longest day in Morden?

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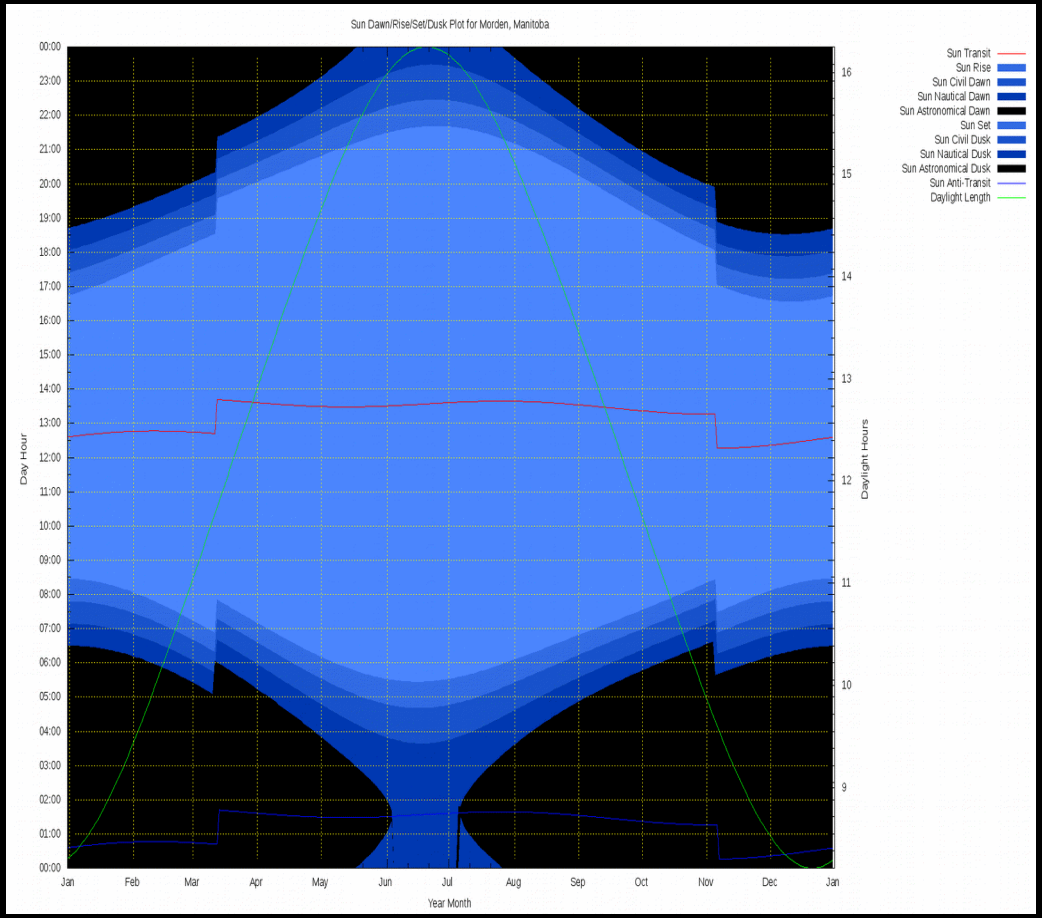

QUESTION: When is the shortest and longest day in Morden?

ANSWER: The shortest day is the 1st day of Winter (~8 hours), and the longest day is the 1st day of Summer (~16 hours).

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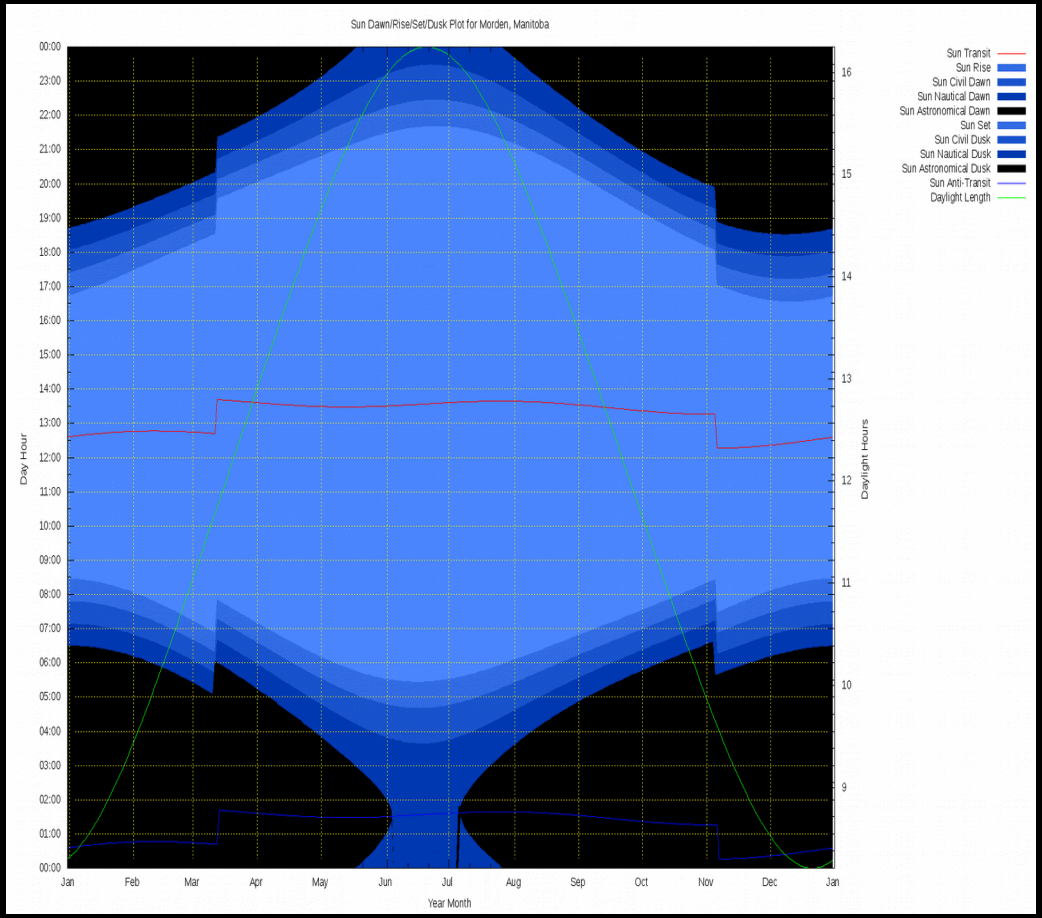

QUESTION: When is the shortest and longest day in Morden?

ANSWER: The shortest day is the 1st day of Winter (~8 hours), and the longest day is the 1st day of Summer (~16 hours).

BONUS: Latest sunrise/earliest sunset not on the 1st day of Winter!

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QUESTION: Is our hottest and coldest day related to our distance from the Sun?

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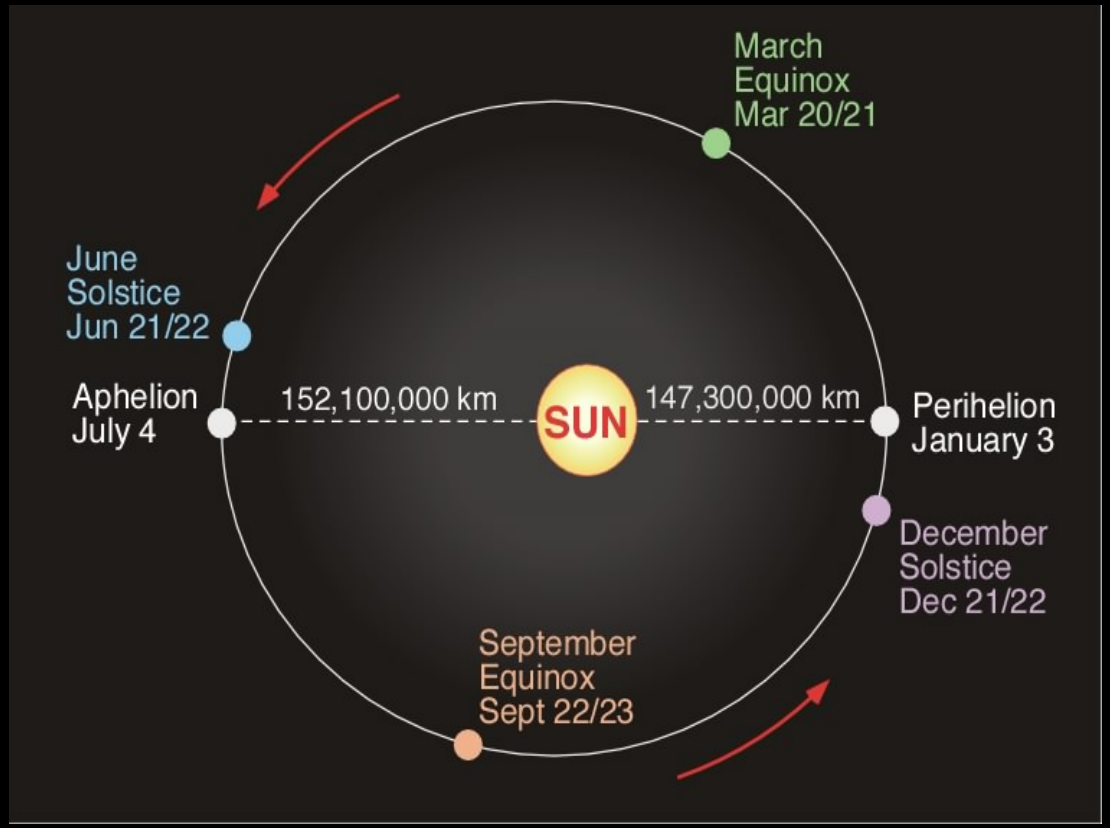
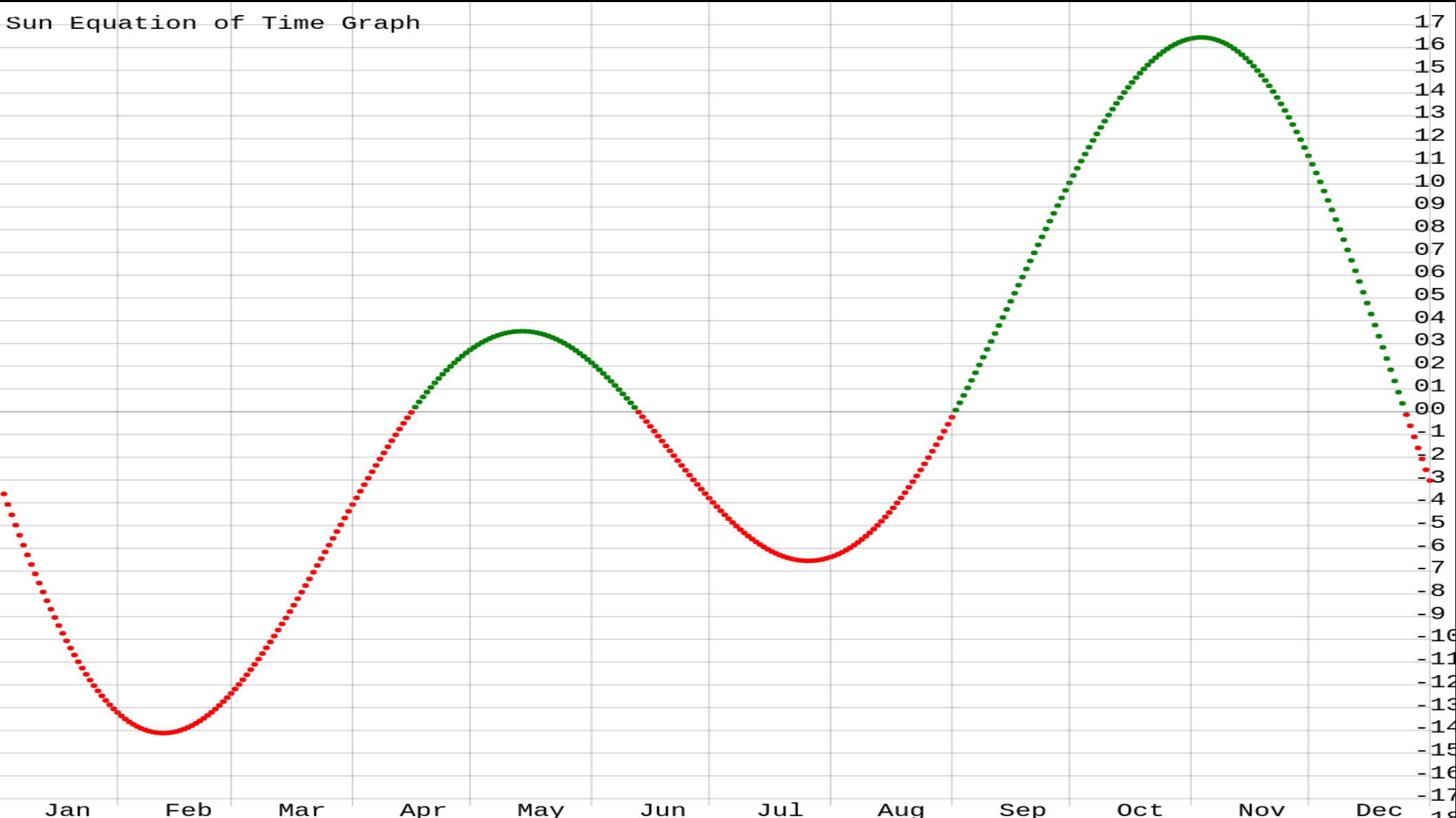
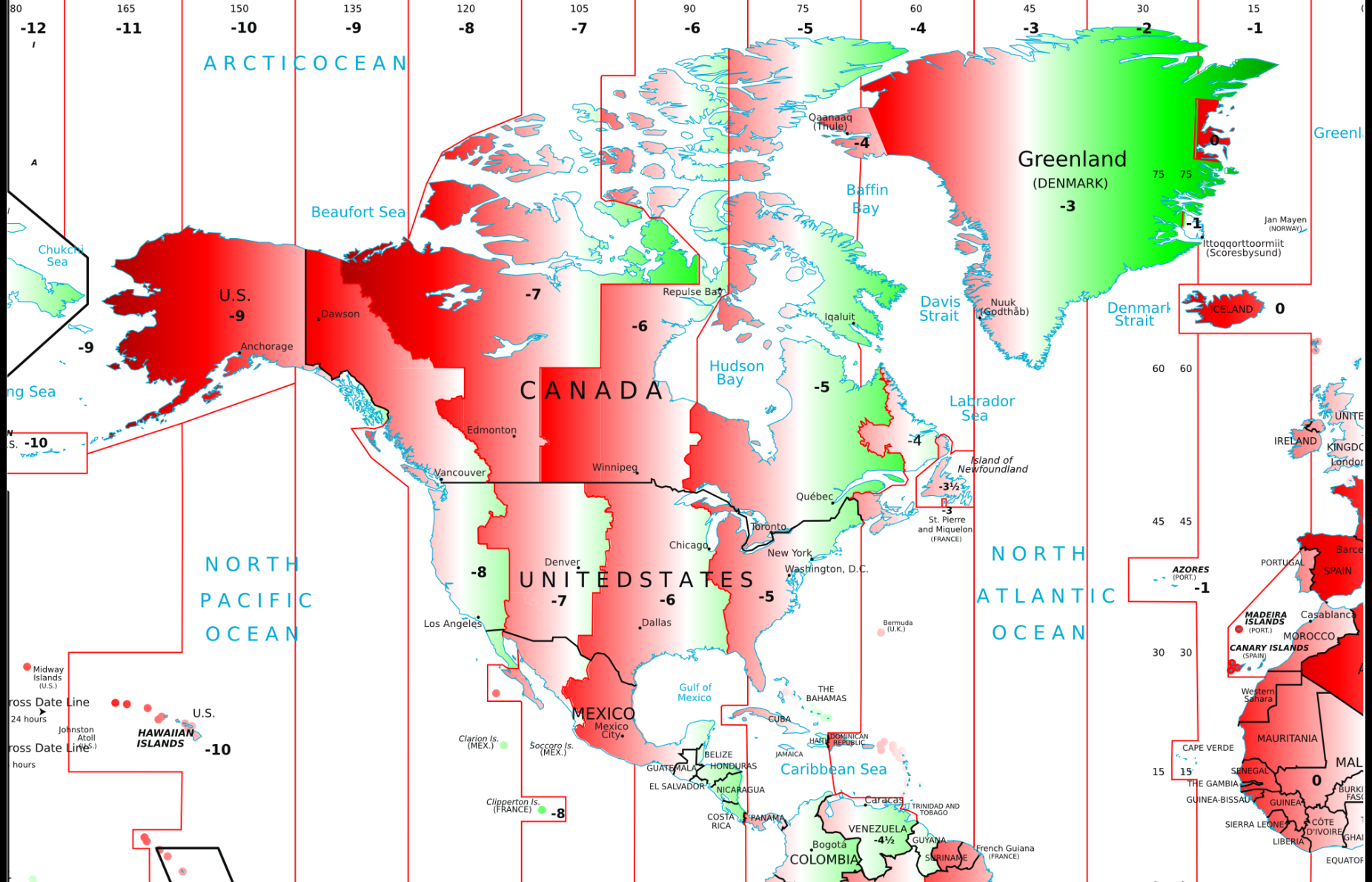
QUESTION: Is our hottest and coldest day related to our distance from the Sun?

ANSWER: No! The closest/farthest Sun distances in Earth's orbit are *not* related to our seasons. Our seasons are caused by the Earth's 23.5° tilt on its axis.

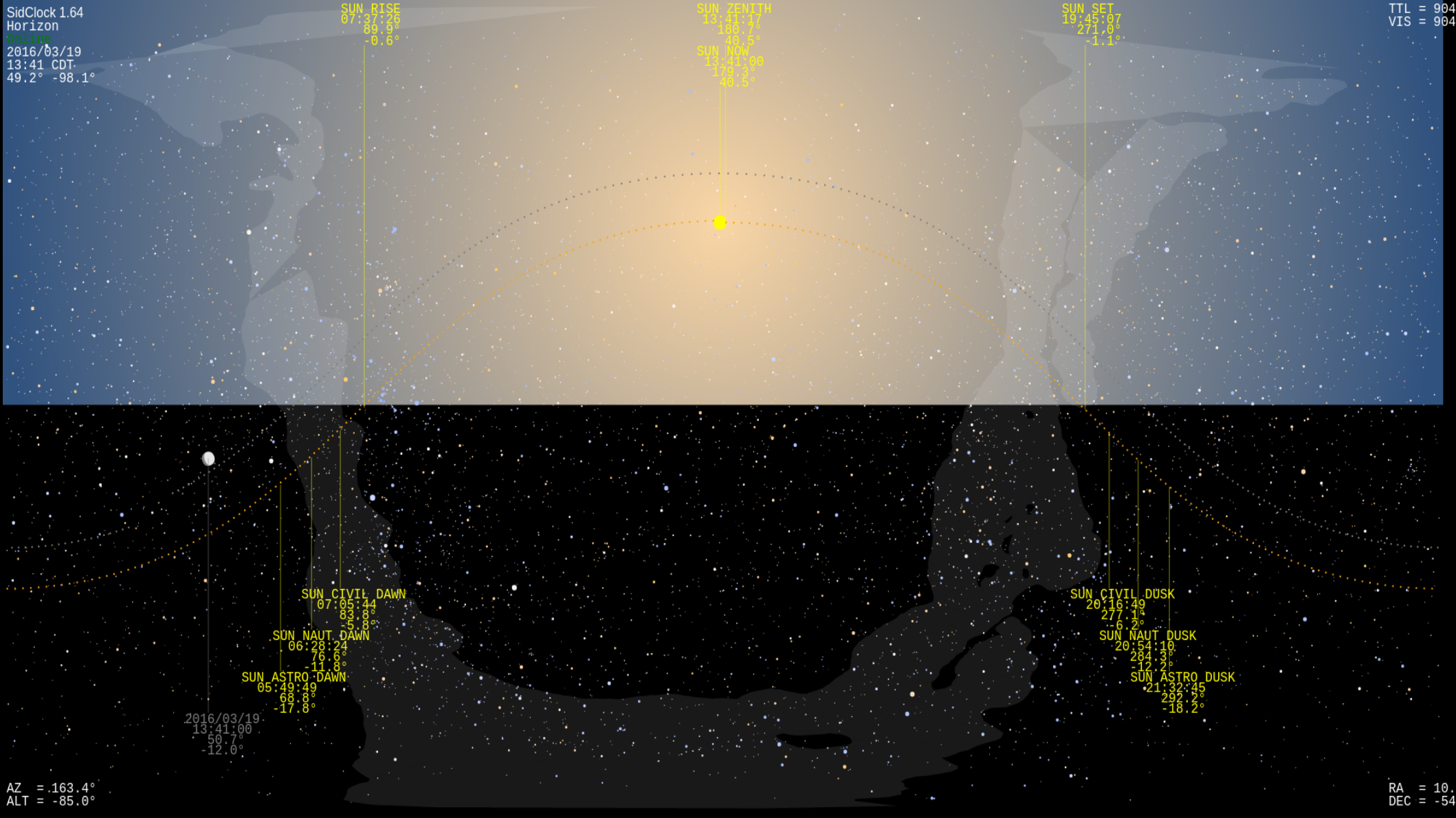


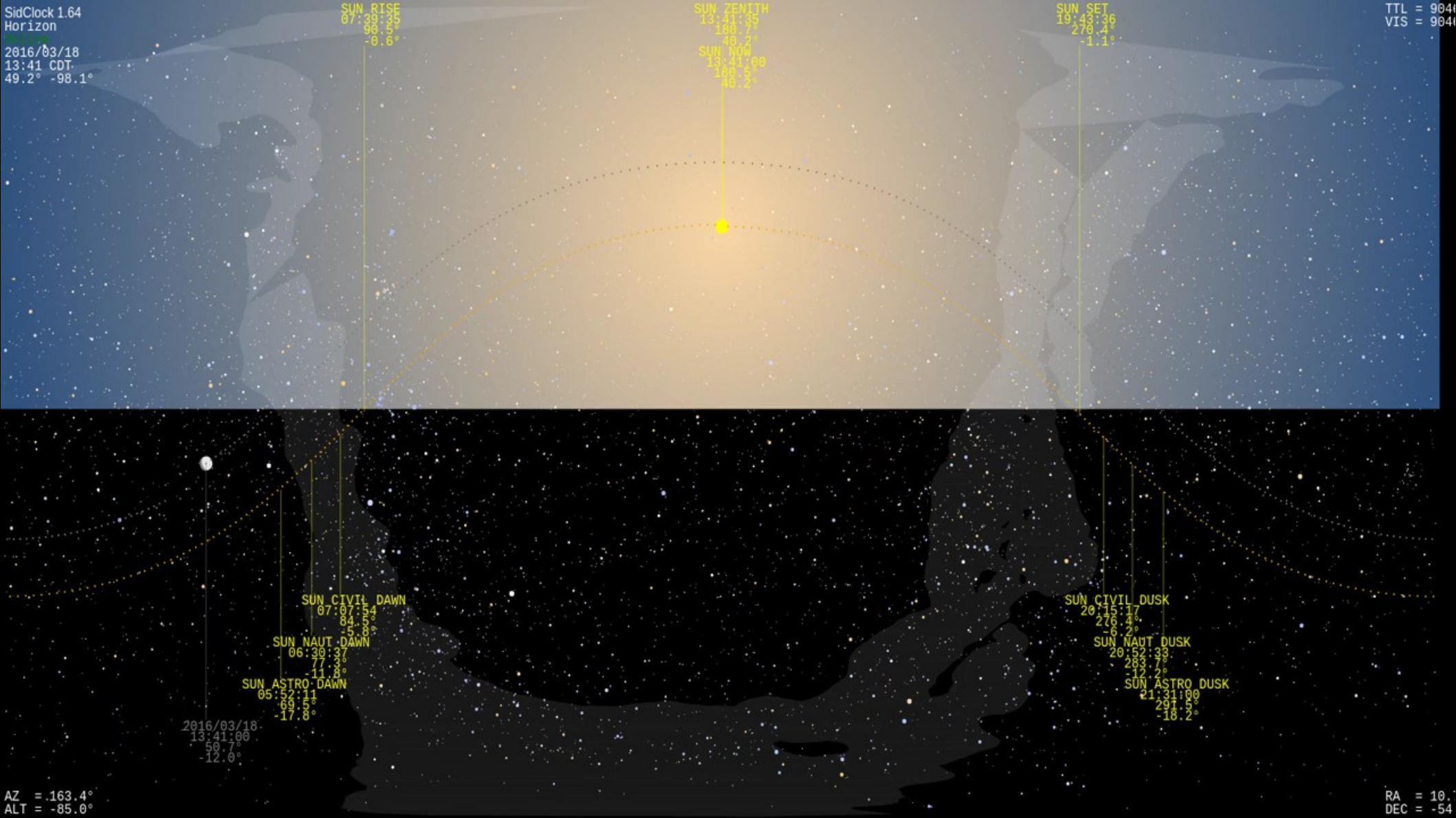

Sun Equation of Time Graph
17
16
15
14
13
12
11
10
09
08
07
06
05
04
03
02
01
00
-1
-2
-3
-4
-5
-6
-7
-8
-9
-16
-11
-12
-13
-14
-15
-16
-17
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

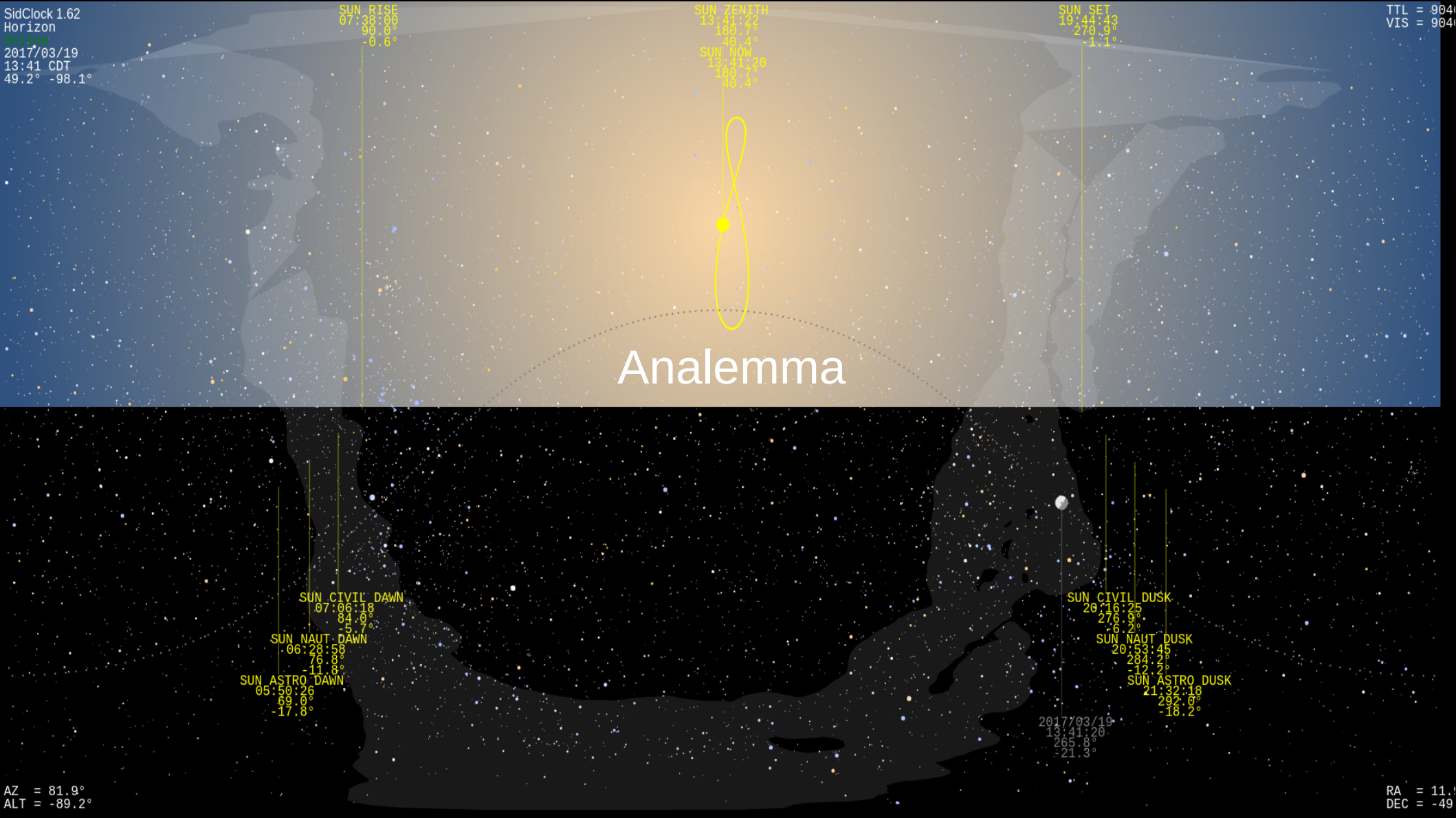

ARCTIC OCEAN
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
Caribbean Sea
Gulf of Mexico
Baffin Bay
Davis Strait
Denmark Strait
Labrador Sea
Hudson Bay
Beaufort Sea
Chukchi Sea
Greenland
(DENMARK)
CANADA
U.S.
UNITEDSTATES
MEXICO
Qaanaaq (Thule)
Ittoqqorttoormiit (Scoresbysund)
Nuuk (Godthåb)
Jan Mayen (NORWAY)
ICELAND
Repulse Bay
Iqaluit
Dawson
Anchorage
Edmonton
Vancouver
Winnipeg
Québec
Toronto
Chicago
New York
Washington, D.C.
Denver
Los Angeles
Dallas
Island of Newfoundland
St. Pierre and Miquelon (FRANCE)
Bermuda (U.K.)
THE BAHAMAS
CUBA
HAITI
DOMINICAN REPUBLIC
JAMAICA
BELIZE
GUATEMALA
HONDURAS
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
Caracas
TRINIDAD AND TOBAGO
VENEZUELA
GUYANA
SURINAME
French Guiana (FRANCE)
Bogotá
COLOMBIA
Mexico City
Clarion Is. (MEX.)
Socorro Is. (MEX.)
Clipperton Is. (FRANCE)
Midway Islands (U.S.)
Johnston Atoll (U.S.)
HAWAIIAN ISLANDS
U.S.
Date Line
24 hours
IRELAND
PORTUGAL
SPAIN
AZORES (PORT.)
MADEIRA ISLANDS (PORT.)
CANARY ISLANDS (SPAIN)
Casablanca
MOROCCO
Western Sahara
MAURITANIA
CAPE VERDE
SENEGAL
THE GAMBIA
GUINEA-BISSAU
GUINEA
SIERRA LEONE
LIBERIA
CÔTE D'IVOIRE
EQUATOR

Celebrate the Wonder of the Night Sky!

ANIMATION: Sun One Year Noon Timelapse

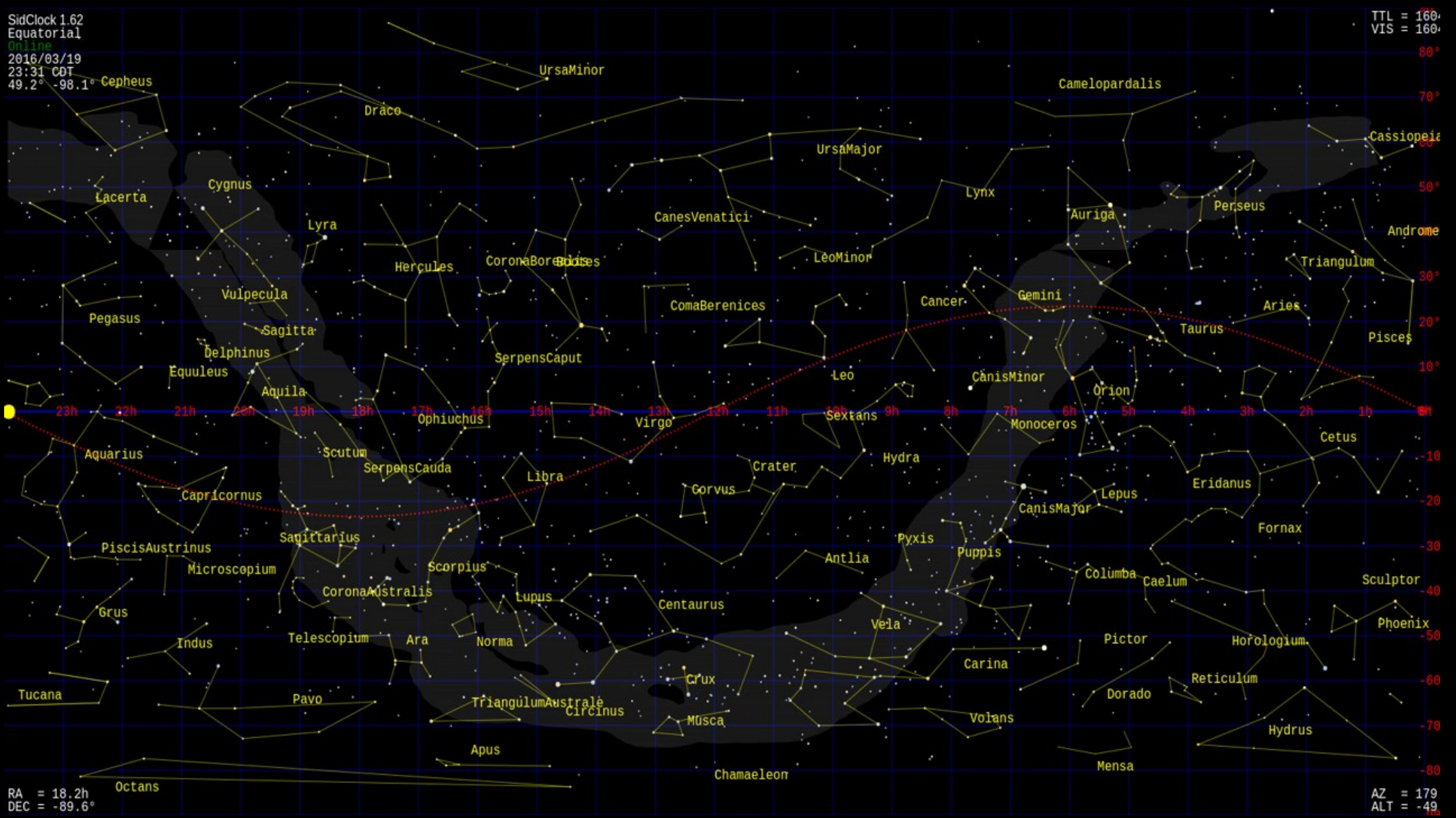

SidClock 1.64
Horizon
Online
2016/03/19
13:41 CDT
49.2° -98.1°
SUN_RISE
07:37:26
89.9°
-0.6°
SUN_ZENITH
13:41:17
180.7°
40.5°
SUN_NOW
13:41:00
179.3°
40.5°
SUN_SET
19:45:07
271.0°
-1.1°
TTL = 904
VIS = 904
SUN_CIVIL_DAWN
07:05:44
83.8°
-5.8°
SUN_NAUT_DAWN
06:28:24
76.6°
-11.8°
SUN_ASTRO_DAWN
05:49:49
68.8°
-17.8°
2016/03/19
13:41:00
50.7°
-12.0°
SUN_CIVIL_DUSK
20:16:49
277.1°
-6.2°
SUN_NAUT_DUSK
20:54:10
284.3°
-12.2°
SUN_ASTRO_DUSK
21:32:45
292.2°
-18.2°
AZ = 163.4°
ALT = -85.0°
RA = 10.
DEC = -54


SidClock 1.64
Horizon
2016/03/18
13:41 CDT
49.2° -98.1°
SUN_RISE
07:39:35
90.5°
-0.6°
SUN_ZENITH
13:41:35
180.7°
40.2°
SUN_NOW
13:41:00
180.5°
40.2°
SUN_SET
19:43:36
270.4°
-1.1°
TTL = 904
VIS = 904
SUN_CIVIL_DAWN
07:07:54
84.5°
-5.8°
SUN_NAUT_DAWN
06:30:37
77.3°
-11.8°
SUN_ASTRO_DAWN
05:52:11
69.5°
-17.8°
2016/03/18
13:41:00
50.7°
-12.0°
SUN_CIVIL_DUSK
20:15:17
276.4°
-6.2°
SUN_NAUT_DUSK
20:52:33
283.7°
-12.2°
SUN_ASTRO_DUSK
21:31:00
291.5°
-18.2°
AZ = 163.4°
ALT = -85.0°
RA = 10.
DEC = -54


SidClock 1.62
Horizon
Online
2017/03/19
13:41 CDT
49.2° -98.1°
SUN RISE
07:38:00
90.0°
-0.6°
SUN ZENITH
13:41:22
180.7°
40.4°
SUN NOW
13:41:20
180.7°
40.4°
SUN SET
19:44:43
270.9°
-1.1°
TTL = 904
VIS = 904
Analemma
SUN CIVIL DAWN
07:06:18
84.0°
-5.7°
SUN NAUT DAWN
06:28:58
76.8°
-11.8°
SUN ASTRO DAWN
05:50:26
69.0°
-17.8°
SUN CIVIL DUSK
20:16:25
276.9°
-6.2°
SUN NAUT DUSK
20:53:45
284.2°
-12.2°
SUN ASTRO DUSK
21:32:18
292.0°
-18.2°
2017/03/19
13:41:20
265.8°
-21.3°
AZ = 81.9°
ALT = -89.2°
RA = 11.
DEC = -49

Celebrate the Wonder of the Night Sky!

ANIMATION: Sun One Year Zodiac Timelapse


SidClock 1.62
Equatorial
Online
2016/03/19
23:31 CDT
49.2° -98.1°
TTL = 160
VIS = 160
UrsaMinor
Cepheus
Draco
Camelopardalis
Cassiopeia
UrsaMajor
Lacerta
Cygnus
Lynx
Auriga
Perseus
Lyra
CanesVenatici
Androme
Hercules
CoronaBorealis
Boötes
LeoMinor
Triangulum
Vulpecula
Cancer
Gemini
Pegasus
ComaBerenices
Aries
Sagitta
Taurus
Pisces
Delphinus
SerpensCaput
Equuleus
Leo
CanisMinor
Aquila
Orion
23h
22h
21h
20h
19h
18h
17h
16h
15h
14h
13h
12h
11h
10h
9h
8h
7h
6h
5h
4h
3h
2h
1h
0h
Ophiuchus
Virgo
Sextans
Monoceros
Cetus
Aquarius
Scutum
Hydra
SerpensCauda
Crater
Libra
Corvus
Eridanus
Capricornus
Lepus
CanisMajor
Fornax
Sagittarius
Pyxis
PiscisAustrinus
Puppis
Antlia
Microscopium
Scorpius
Columba
Caelum
Sculptor
CoronaAustralis
Lupus
Centaurus
Grus
Vela
Phoenix
Indus
Telescopium
Ara
Norma
Pictor
Horologium
Carina
Crux
Reticulum
Tucana
Pavo
Dorado
TriangulumAustrale
Circinus
Musca
Volans
Hydrus
Apus
Mensa
Chamaeleon
Octans
80°
70°
60°
50°
40°
30°
20°
10°
0°
-10°
-20°
-30°
-40°
-50°
-60°
-70°
-80°
RA = 18.2h
DEC = -89.6°
AZ = 179
ALT = -49

Celebrate the Wonder of the Night Sky!

Moon

Celebrate the Wonder of the Night Sky!

God made two great lights...and the smaller one to govern the night.[Genesis 1:16b NLT]

Celebrate the Wonder of the Night Sky!

Moon

- Diameter 3474 km (1/4 of Earth) *
- 1/81 mass of the Earth

Celebrate the Wonder of the Night Sky!

Moon

- Diameter 3474 km (1/4 of Earth) *
- 1/81 mass of the Earth
- Rotates on axis in 27.3 days
- Revolves around Earth in 27.3 days

Celebrate the Wonder of the Night Sky!

Moon

- Diameter 3474 km (1/4 of Earth) *
- 1/81 mass of the Earth
- Rotates on axis in 27.3 days
- Revolves around Earth in 27.3 days
- *So it shows the same side to us!*

Celebrate the Wonder of the Night Sky!

Moon

- Diameter 3474 km (1/4 of Earth) *
- 1/81 mass of the Earth
- Rotates on axis in 27.3 days
- Revolves around Earth in 27.3 days
- *So it shows the same side to us!*
- BONUS: A lunar month ~ 29.5 days and is basis for Hebrew/Islamic calendar

Celebrate the Wonder of the Night Sky!

QUESTION: What is the relative distance of the Earth to the Moon?

Celebrate the Wonder of the Night Sky!

QUESTION: What is the relative distance of the Earth to the Moon?

ANSWER: Using the Earth ‘globe’ size comparison, the Moon would be about 9 meters (30 feet) away (30x the Earth’s diameter *)

Celebrate the Wonder of the Night Sky!

QUESTION: What is the relative distance of the Earth to the Moon?

ANSWER: Using the Earth ‘globe’ size comparison, the Moon would be about 9 meters (30 feet) away (30x the Earth’s diameter *)

BONUS #1: October 16 was a full Moon at perigee (closest to Earth) so it was a ‘Super Moon’

Celebrate the Wonder of the Night Sky!

QUESTION: What is the relative distance of the Earth to the Moon?

ANSWER: Using the Earth ‘globe’ size comparison, the Moon would be about 9 meters (30 feet) away (30x the Earth’s diameter *)

BONUS #2: The Sun is 400x the Moon’s diameter, but the Sun is also 400x further away, so the Moon often is exactly enough to block the Sun during a Solar Eclipse! *

Celebrate the Wonder of the Night Sky!

VIDEO: Full Moon Movement

Full Moon in Spotting Scope

Short Clip

Celebrate the Wonder of the Night Sky!

ANIMATION: Moon Phases


SidClock 1.64
Moon
2016/10/22
18:00 CDT
48% Ful
Waning

Celebrate the Wonder of the Night Sky!

Celebrate the Wonder of the Night Sky!

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C

Celebrate the Wonder of the Night Sky!

QUESTION: What is the difference between a *lunar* eclipse and a *solar* eclipse?

Celebrate the Wonder of the Night Sky!

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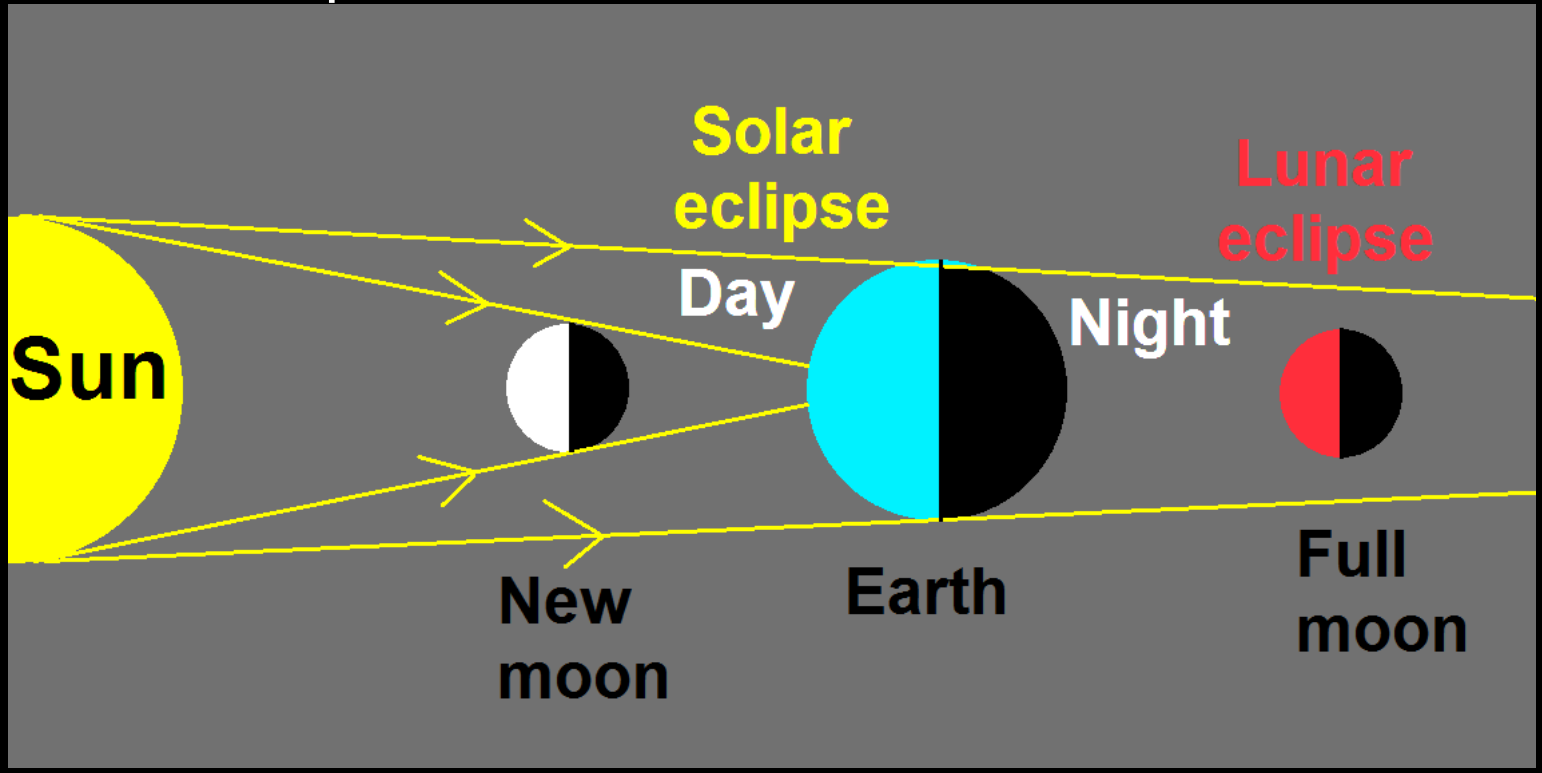


Celebrate the Wonder of the Night Sky!


SidClock 1.62
Horizon
Online
2017/08/21
12:57 CDT
49.2° -98.1°
SUN_RISE
06:34:42
70.9°
-0.4°
SUN_ZENITH
13:16:56
180.9°
52.7°
SUN_SET
20:39:11
289.9°
-1.3°
SUN_NOW
12:57:00
164.8°
51.8°
TTL = 904
VIS = 904
August 21, 2017
Total Solar Eclipse!
...but not in Morden :(
SUN_CIVIL_DAWN
06:00:22
64.2°
-5.6°
SUN_NAUT_DAWN
05:17:44
55.6°
-11.6°
SUN_ASTRO_DAWN
04:29:46
45.2°
-17.7°
SUN_CIVIL_DUSK
21:13:31
296.5°
-6.4°
SUN_NAUT_DUSK
21:56:09
305.2°
-12.4°
SUN_ASTRO_DUSK
22:44:07
315.7°
-18.4°
2017/08/21
12:57:00
164.8°
51.8°
AZ = 98.5°
ALT = -89.4°
RA = 21.
DEC = -40

Celebrate the Wonder of the Night Sky!

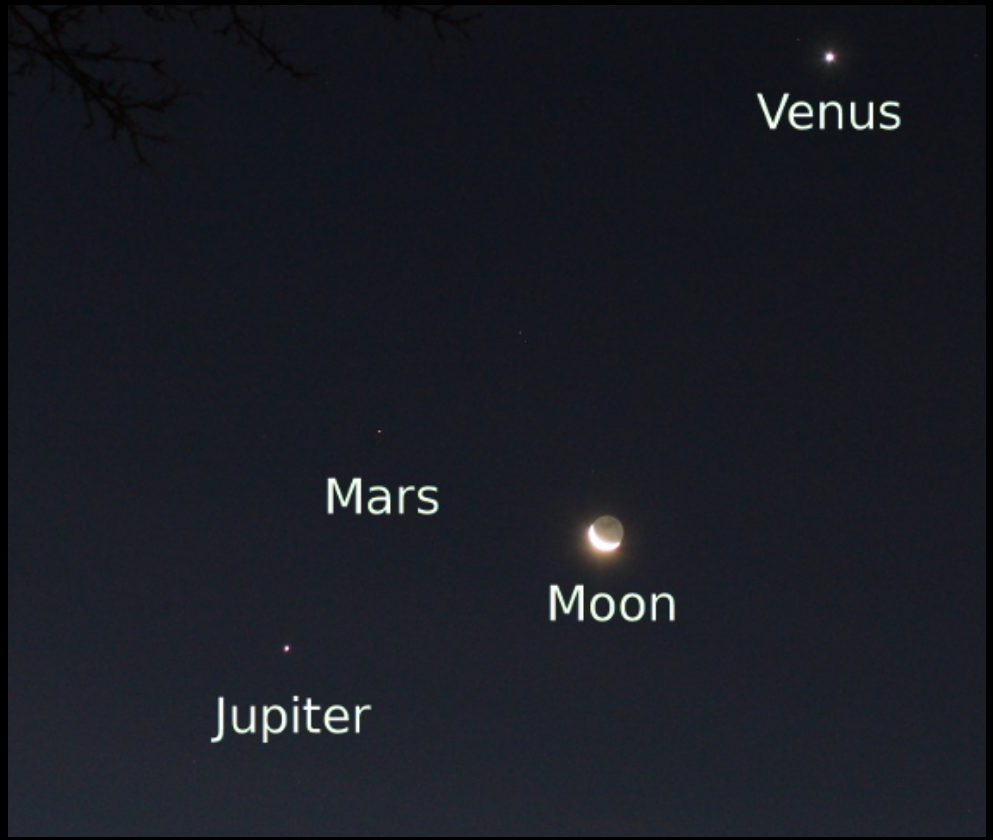
Then God said, “Let lights appear in the sky to separate the day from the night. Let them be signs to mark the seasons, days, and years. [Genesis 1:14 NLT]

Celebrate the Wonder of the Night Sky!

Planets


Venus
Mars
Moon
Jupiter

Celebrate the Wonder of the Night Sky!



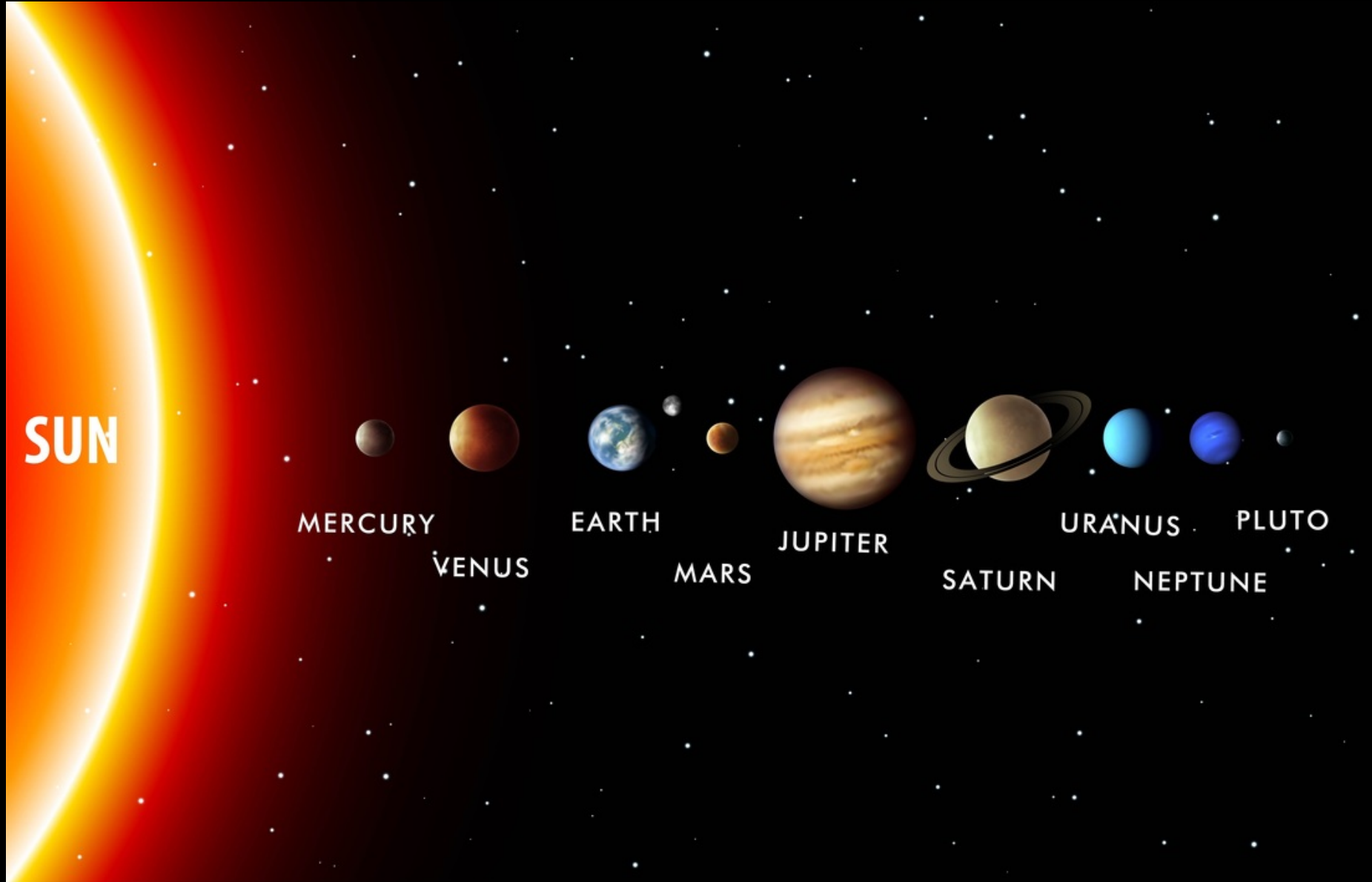
Solar System Planets

- 8 planets: *My Very Educated Mother Just Served Us Nachos*
- 4 inner/terrestrial:

  Mercury, Venus, Earth, Mars [Rocky / Metallic]
- 4 outer/giant:

  Jupiter, Saturn [Gas],

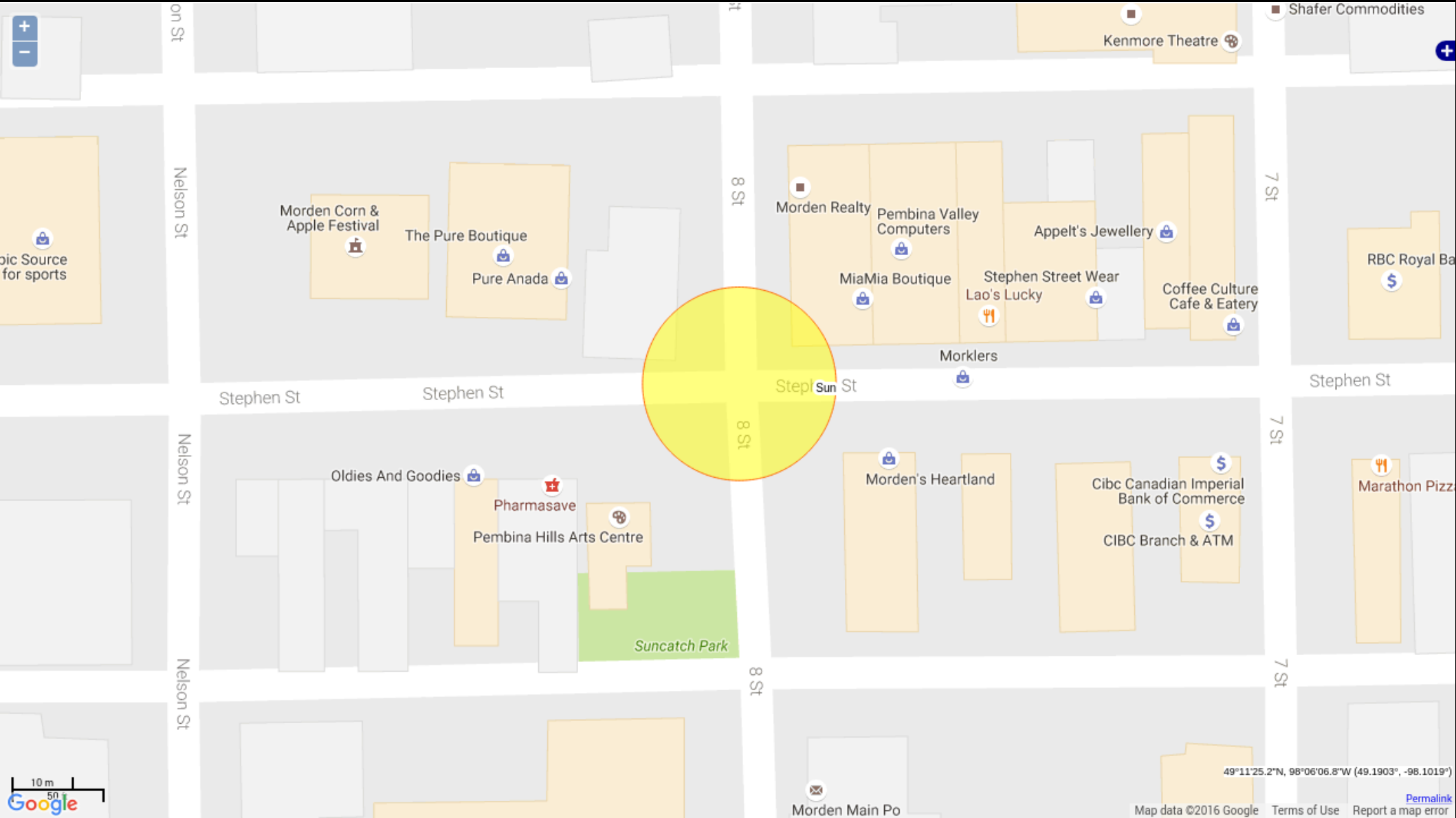
  Uranus, Neptune [Ice]
- Pluto is now a ‘dwarf planet’ (2006)

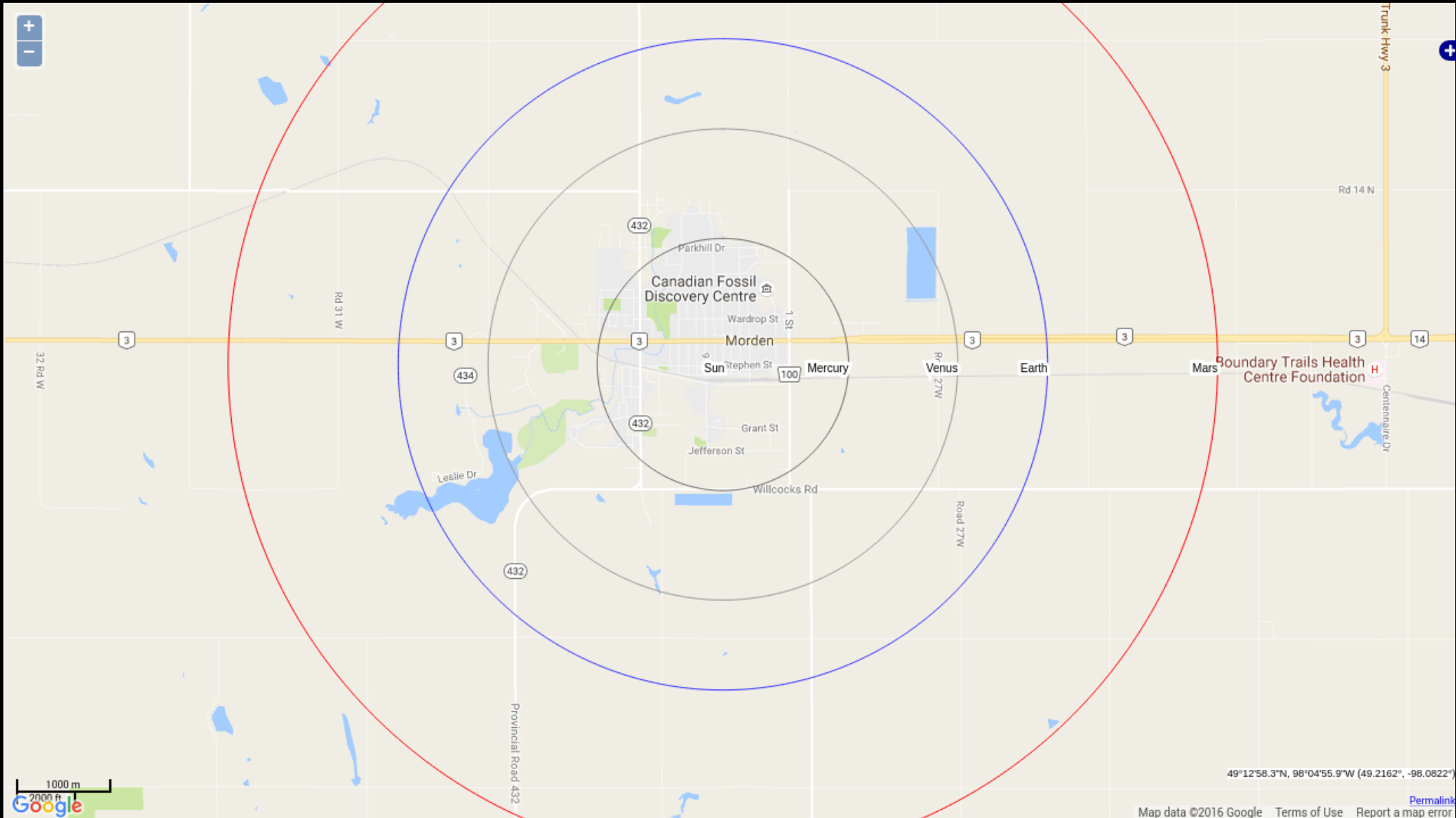

SUN
MERCURY
VENUS
EARTH
MARS
JUPITER
SATURN
URANUS
NEPTUNE
PLUTO

Dare's Scaled Solar System Map Overlay

Version 0.1

Imagine shrinking the Earth down to the same size as a typical 12" (30 cm) diameter desk-top world globe (1:41849600). Now imagine using the same scale to shrink the entire Solar System, and overlay the size of the Sun, and the average orbits of the planets, as concentric rings centered on downtown Morden Manitoba, Canada -- using OpenLayers.


Kenmore Theatre
Shafer Commodities
Nelson St
8 St
7 St
Morden Corn & Apple Festival
The Pure Boutique
Pure Anada
Morden Realty
Pembina Valley Computers
Appelt's Jewellery
MiaMia Boutique
Stephen Street Wear
Lao's Lucky
Coffee Culture Cafe & Eatery
RBC Royal Ba
Morklers
Stephen St
Sun
Oldies And Goodies
Pharmasave
Pembina Hills Arts Centre
Suncatch Park
Morden's Heartland
Cibc Canadian Imperial Bank of Commerce
CIBC Branch & ATM
Marathon Pizz
Morden Main Po
10 m
50
Google
49°11'25.2"N, 98°06'06.8"W (49.1903°, -98.1019°)
Permalink
Map data ©2016 Google
Terms of Use
Report a map error


Canadian Fossil Discovery Centre
Morden
Parkhill Dr
Wardrop St
1 St
Stephen St
Grant St
Jefferson St
Willcocks Rd
Leslie Dr
Rd 31 W
32 Rd W
Road 27W
Provincial Road 432
Rd 14 N
Trunk Hwy 3
Centennaire Dr
Boundary Trails Health Centre Foundation
Sun
Mercury
Venus
Earth
Mars
3
14
100
432
434
1000 m
2000 ft
Google
49°12'58.3"N, 98°04'55.9"W (49.2162°, -98.0822°)
Permalink
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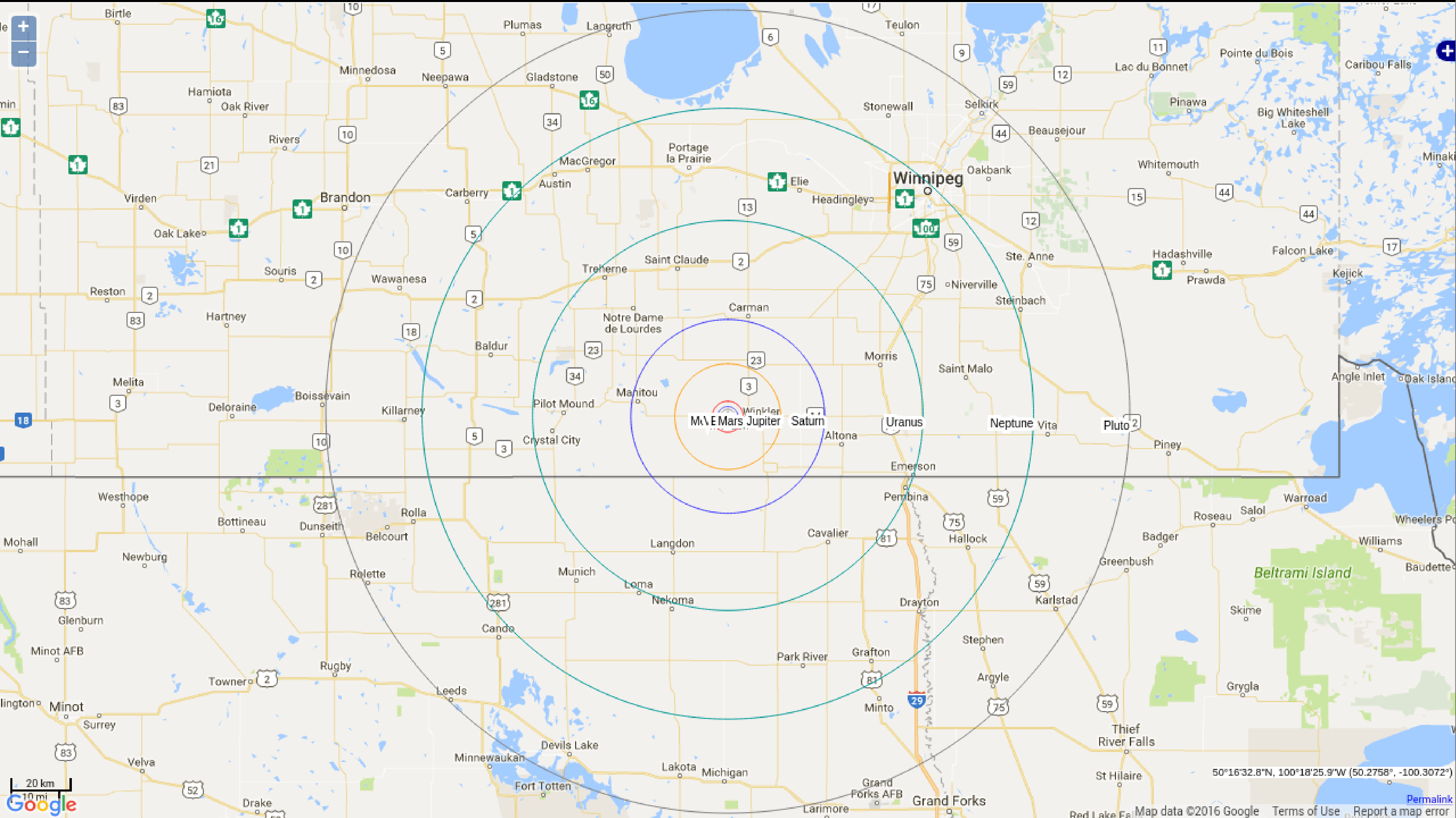
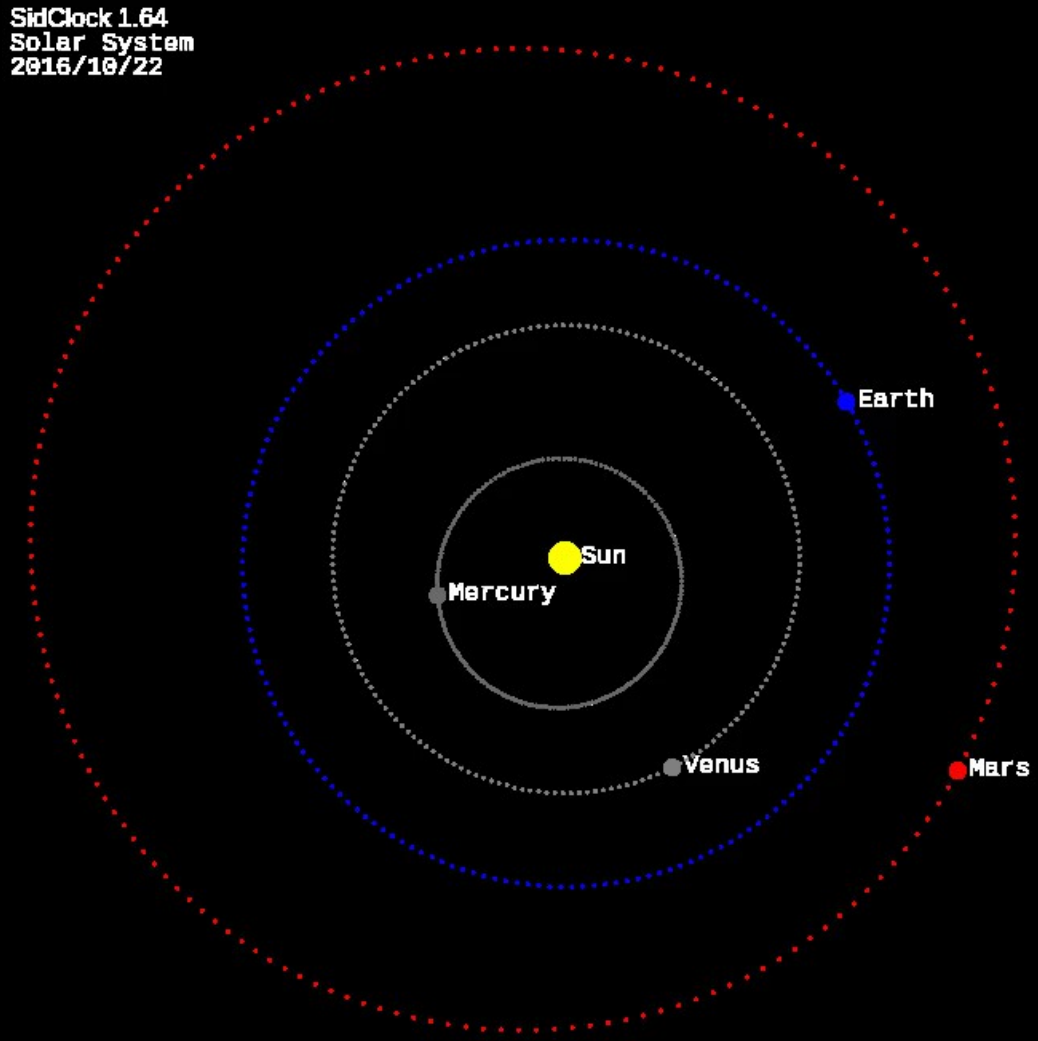
Terms of Use
Report a map error



Mars
Jupiter
Saturn
Uranus
Neptune
Pluto
Birtle
Plumas
Langruth
Teulon
Minnedosa
Neepawa
Gladstone
Hamiota
Oak River
Rivers
Portage la Prairie
MacGregor
Austin
Carberry
Brandon
Virden
Oak Lake
Elie
Headingley
Winnipeg
Stonewall
Selkirk
Oakbank
Beausejour
Lac du Bonnet
Pointe du Bois
Pinawa
Big Whiteshell Lake
Caribou Falls
Whitemouth
Souris
Reston
Wawanesa
Hartney
Treherne
Saint Claude
Carman
Notre Dame de Lourdes
Baldur
Melita
Boissevain
Deloraine
Killarney
Pilot Mound
Manitou
Crystal City
Winkler
Altona
Morris
Saint Malo
Ste. Anne
Niverville
Steinbach
Hadashville
Falcon Lake
Prawda
Kejick
Angle Inlet
Oak Island
Vita
Piney
Emerson
Pembina
Westhope
Bottineau
Dunseith
Rolla
Belcourt
Mohall
Newburg
Rolette
Langdon
Cavalier
Hallock
Munich
Loma
Nekoma
Cando
Glenburn
Minot AFB
Rugby
Towner
Leeds
Minot
Surrey
Velva
Drake
Minnewaukan
Devils Lake
Fort Totten
Lakota
Michigan
Park River
Grafton
Minto
Drayton
Stephen
Argyle
Karlstad
Greenbush
Badger
Roseau
Salol
Warroad
Williams
Baudette
Beltrami Island
Skime
Grygla
Thief River Falls
St Hilaire
Grand Forks AFB
Grand Forks
Larimore
20 km
10 mi
50°16'32.8"N, 100°18'25.9"W (50.2758°, -100.3072°)
Permalink
Map data ©2016 Google
Terms of Use
Report a map error

Celebrate the Wonder of the Night Sky!

ANIMATION: Planet Inner & Outer Orbit Timelapses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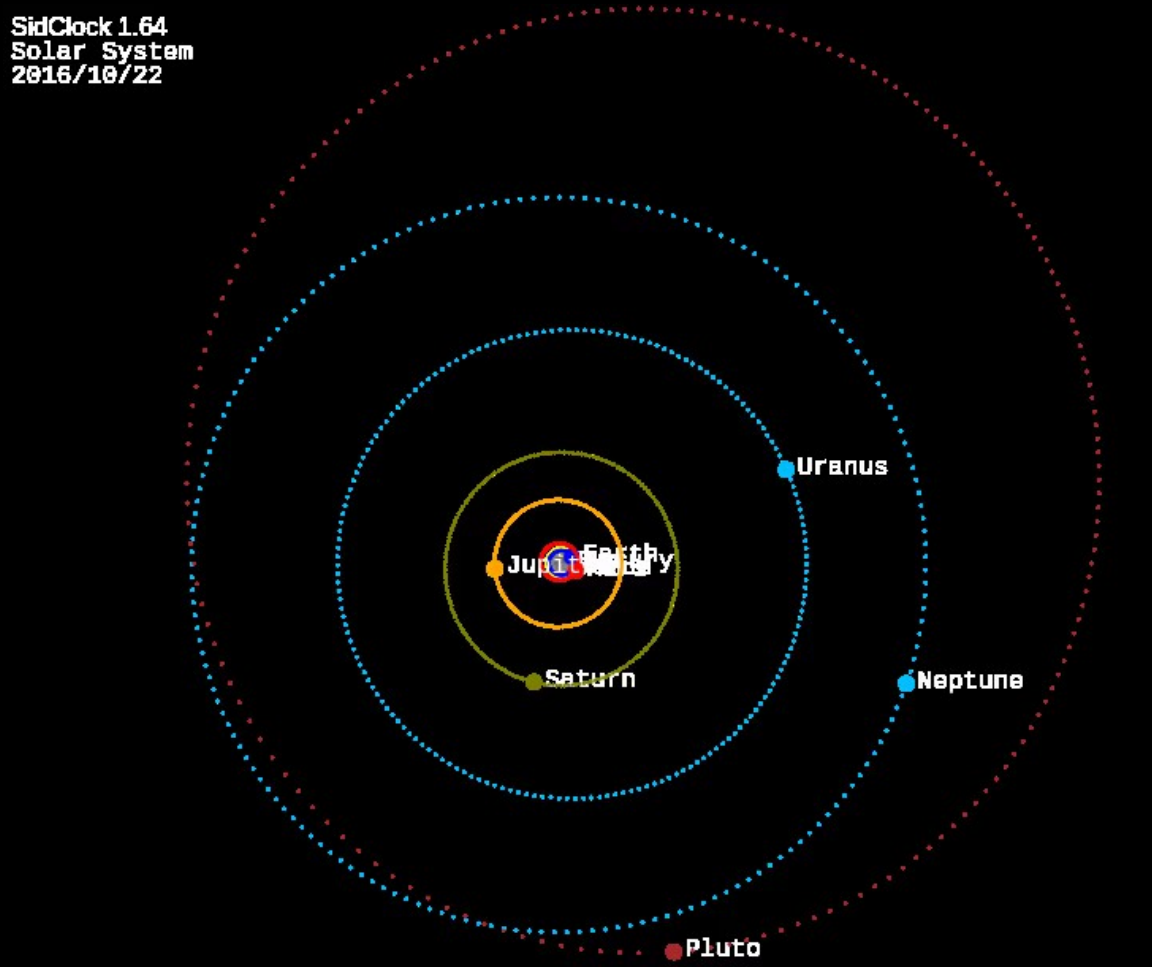
Solar System
2016/10/22
Earth
Sun
Mercury
Venus
Mars


SidClock 1.64
Solar System
2016/10/22
Uranus
Saturn
Neptune
Pluto

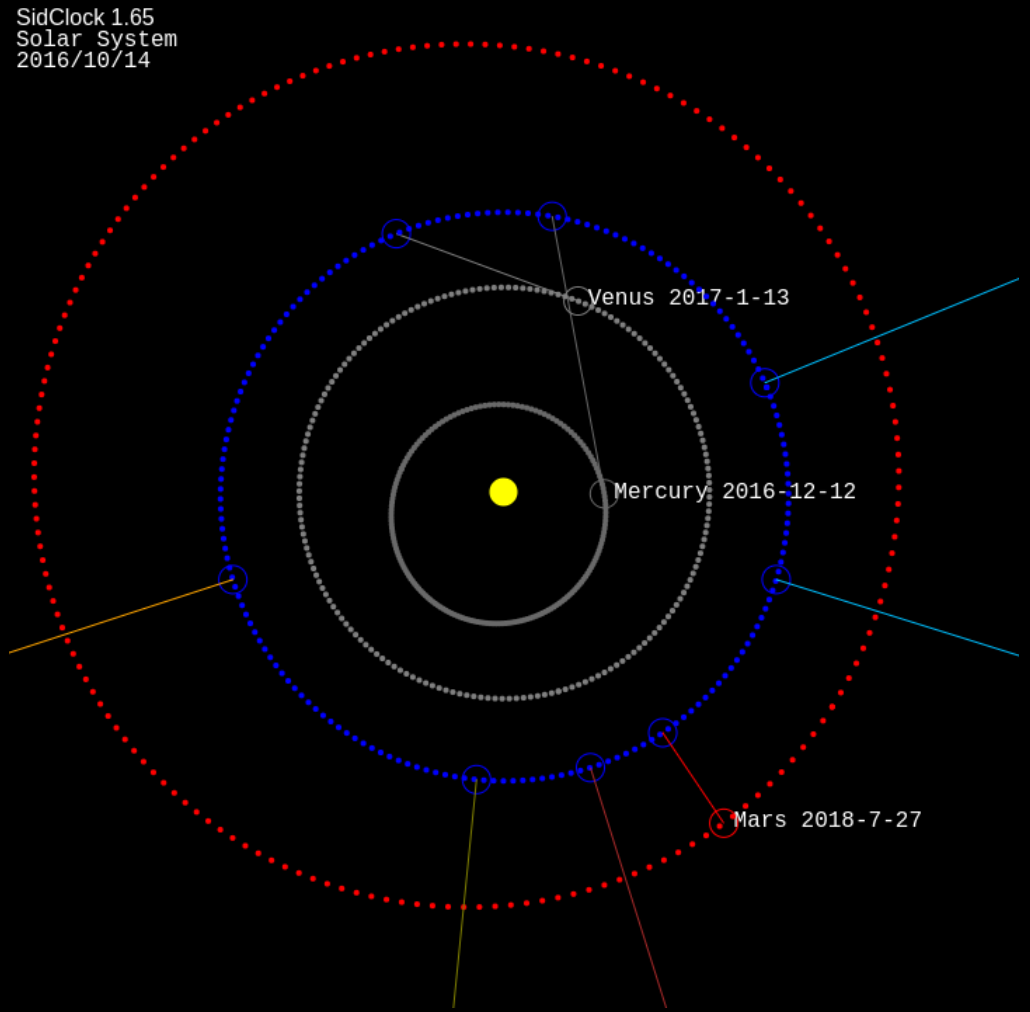
Celebrate the Wonder of the Night Sky!

QUESTION: When are the best opportunities to view planets?

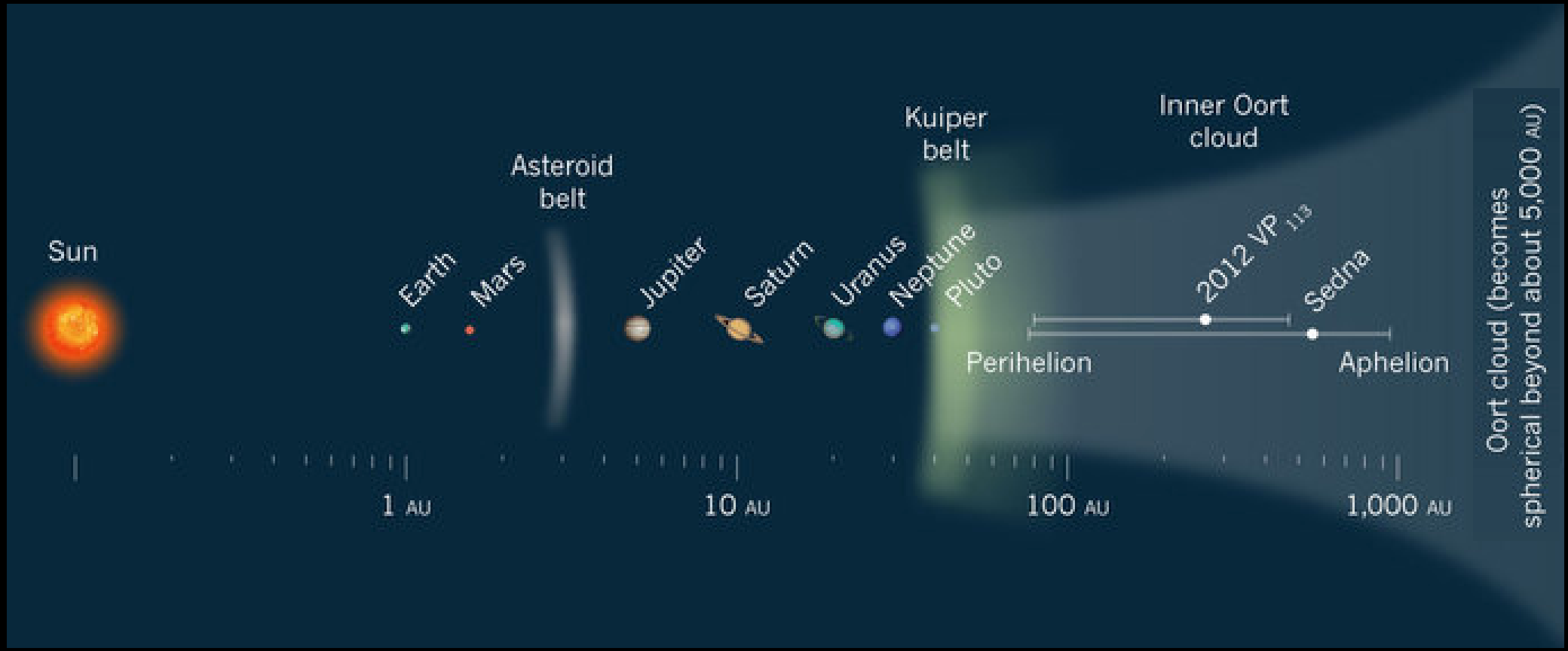
Celebrate the Wonder of the Night Sky!

QUESTION: When are the best opportunities to view planets?

ANSWER: When the planets are visible at the farthest angle from the Sun in the sky – *not* when they are closest to the Earth!



Celebrate the Wonder of the Night Sky!



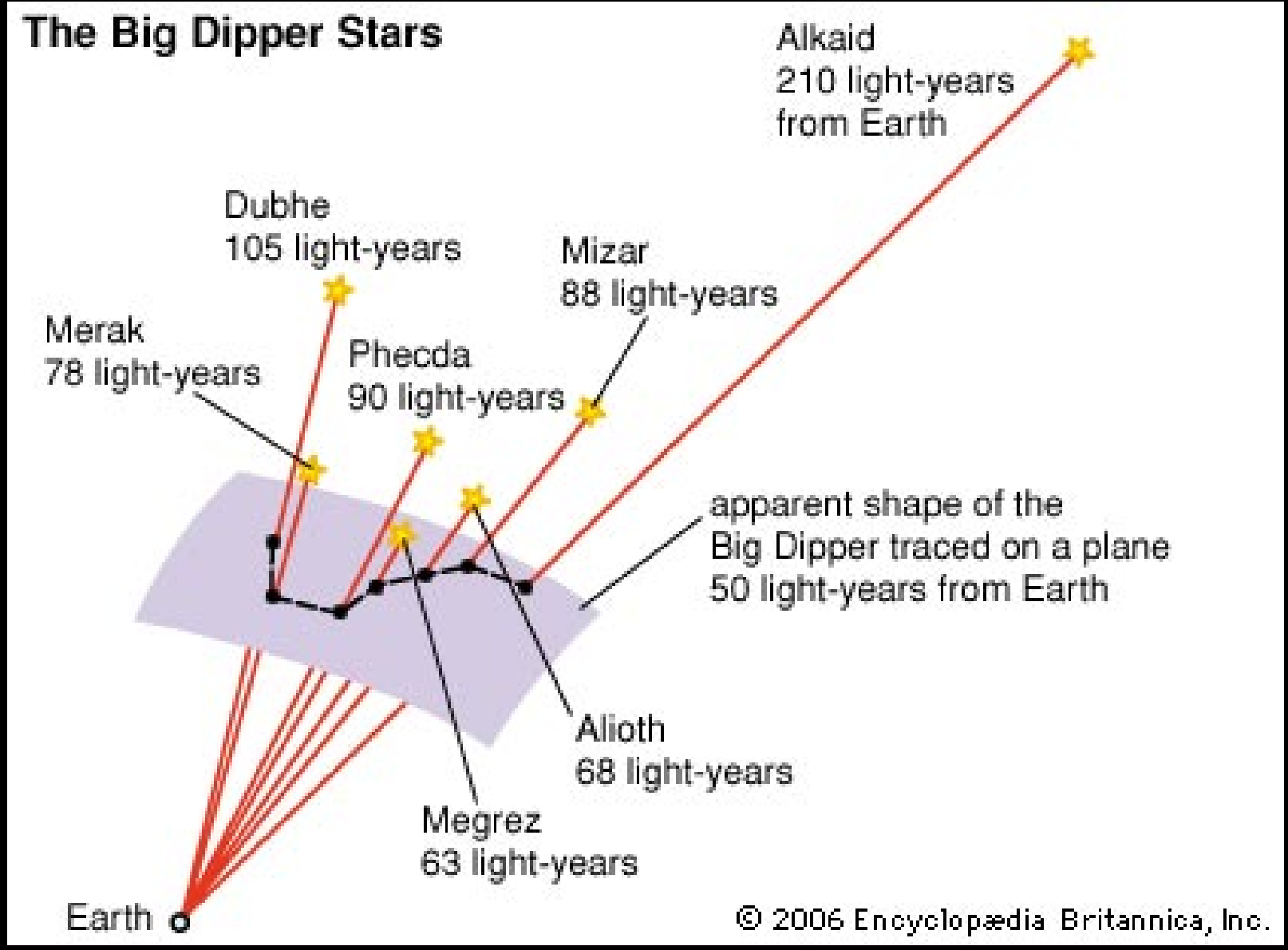
Celebrate the Wonder of the Night Sky!

Stars

Celebrate the Wonder of the Night Sky!

He made all the stars—the Bear and Orion, the Pleiades and the constellations of the southern sky. [Job 9:9 NLT]


3Dra
84UMa
83UMa
81UMa
Alcor
Mizar
78UMa
Alioth
74UMa
70UMa
Dubhe
71UMa
Megrez
73UMa
Ursa Major
66UMa
42UMa
5CVn
Phad / Phecda
Merak
39UMa
43UMa
3CVn
44UMa


The Big Dipper Stars
Alkaid
210 light-years
from Earth
Dubhe
105 light-years
Mizar
88 light-years
Merak
78 light-years
Phecda
90 light-years
apparent shape of the
Big Dipper traced on a plane
50 light-years from Earth
Alioth
68 light-years
Megrez
63 light-years
Earth
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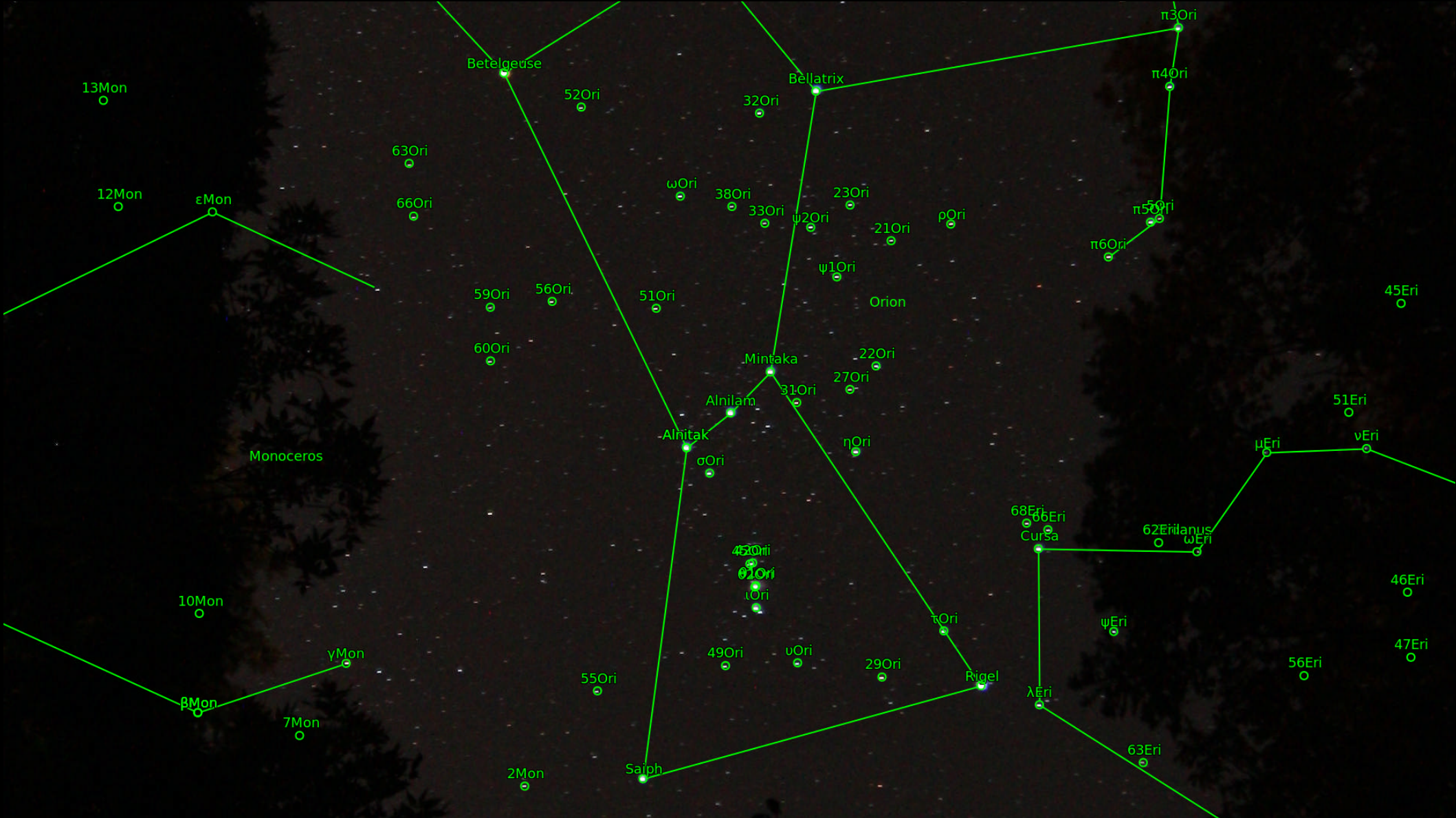
IC 353
Pleione
TAtlas
IC 354
IC 1990
18Tau
Sterope I
ηTau
NGC 1432
Maia nebula
Taygeta
Merope
Celaeno
Electra
NGC 1435 / Merope nebula
NGC 1456

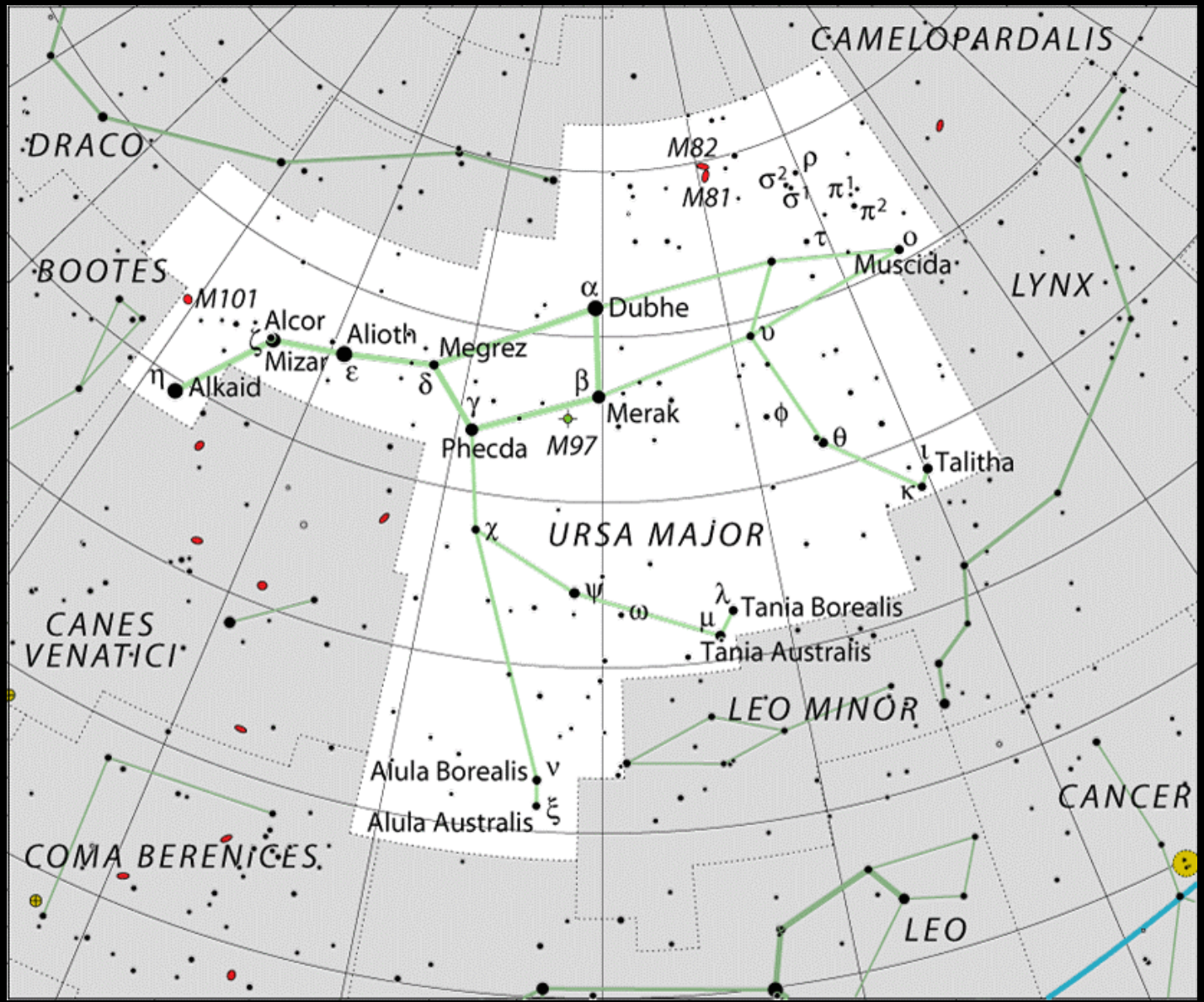

π3Ori
Betelgeuse
Bellatrix
π4Ori
13Mon
52Ori
32Ori
63Ori
12Mon
εMon
66Ori
ωOri
38Ori
23Ori
33Ori
ψ2Ori
ρOri
21Ori
π5Ori
π6Ori
ψ1Ori
59Ori
56Ori
51Ori
Orion
45Eri
60Ori
Mintaka
22Ori
27Ori
31Ori
Alnilam
51Eri
Alnitak
ηOri
νEri
μEri
Monoceros
σOri
68Eri
66Eri
Cursa
62Eri
Eridanus
ωEri
46Eri
θ1Ori
ιOri
10Mon
τOri
ψEri
γMon
49Ori
υOri
29Ori
Rigel
47Eri
56Eri
55Ori
λEri
βMon
7Mon
63Eri
Saiph
2Mon


πSgr
σ2Sgr
33Sgr
14Sgr
σSgr
28Sgr
50Sgr
ν2Sgr
ρSgr
11Sgr
4Sgr
24Sgr
9Sgr
χ3Sgr
Kaus Borealis
χ1Sgr
ψSgr
Nunki
φSgr
3Sgr
τSgr
Sagittarius
γ1Sgr
Media
Alnasl
Ascella
18Sgr
Kaus Australis
ηSgr

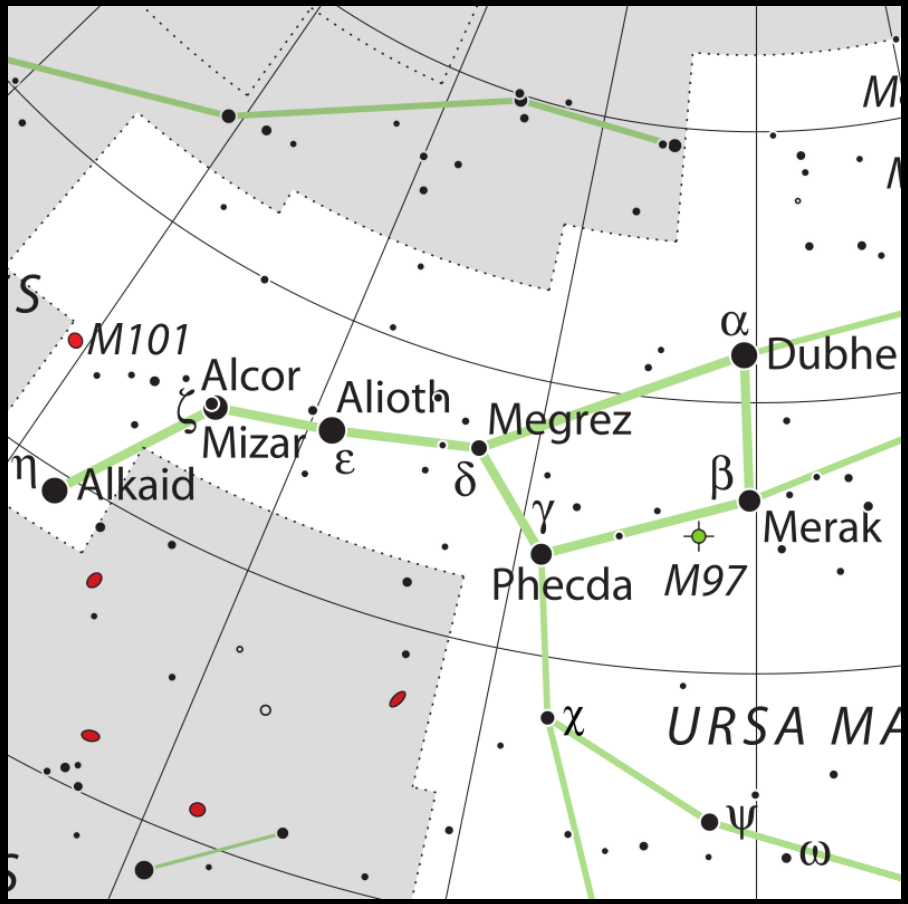

τCas
9Cas
40Cas
ρCas
Caph
σCas
31Cas
12Cas
38Cas
κCas
42Cas
48Cas
ψCas
43Cas
32Cas
ωCas
Navi
Cassiopeia
Schedar
λCas
υ2Cas
υ1Cas
ηCas
ιCas
ζCas
53Cas
εCas
Ruchbah
φCas
44Cas
χCas
ξCas
θCas
μCas
νCas

Celebrate the Wonder of the Night Sky!

QUESTION: How do we identify stars?


CAMELOPARDALIS
DRACO
M82
M81
σ2
ρ
σ1
π1
π2
τ
υ
Muscida
BOOTES
LYNX
M101
α
Dubhe
Alcor
ζ
Mizar
Alioth
ε
Megrez
δ
η
Alkaid
γ
β
Merak
Phecda
M97
ϕ
θ
ι
Talitha
κ
χ
URSA MAJOR
ψ
ω
λ
μ
Tania Borealis
Tania Australis
CANES VENATICI
LEO MINOR
Alula Borealis
ν
ξ
Alula Australis
CANCER
COMA BERENICES
LEO

Celebrate the Wonder of the Night Sky!

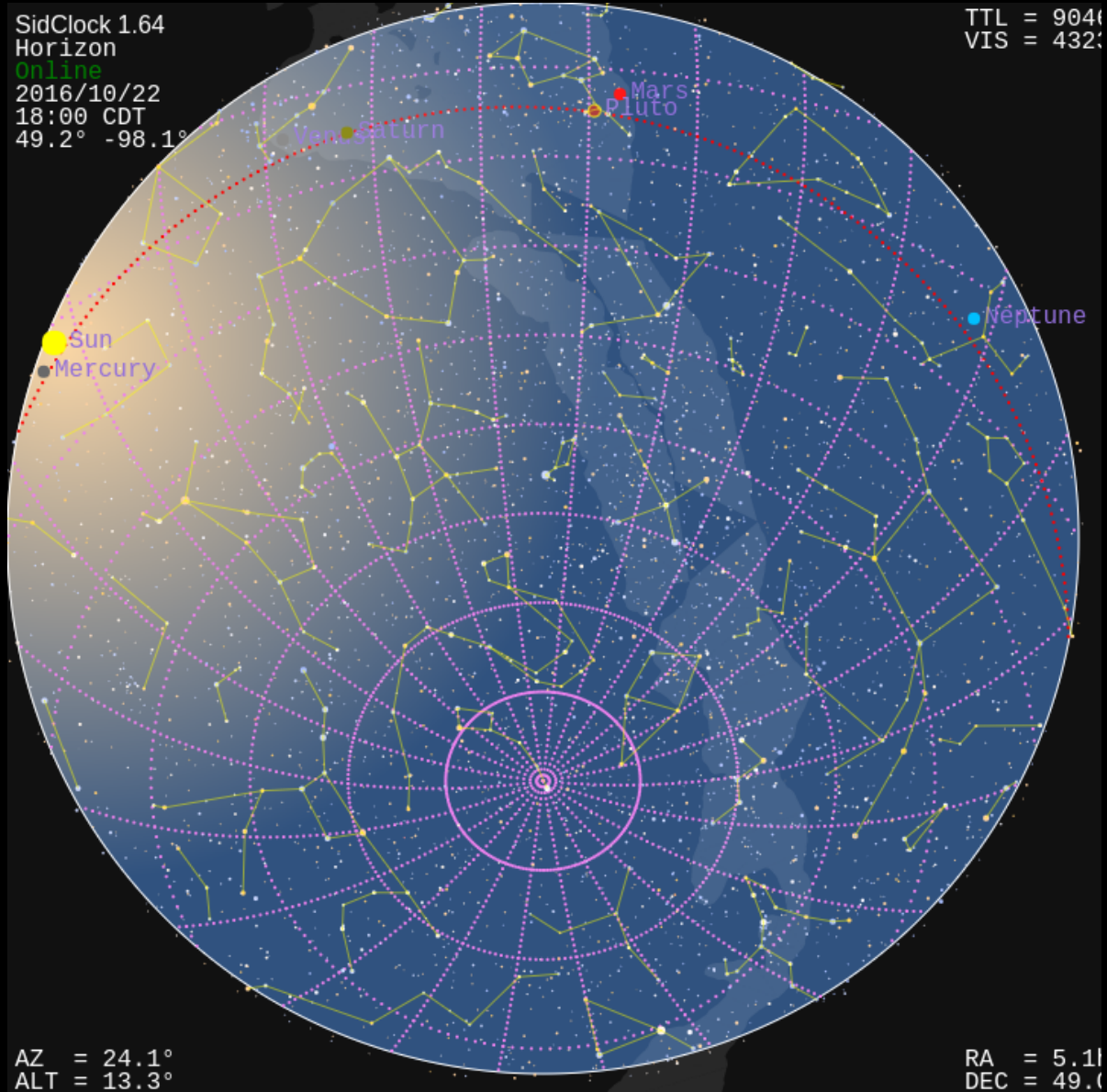


Identifying Stars

- Star Name: Dubhe (Arabic 'bear')
- Bayer: α Ursae Majoris (α UMa)
- Flamsteed: 50 Ursae Majoris (50UMa)
- Yale Bright Star: HR 4301
- Henry Draper: HD 95689

Celebrate the Wonder of the Night Sky!

ANIMATION: Stars Overhead Rotation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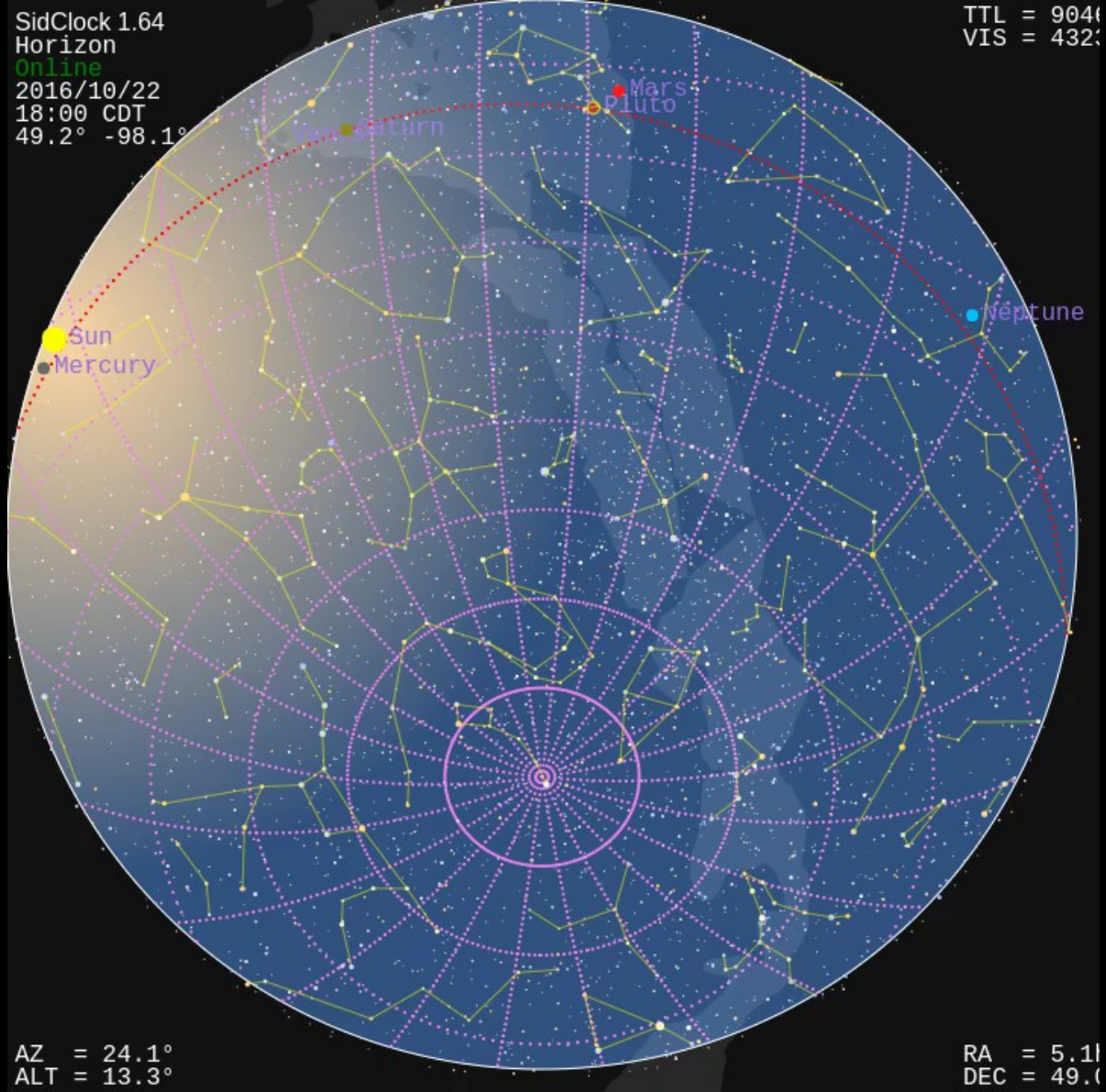
Online
2016/10/22
18:00 CDT
49.2° -98.1°
TTL = 9046
VIS = 4323
Mars
Pluto
Venus
Saturn
Neptune
Sun
Mercury
AZ = 24.1°
ALT = 13.3°
RA = 5.1
DEC = 49.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Horizon
Online
2016/10/22
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VIS = 432
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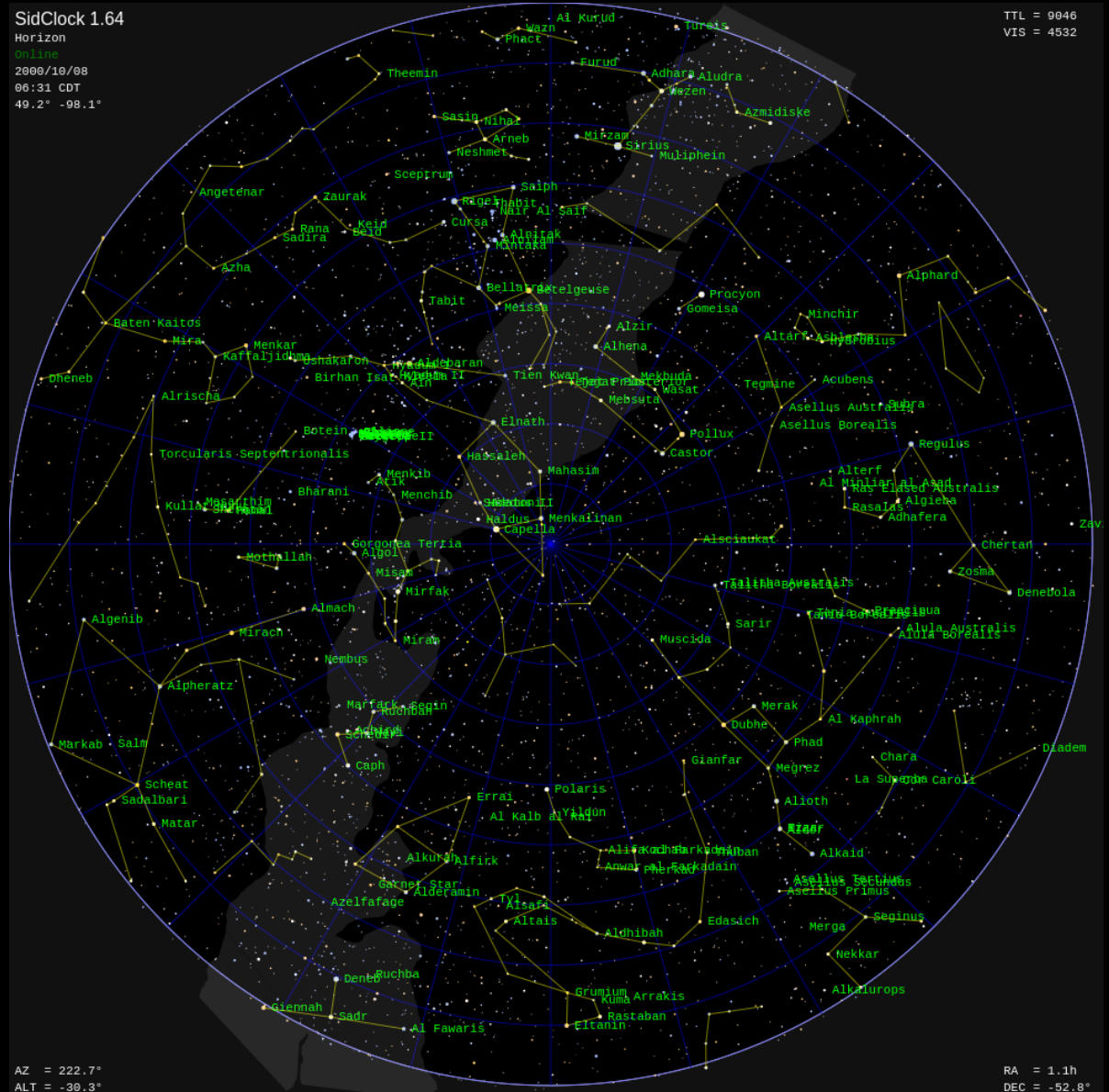
Pluto
Saturn
Neptune
Sun
Mercury
AZ = 24.1°
ALT = 13.3°
RA = 5.1
DEC = 49.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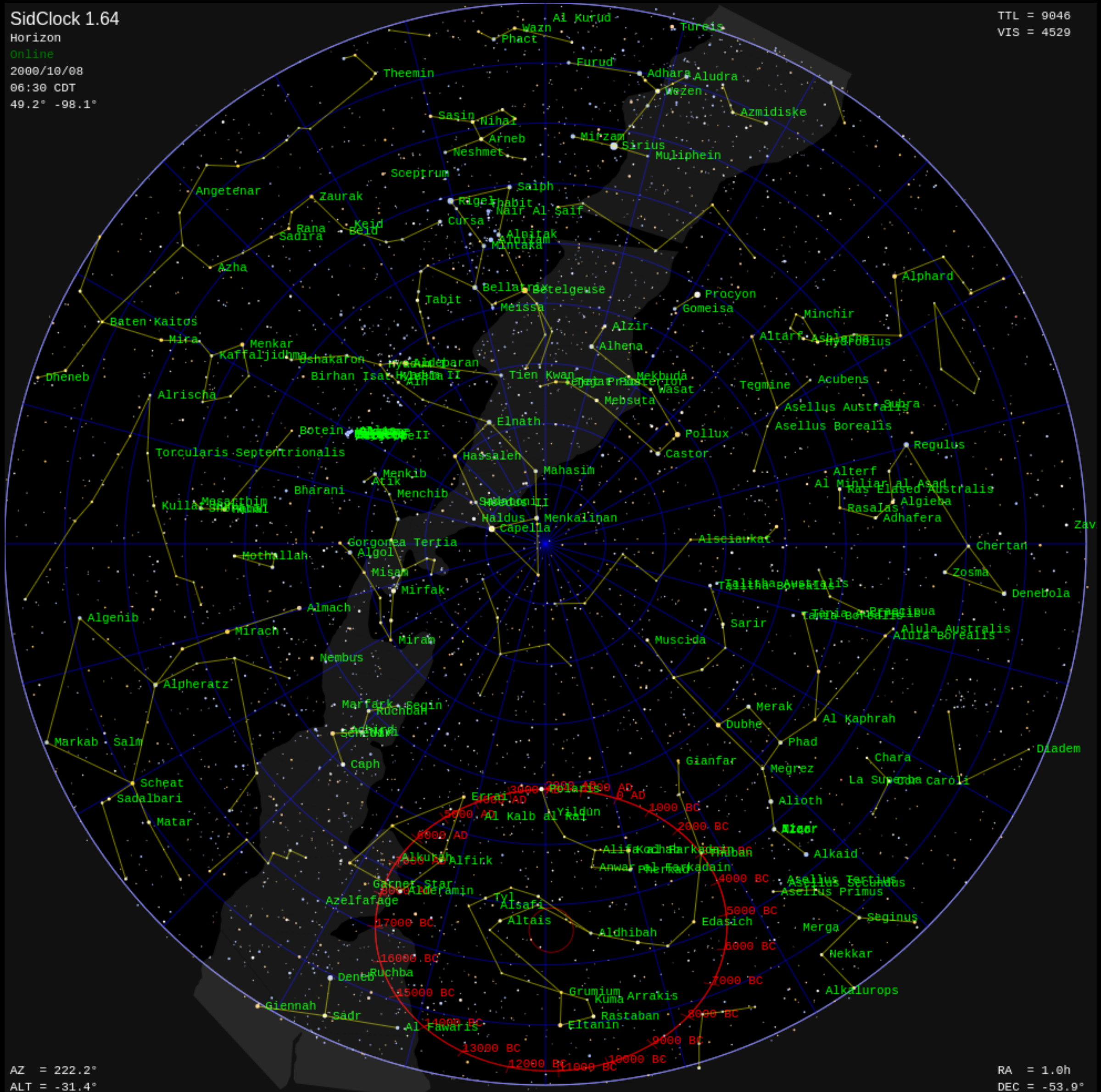
Horizon
Online
2000/10/08
06:31 CDT
49.2° -98.1°
TTL = 9046
VIS = 4532
Al Kurud
Wazn
Phact
Furud
Theemin
Adhara
Aludra
Wezen
Azmidiske
Sasin
Nihal
Arneb
Mirzam
Sirius
Muliphein
Neshmet
Scepirum
Angetenar
Zaurak
Rigel
Thabit
Nair Al Saif
Rana
Keid
Sadira
Beid
Cursa
Alnitak
Mintaka
Saiph
Azha
Bellatrix
Betelgeuse
Procyon
Alphard
Tabit
Meissa
Gomeisa
Minchir
Baten Kaitos
Mira
Menkar
Alzir
Alhena
Altarf
Asellus Borealis
Kaffaljidhma
Dheneb
Alrischa
Birhan
Tien Kwan
Mebsuta
Wasat
Tegmine
Acubens
Asellus Australis
Elnath
Pollux
Botein
Castor
Regulus
Torcularis Septentrionalis
Hassaleh
Mahasim
Alterf
Al Minliar Al Asad
Menkib
Atik
Bharani
Menchib
Ras Elased Australis
Algieba
Rasalas
Adhafera
Capella
Menkalinan
Haldus
Alsciaukat
Chertan
Gorgonea Tertia
Algol
Mothallah
Zosma
Denebola
Mirfak
Almach
Algenib
Mirach
Sarin
Muscida
Alula Borealis
Nembus
Alpheratz
Merak
Dubhe
Al Kaphrah
Markab
Phad
Gianfar
Megrez
Chara
Diadem
Caph
Scheat
Polaris
Errai
Alioth
Sadalbari
Matar
Alkaid
Alkurah
Alfirk
Garnet Star
Alderamin
Azelfafage
Edasich
Seginus
Merga
Aldhibah
Nekkar
Deneb
Ruchba
Grumium
Arrakis
Rastaban
Eltanin
Sadr
Al Fawaris
AZ = 222.7°
ALT = -30.3°
RA = 1.1h
DEC = -52.8°


SidClock 1.64
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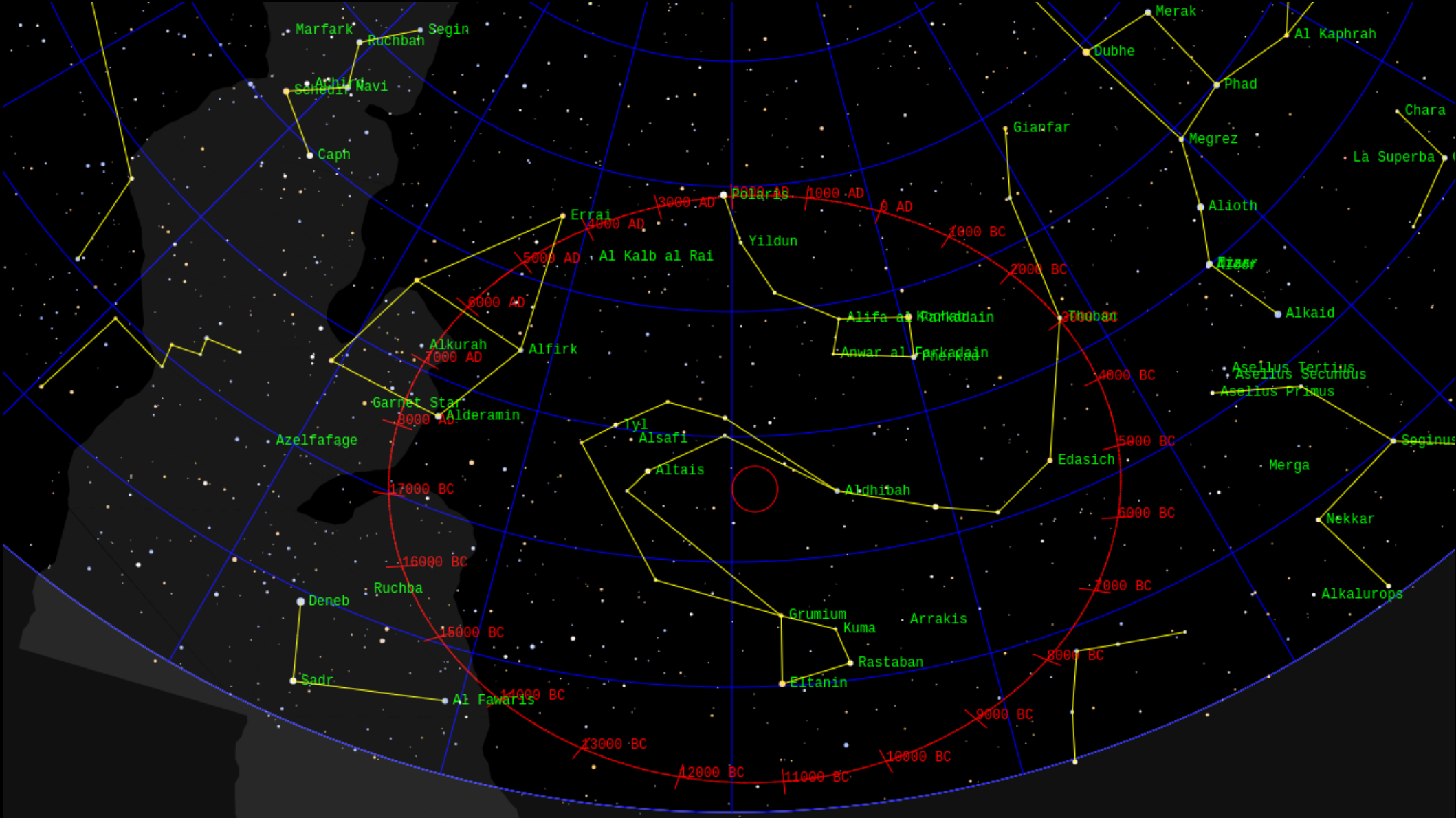
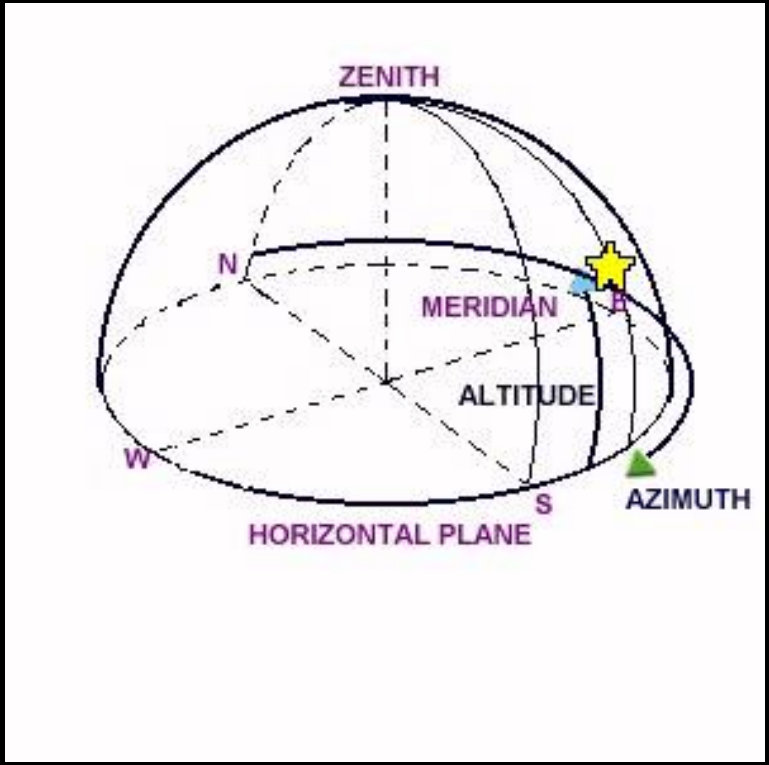
Online
2000/10/08
06:30 CDT
49.2° -98.1°
TTL = 9046
VIS = 4529
AZ = 222.2°
ALT = -31.4°
RA = 1.0h
DEC = -53.9°
Al Kurud
Wazn
Phact
Turais
Theemin
Furud
Adhara
Aludra
Wezen
Azmidiske
Sasin
Nihal
Arneb
Mirzam
Sirius
Muliphein
Neshmet
Sceptrum
Saiph
Angetenar
Zaurak
Rigel
Cursa
Rana
Sadira
Mintaka
Azha
Bellatrix
Betelgeuse
Procyon
Gomeisa
Tabit
Meissa
Alphard
Minchir
Baten Kaitos
Mira
Alzir
Menkar
Alhena
Dheneb
Birhan Isat
Tien Kwan
Mekbuda
Wasat
Tegmine
Acubens
Alrischa
Mebsuta
Elnath
Asellus Australis
Asellus Borealis
Pollux
Castor
Botein
Torcularis Septentrionalis
Hassaleh
Regulus
Mahasim
Menkib
Atik
Alterf
Bharani
Menchib
Algieba
Haldus
Menkalinan
Capella
Rasalas
Adhafera
Alsciaukat
Gorgonea Tertia
Chertan
Mothallah
Algol
Misam
Zosma
Mirfak
Denebola
Almach
Sarir
Algenib
Mirach
Miram
Muscida
Nembus
Alpheratz
Merak
Dubhe
Al Kaphrah
Markab
Salm
Phad
Caph
Gianfar
Megrez
Chara
Diadem
Scheat
Sadalbari
Alioth
Matar
Errai
Polaris
Yildun
Al Kalb al Rai
Alkaid
Alfirk
Alkurhah
Anwar al Farkadain
Aselus Primus
Alderamin
Azelfafage
Tyl
Alsafi
Altais
Aldhibah
Edasich
Seginus
Merga
Nekkar
Deneb
Ruchba
Grumium
Kuma
Arrakis
Rastaban
Eltanin
Alkalurops
Giennah
Sadr
Al Fawaris
1000 BC
2000 BC
4000 BC
5000 BC
6000 BC
7000 BC
8000 BC
9000 BC
10000 BC
11000 BC
12000 BC
13000 BC
14000 BC
15000 BC
16000 BC
17000 BC
0 AD
6000 AD
8000 AD

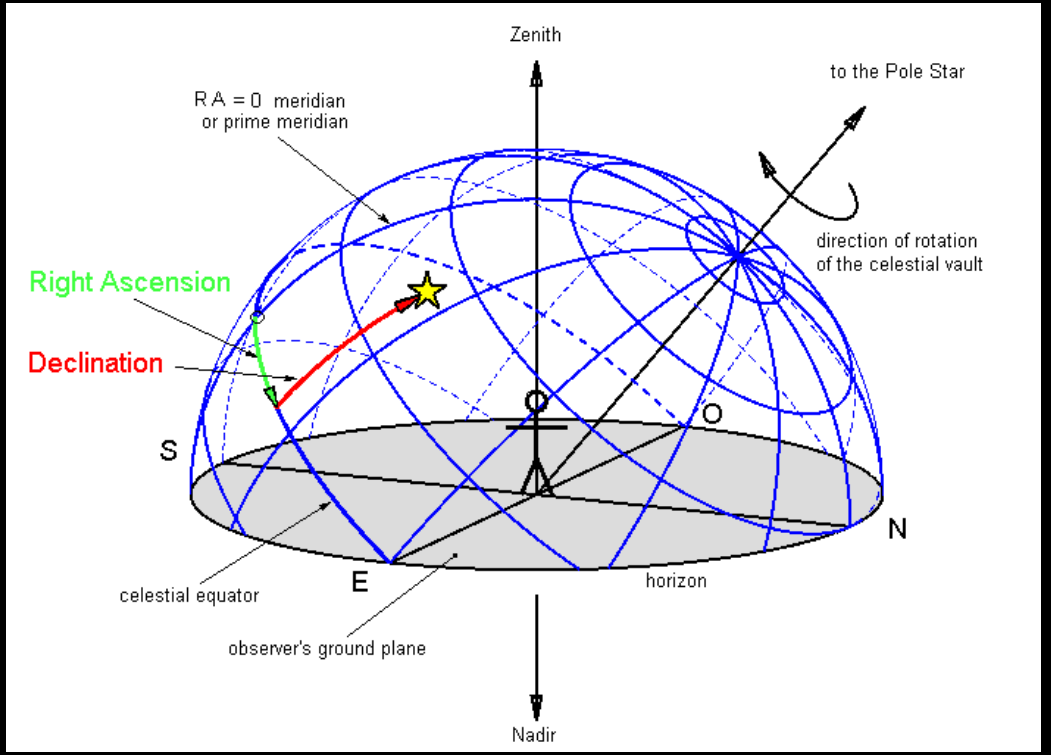

Marfark
Segin
Ruchbah
Achird
Schedir
Navi
Caph
Merak
Dubhe
Al Kaphrah
Phad
Chara
Megrez
La Superba
Gianfar
Alioth
Alkaid
Polaris
3000 AD
2000 AD
1000 AD
0 AD
1000 BC
2000 BC
3000 BC
4000 BC
5000 BC
6000 BC
7000 BC
8000 BC
9000 BC
10000 BC
11000 BC
12000 BC
13000 BC
14000 BC
15000 BC
16000 BC
17000 BC
Errai
4000 AD
5000 AD
Al Kalb al Rai
Yildun
6000 AD
7000 AD
8000 AD
Alkurah
Alfirk
Garnet Star
Alderamin
Azelfafage
Tyl
Alsafi
Altais
Aldhibah
Edasich
Asellus Tertius
Asellus Secundus
Asellus Primus
Merga
Nekkar
Alkalurops
Seginus
Ruchba
Deneb
Sadr
Al Fawaris
Grumium
Kuma
Arrakis
Rastaban
Eltanin

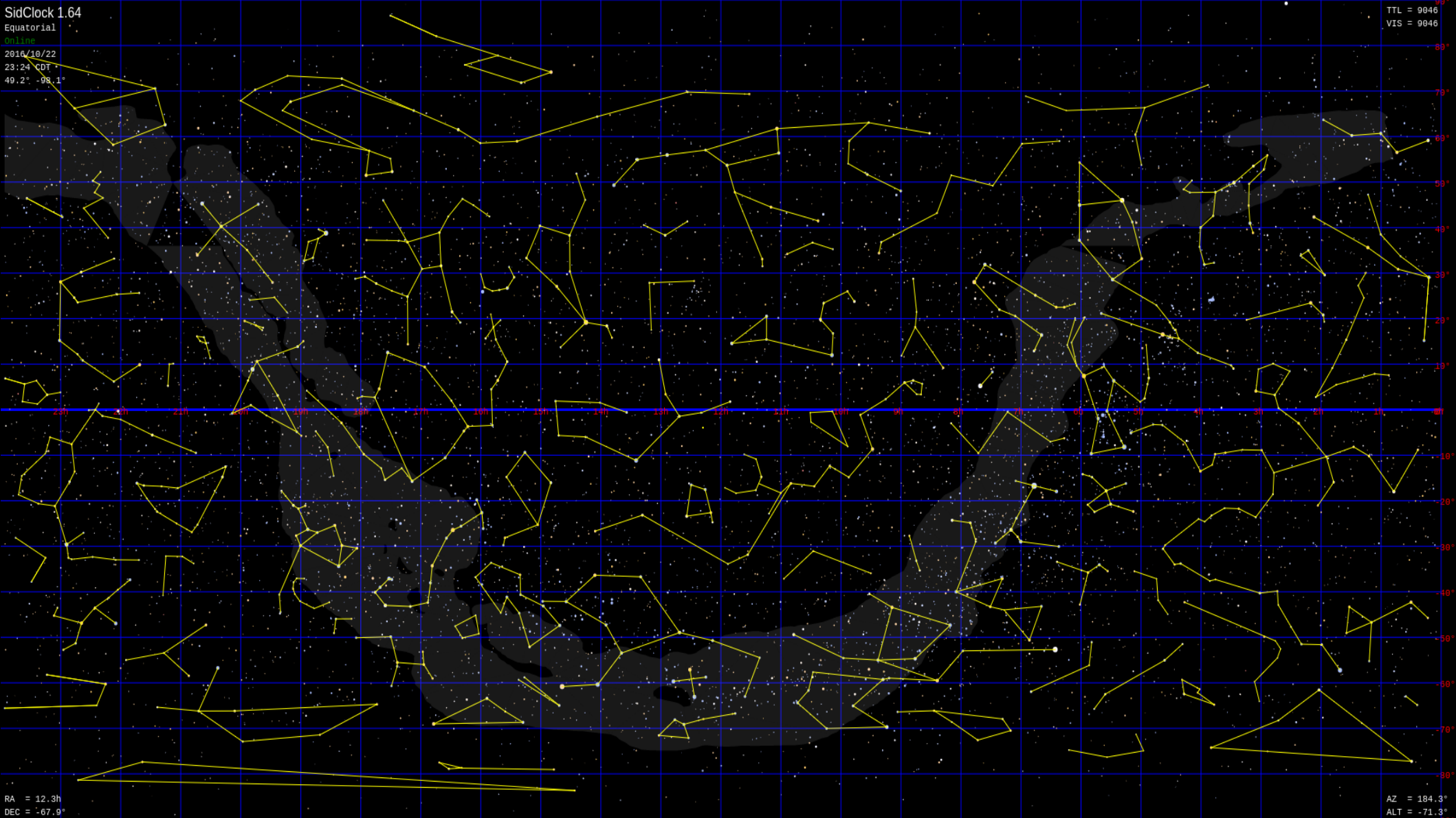
Celebrate the Wonder of the Night Sky!

Horizontal Coordinate System



Celestial Coordinate System

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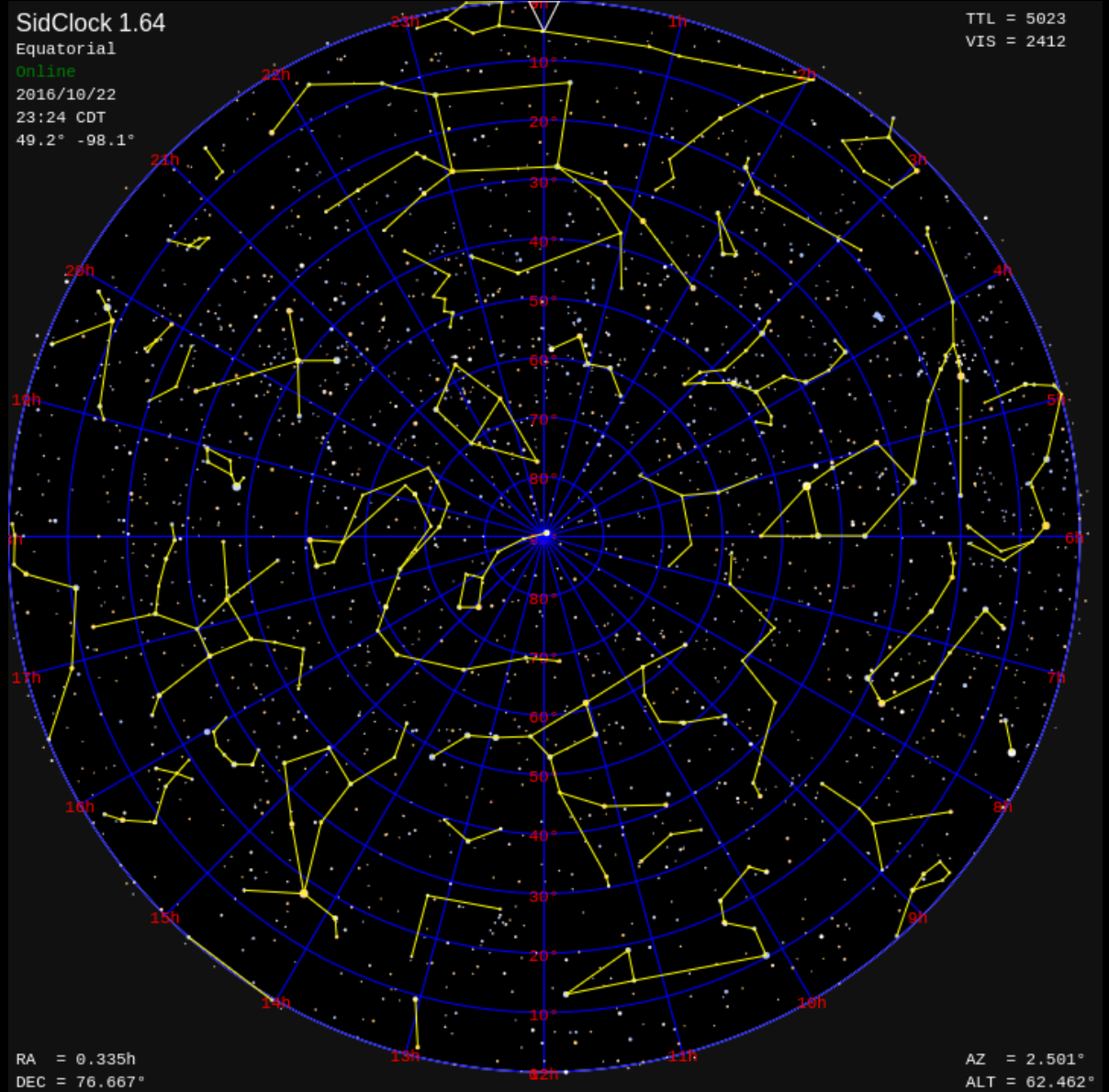
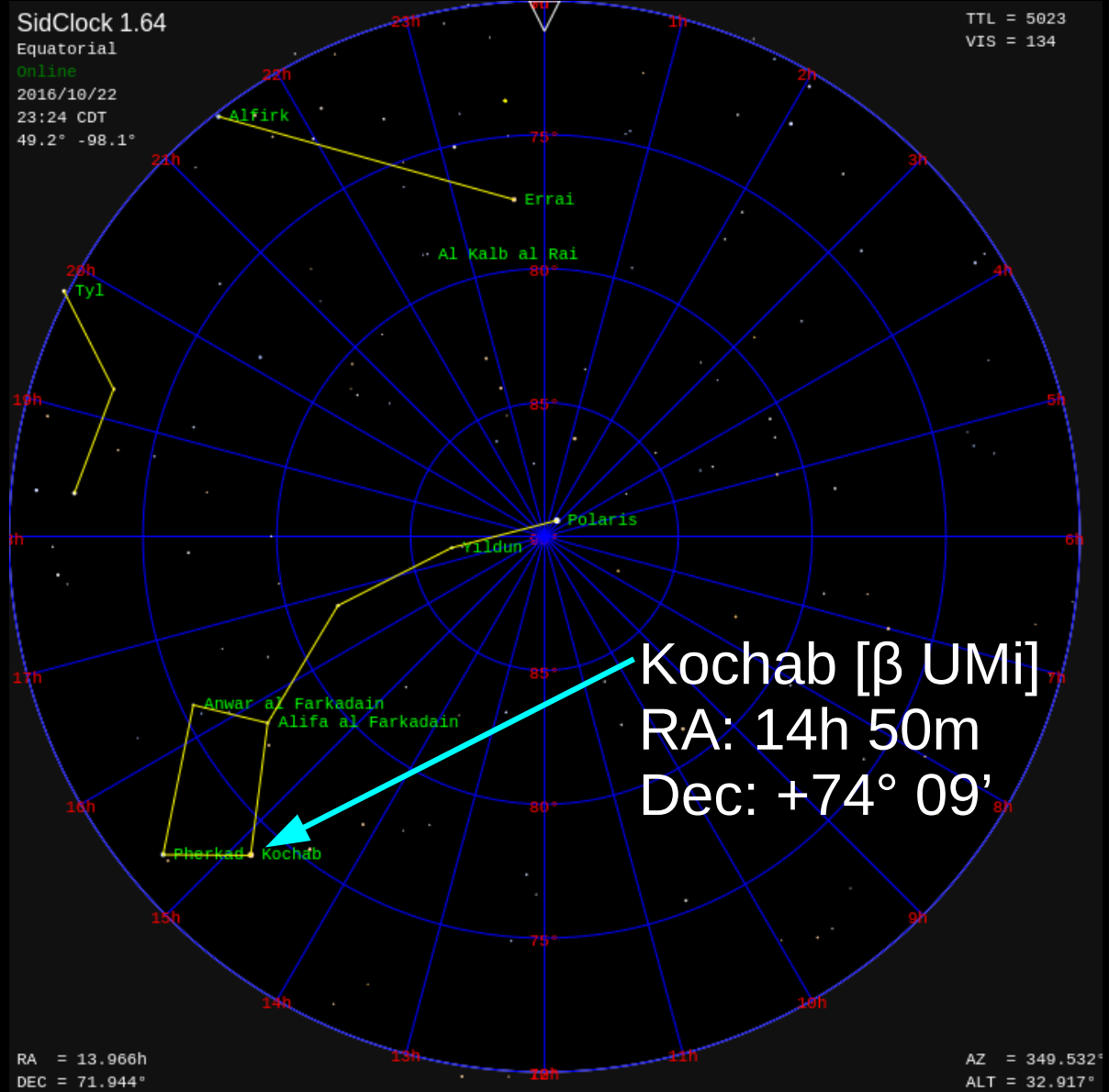
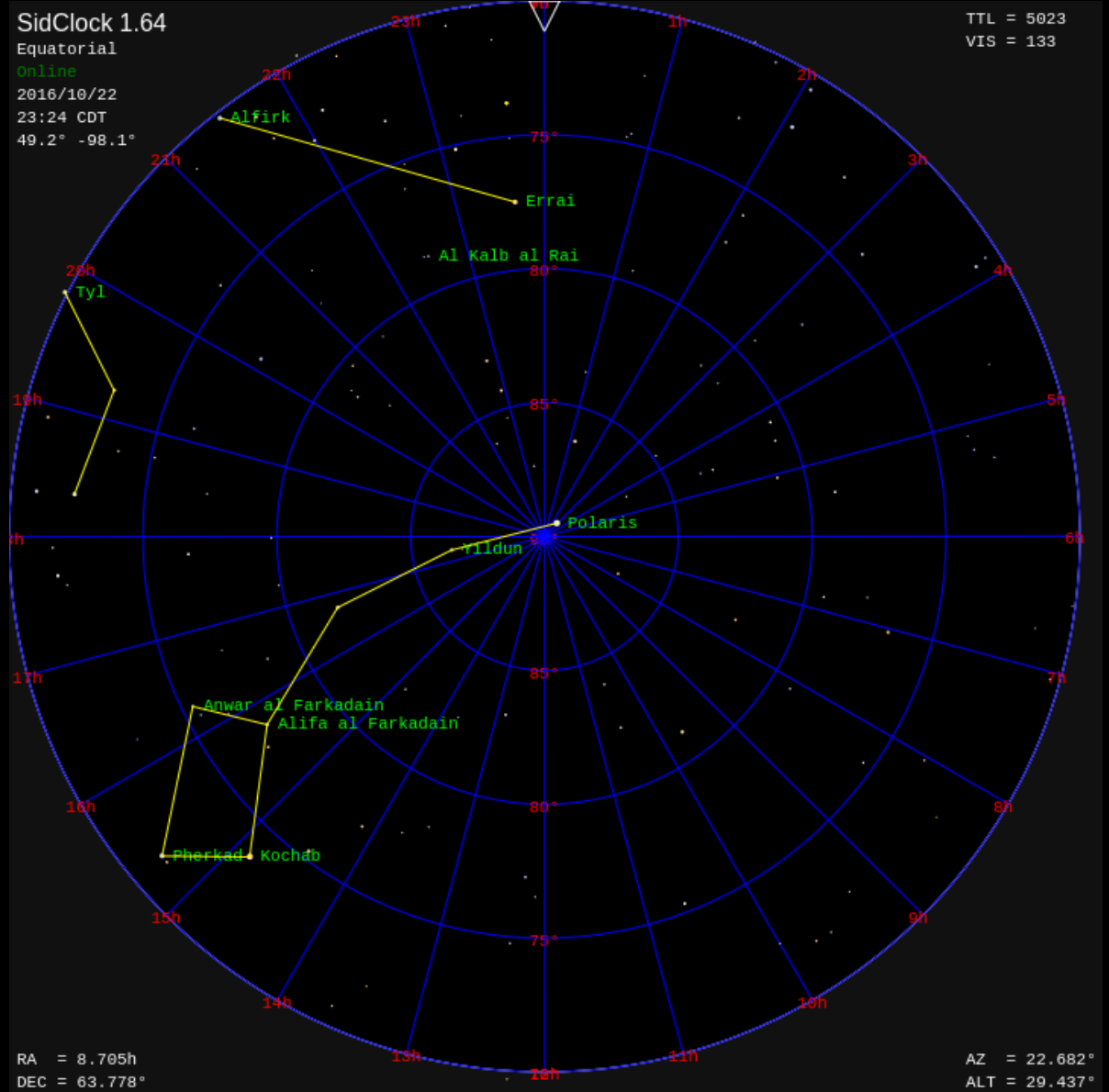
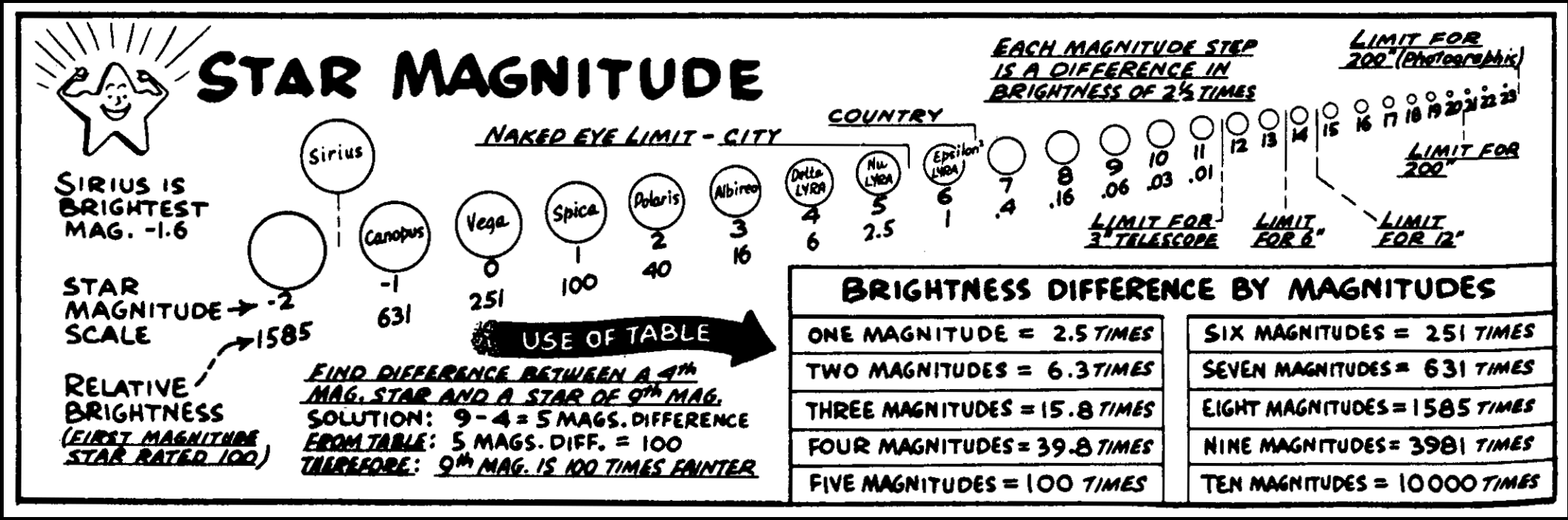
Equatorial
Online
2016/10/22
23:24 CDT
49.2° -98.1°
TTL = 9046
VIS = 9046
90°
80°
70°
60°
50°
40°
30°
20°
10°
0°
-10°
-20°
-30°
-40°
-50°
-60°
-70°
-80°
22h
21h
20h
19h
18h
17h
16h
15h
14h
13h
12h
11h
10h
9h
8h
7h
6h
5h
4h
3h
2h
1h
0h
RA = 12.3h
DEC = -67.9°
AZ = 184.3°
ALT = -71.3°


SidClock 1.64
Equatorial
Online
2016/10/22
23:24 CDT
49.2° -98.1°
TTL = 5023
VIS = 2412
RA = 0.335h
DEC = 76.667°
AZ = 2.501°
ALT = 62.462°
0h
1h
2h
3h
4h
5h
6h
7h
8h
9h
10h
11h
12h
13h
14h
15h
16h
17h
18h
19h
20h
21h
22h
23h
10°
20°
30°
40°
50°
60°
70°
80°

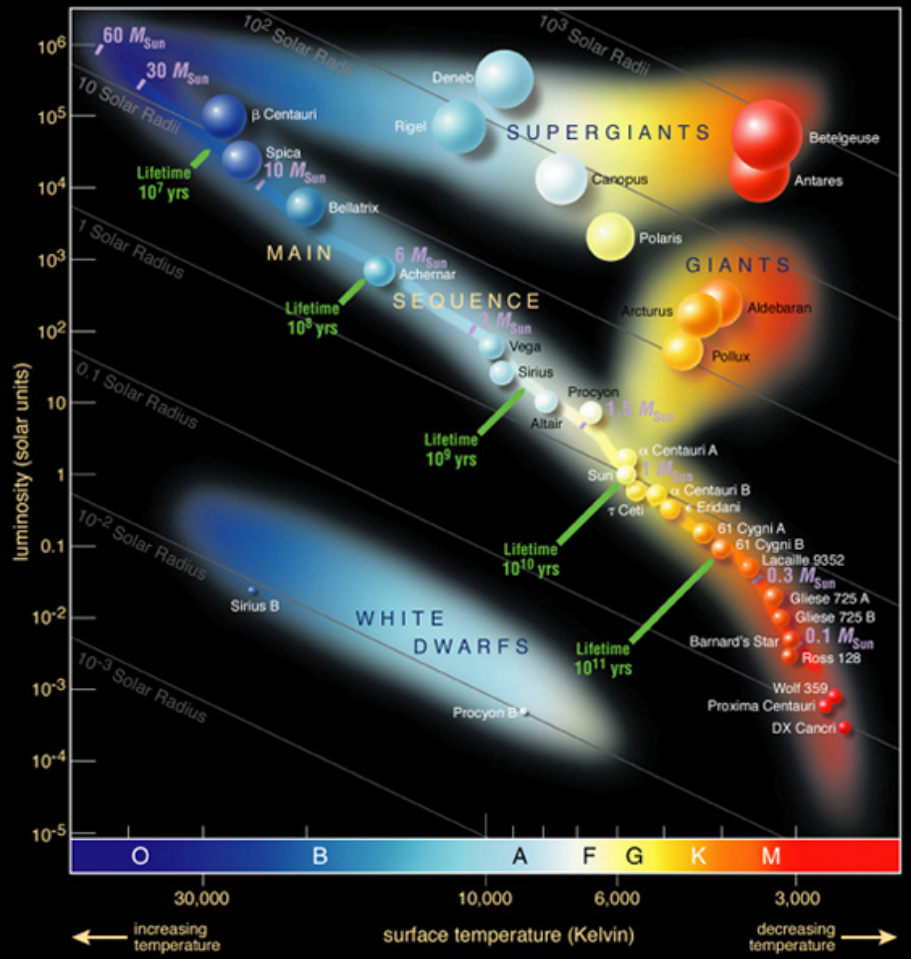

SidClock 1.64
Equatorial
Online
2016/10/22
23:24 CDT
49.2° -98.1°
TTL = 5023
VIS = 134
Alfirk
Errai
Al Kalb al Rai
Tyl
Polaris
Yildun
Anwar al Farkadain
Alifa al Farkadain
Pherkad
Kochab
Kochab [β UMi]
RA: 14h 50m
Dec: +74° 09’
RA = 13.966h
DEC = 71.944°
AZ = 349.532°
ALT = 32.917°


SidClock 1.64
Equatorial
Online
2016/10/22
23:24 CDT
49.2° -98.1°
TTL = 5023
VIS = 133
Alfirk
Errai
Al Kalb al Rai
Tyl
Polaris
Yildun
Anwar al Farkadain
Alifa al Farkadain
Pherkad
Kochab
RA = 8.705h
DEC = 63.778°
AZ = 22.682°
ALT = 29.437°

Celebrate the Wonder of the Night Sky!



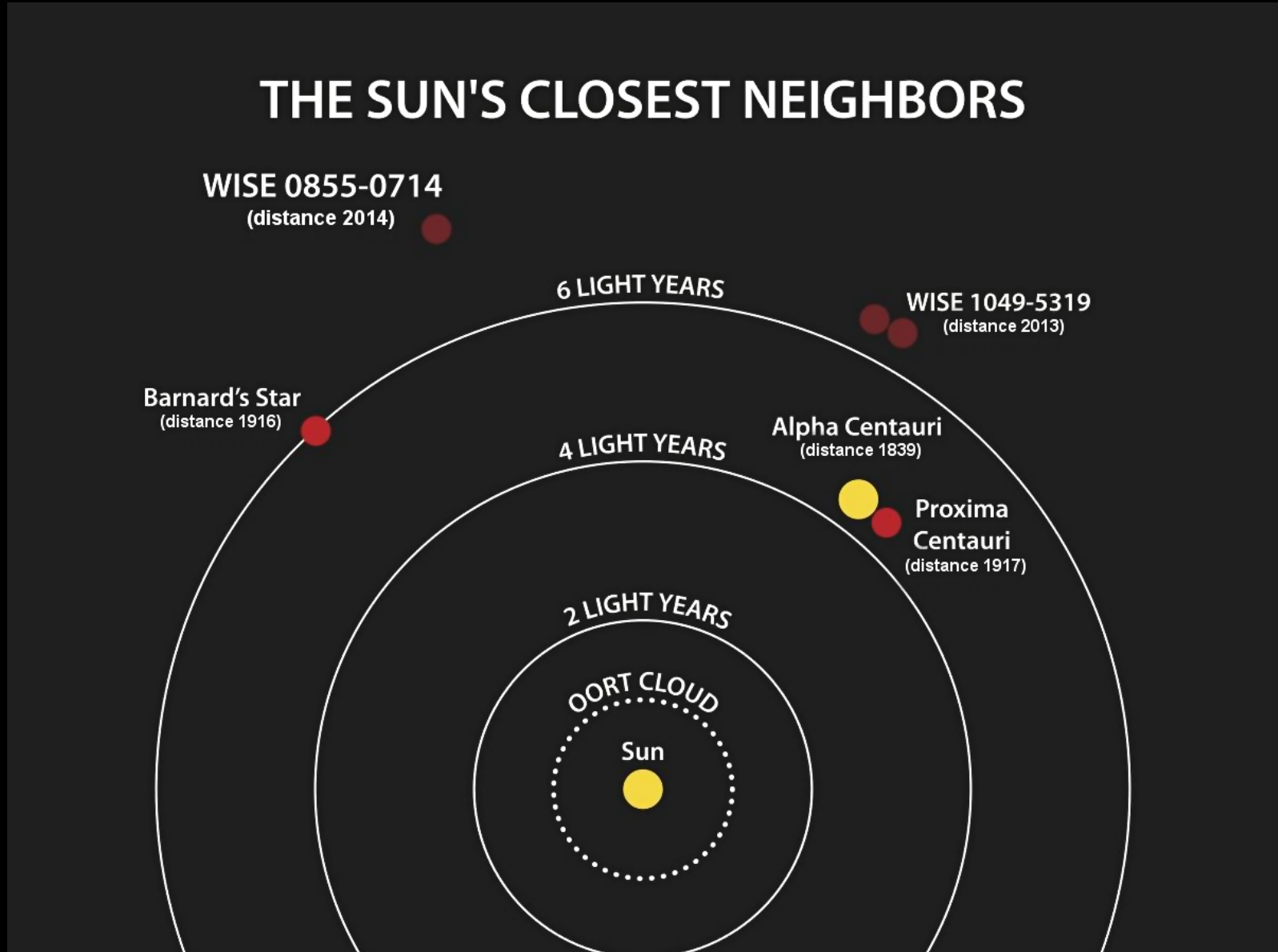
Celebrate the Wonder of the Night Sky!



Star Categories

- H-R (Hertzsprung-Russel)
- Plots brightness vs temperature
- Hot stars = short life
- Cool stars = long life
- Main sequence are dwarf stars
- Sun is a type ‘G’ dwarf star
- OBAFGKM easy to remember :)

THE SUN'S CLOSEST NEIGHBORS



length conversion

Category: *main menu* • *length menu* • *Light-years*

Amount: 1 light-year (ly) of distance

Equals: 63,241.08 astronomical units (au - ua) in astronomy length

length from light-year to astronomical unit Conversion Results:

Amount : 1 light-year (ly of length)

Equals : 63 241.08 astronomical units (au - ua / length)

Fraction : 63 241 $^{2}/_{25}$ astronomical units (au - ua / length)

Enter a New *light-year* Amount of length to Convert From

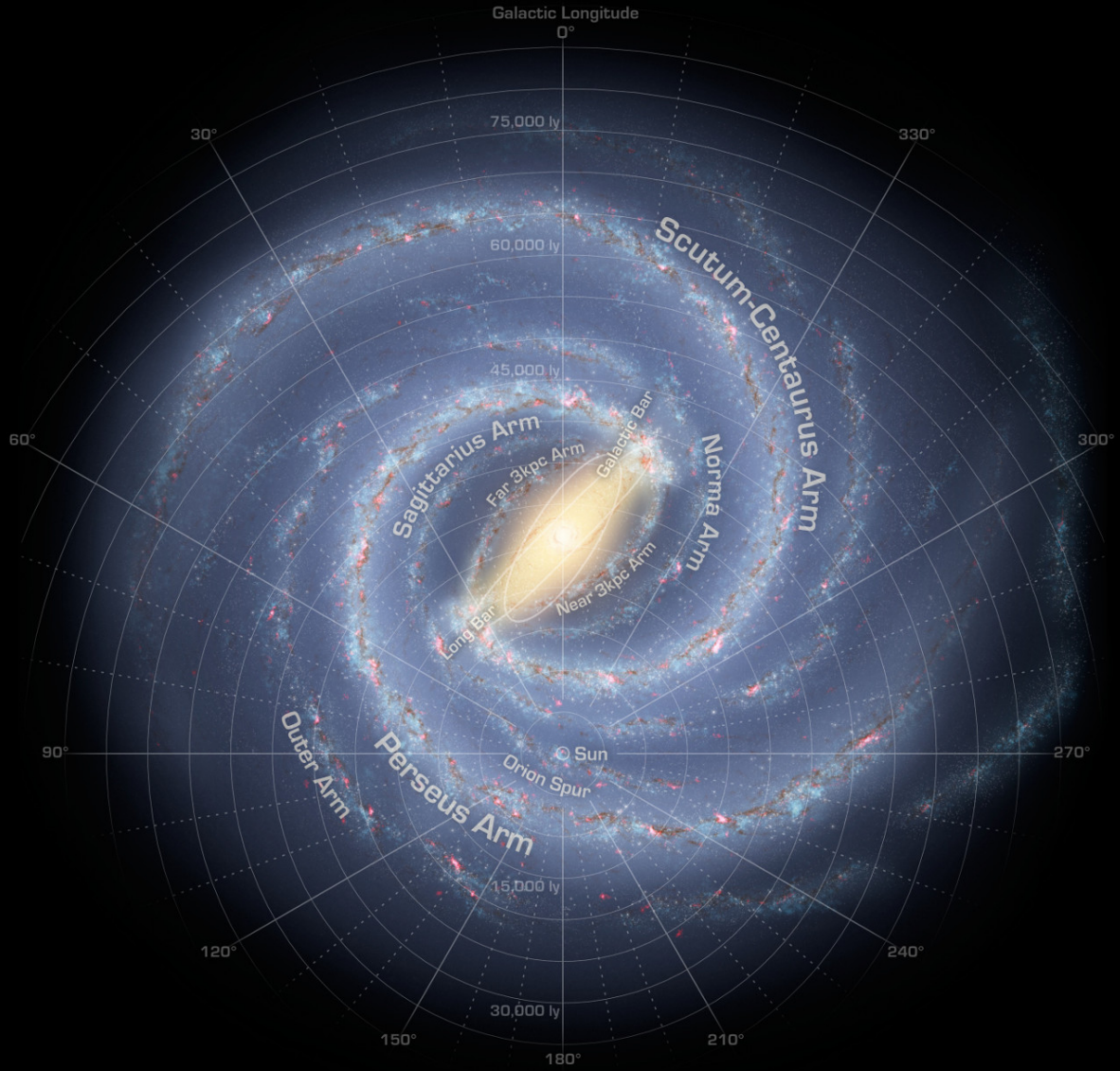
* Whole numbers, decimals or fractions (ie: 6, 5.33, 17 3/8)
* Precision is how many numbers after decimal point (1 - 9)

Enter Amount : 1

Decimal Precision : 2

Celebrate the Wonder of the Night Sky!

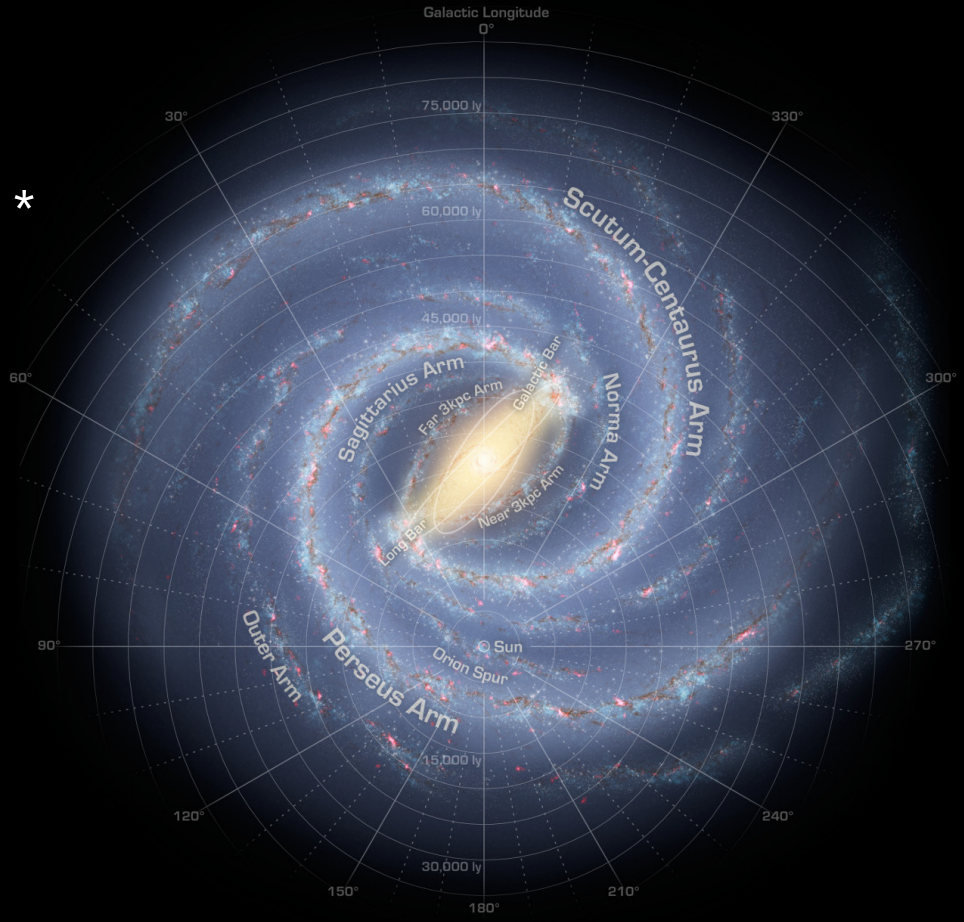
Galaxy


Galactic Longitude
0°
30°
330°
60°
300°
90°
270°
120°
240°
150°
210°
180°
75,000 ly
60,000 ly
45,000 ly
30,000 ly
15,000 ly
Scutum-Centaurus Arm
Sagittarius Arm
Norma Arm
Perseus Arm
Outer Arm
Far 3kpc Arm
Galactic Bar
Near 3kpc Arm
Long Bar
Sun
Orion Spur

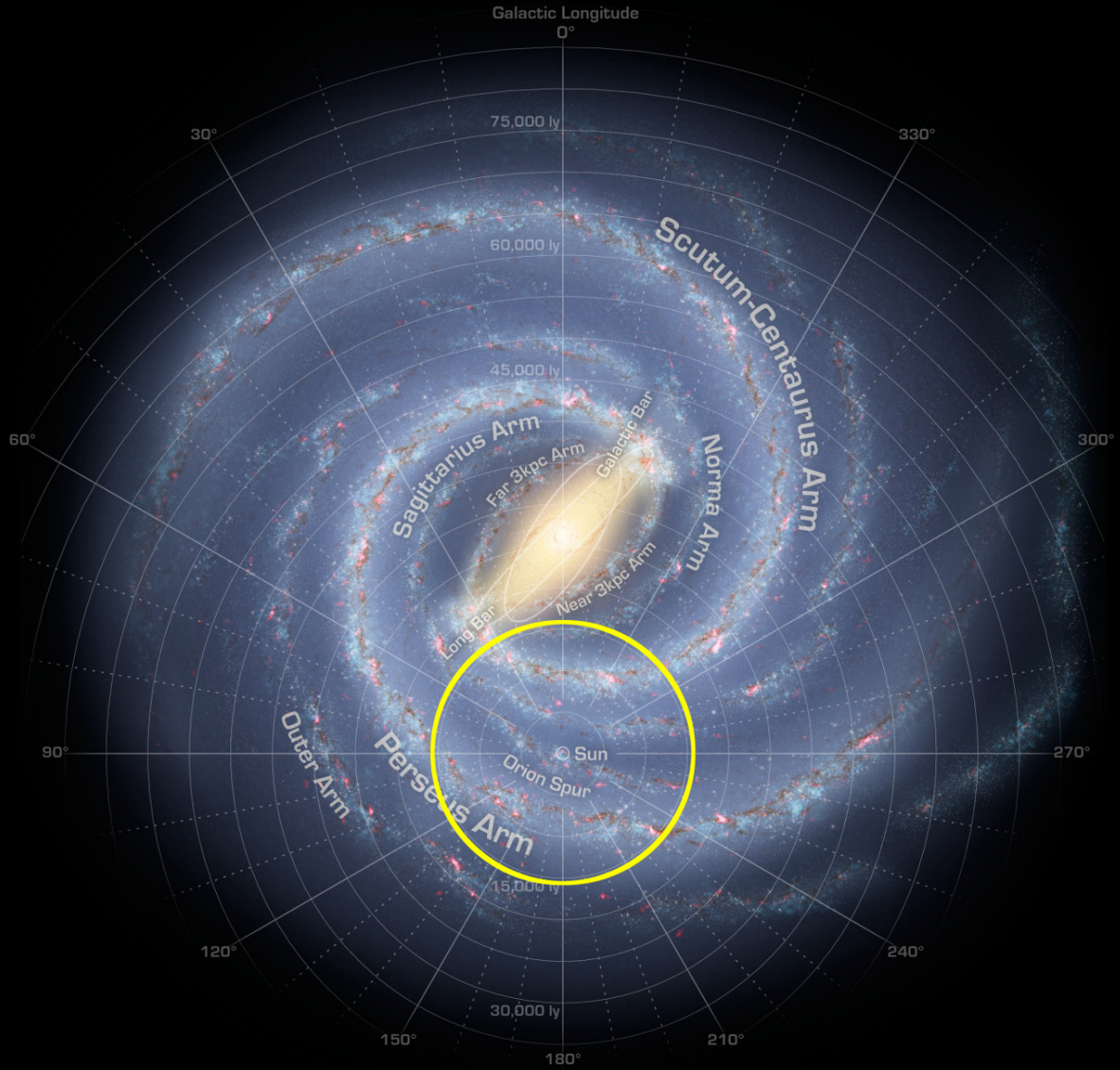
Celebrate the Wonder of the Night Sky!

Milky Way galaxy

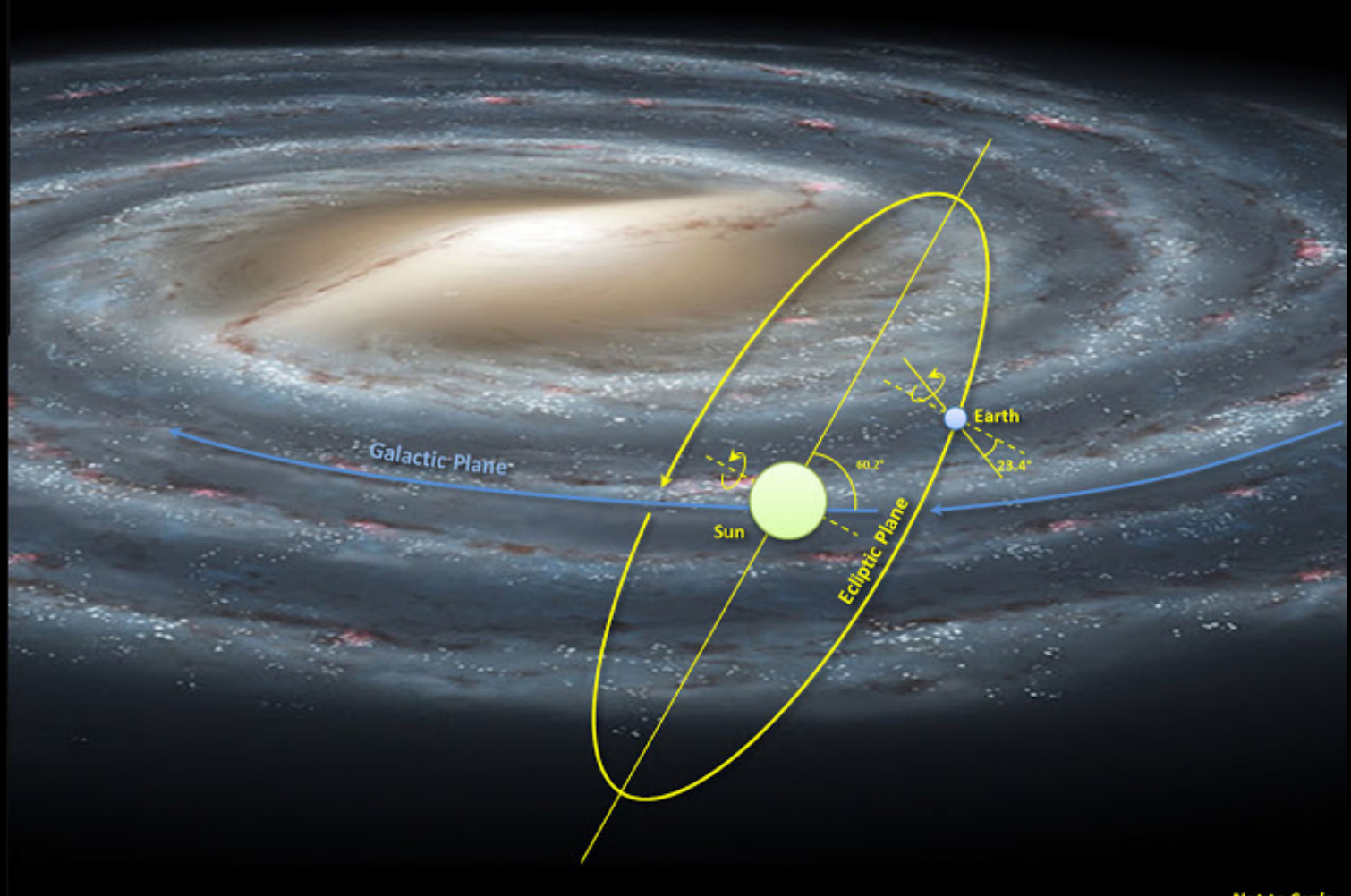
- Disk-shaped 100000 light years diameter *
- Type is a ‘Barred Spiral’
- Our solar system is in the ‘Orion Spur’, about 26 light years from center (~¼) *
- Rotates once every 200 million years
- Contains 200 to 400 billion stars
- Estimate at least one planet per star average (~ 3500 discovered so far)



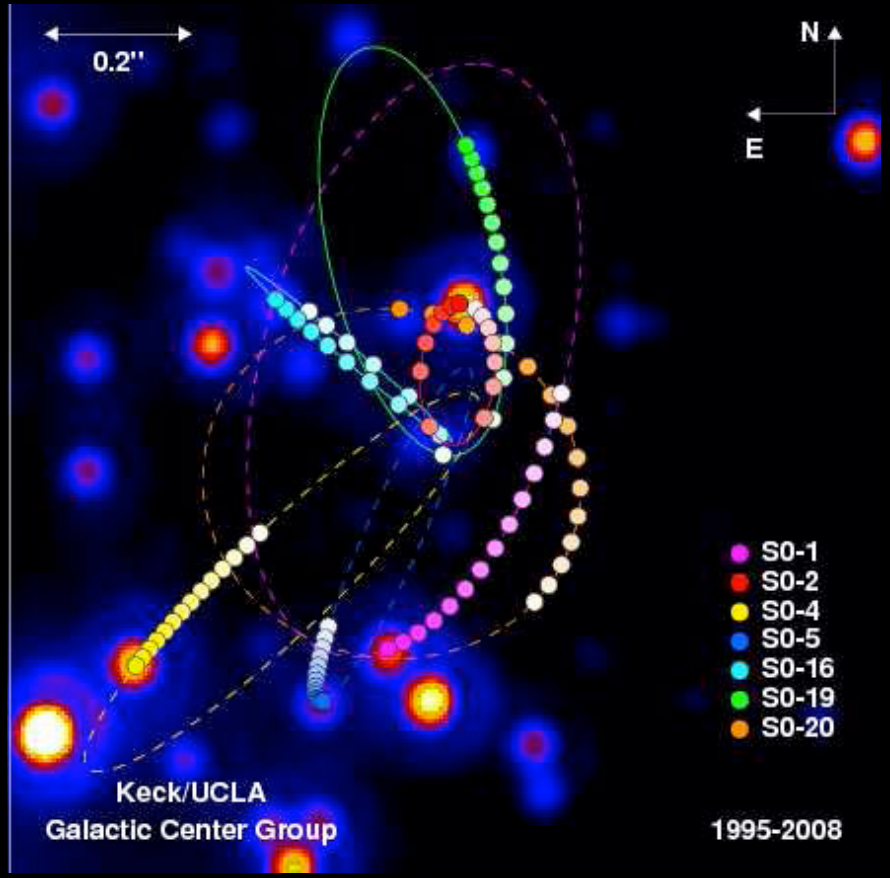

4Cas
ξCas
41And
ιCep
λCas
ζCas
νCas
Caph
6Cas
φAnd
9Cas
Schedar
ξAnd
ωAnd
οCep
10Cas
12Cas
ηCas
49And
μCas
θCas
κCas
υ1Cas
υ2Cas
Cepheus
Navi
Cassiopeia
51And
φCas
φPer
πCep
Ruchbah
2Per
3Per
32Cas
χCas
1Per
44Cas
31Cas
4Per
Errai
V762
ψCas
63And
64And
65And
εCas
38Cas
43Cas
53Cas
8Per
7Per
9Per
42Cas
ωCas
40Cas
48Cas
θPer
50Cas
11Per


Galactic Longitude
0°
30°
330°
60°
300°
90°
270°
120°
240°
150°
210°
180°
75,000 ly
60,000 ly
45,000 ly
30,000 ly
15,000 ly
Scutum-Centaurus Arm
Sagittarius Arm
Far 3kpc Arm
Galactic Bar
Norma Arm
Near 3kpc Arm
Long Bar
Outer Arm
Perseus Arm
Sun
Orion Spur

Motion of Earth and Sun around the Milky Way




πSgr
σ2Sgr
33Sgr
σSgr
28Sgr
50Sgr
ν2Sgr
ρSgr
14Sgr
11Sgr
4Sgr
24Sgr
9Sgr
χ3Sgr
χ1Sgr
ψSgr
Kaus Borealis
Nunki
φSgr
3Sgr
τSgr
Sagittarius
γ1Sgr
Media
Alnasl
Ascella
18Sgr
Kaus Australis
ηSgr



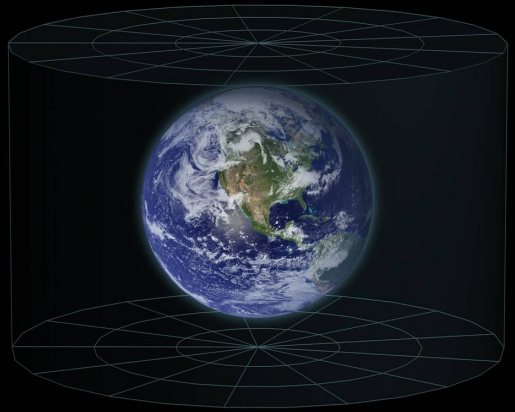
Sagittarius A*

- Super-massive black hole at the center of the Milky Way
- 44 million km diameter (~30x our Sun)
- 4 million solar masses
- 7 stars orbit this black hole

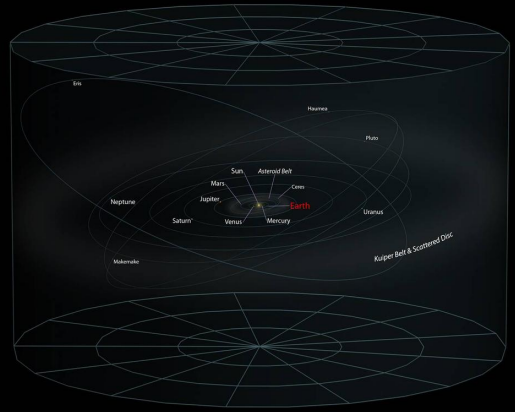
Celebrate the Wonder of the Night Sky!

Beyond

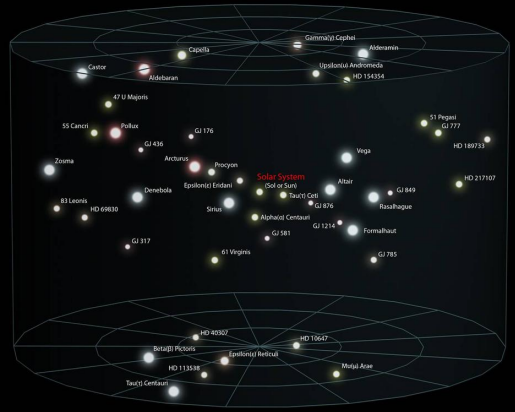
Earth



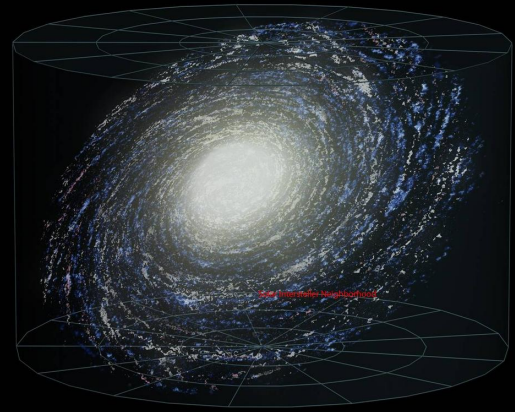
Solar System



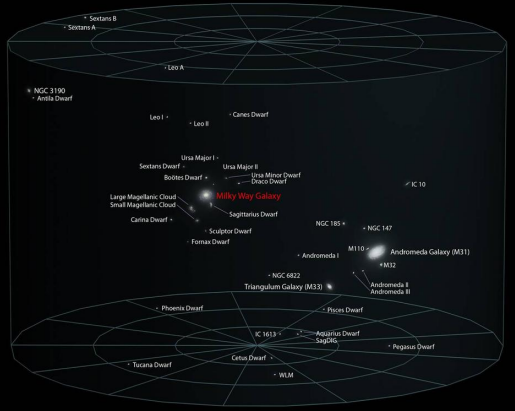
Solar Interstellar Neighborhood



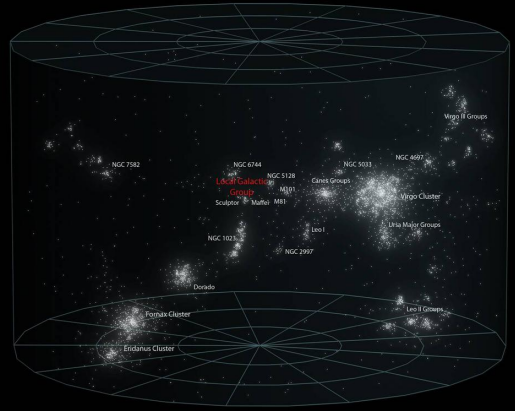
Milky Way Galaxy



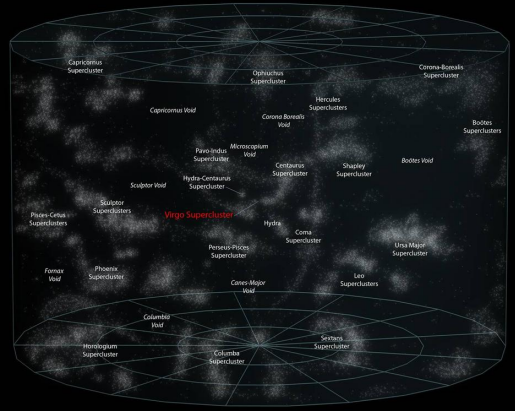
Local Galactic Group



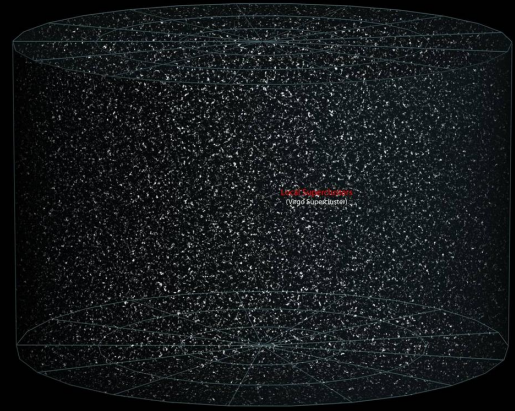
Virgo Supercluster



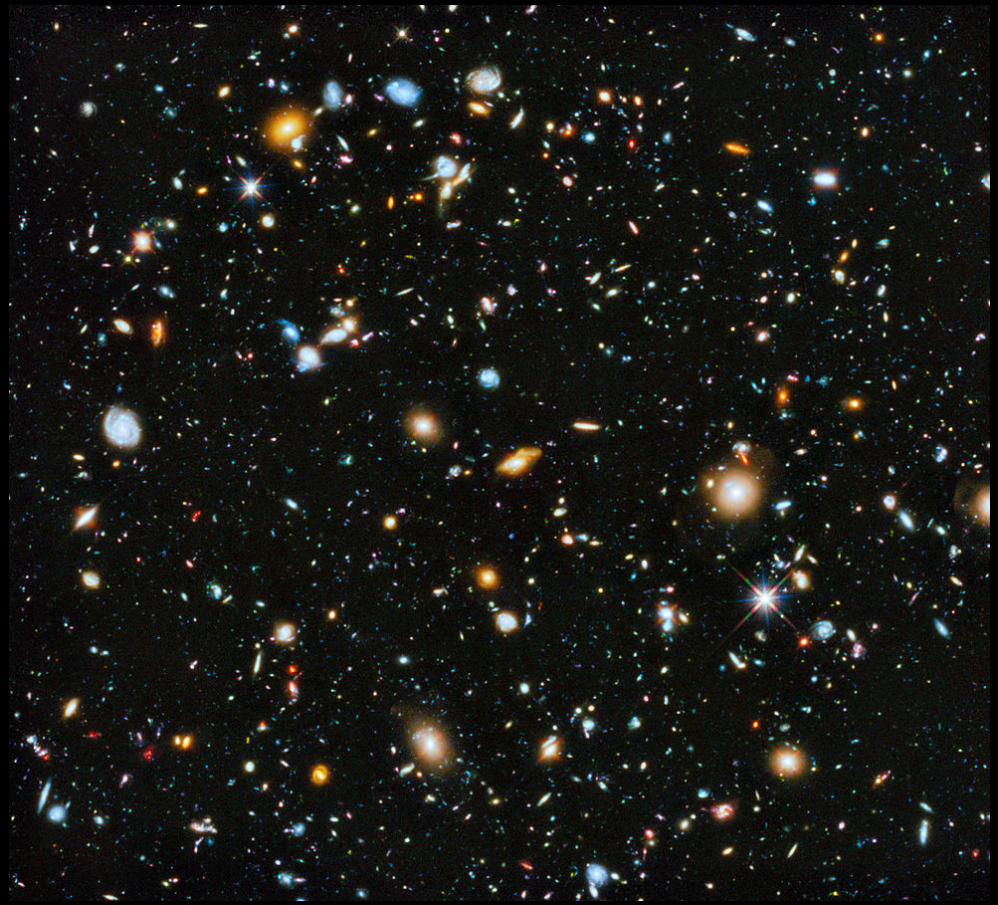
Local Superclusters



Observable Universe



Celebrate the Wonder of the Night Sky!



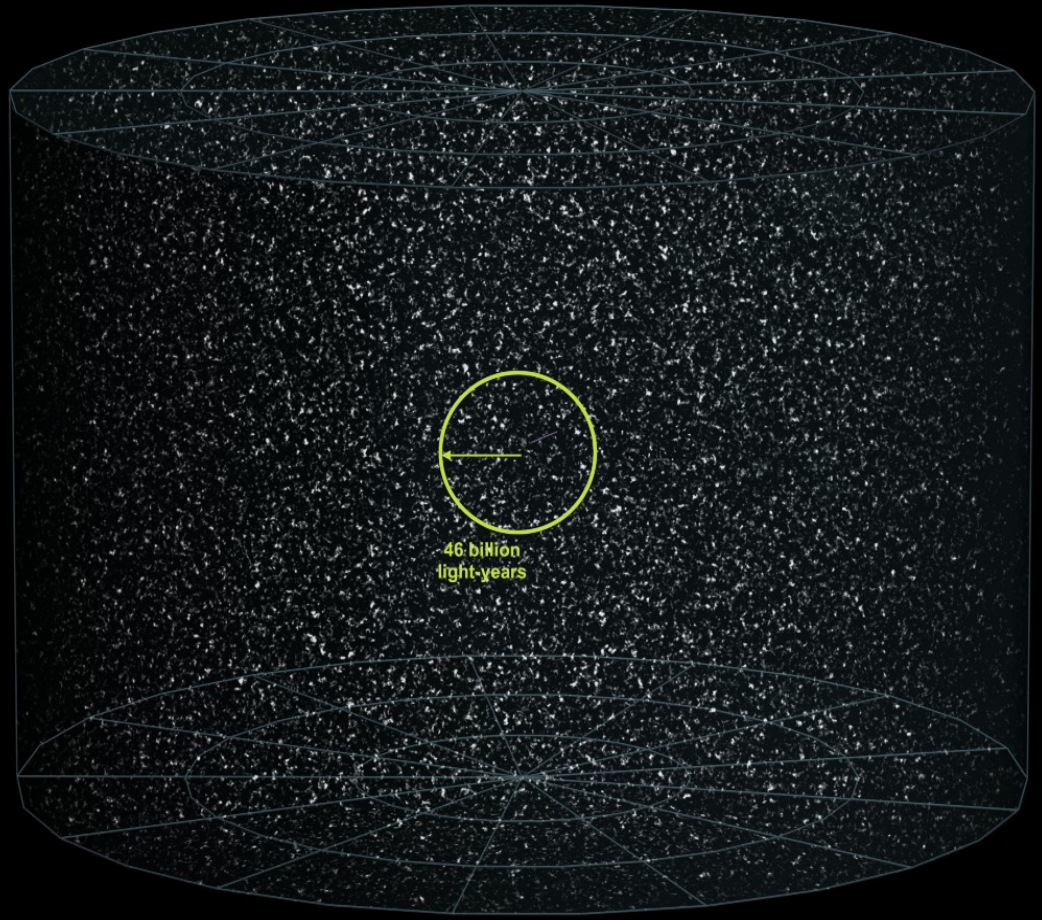
Hubble Ultra Deep Field (HUDF)

- Composite image from 2003-2013
- Tiny piece of dark sky 1/10th Moon diameter in Fornax constellation
- Contains 10000 galaxies!
- Contains galaxies that date back almost to the birth of the Universe!

Celebrate the Wonder of the Night Sky!

Observable Universe

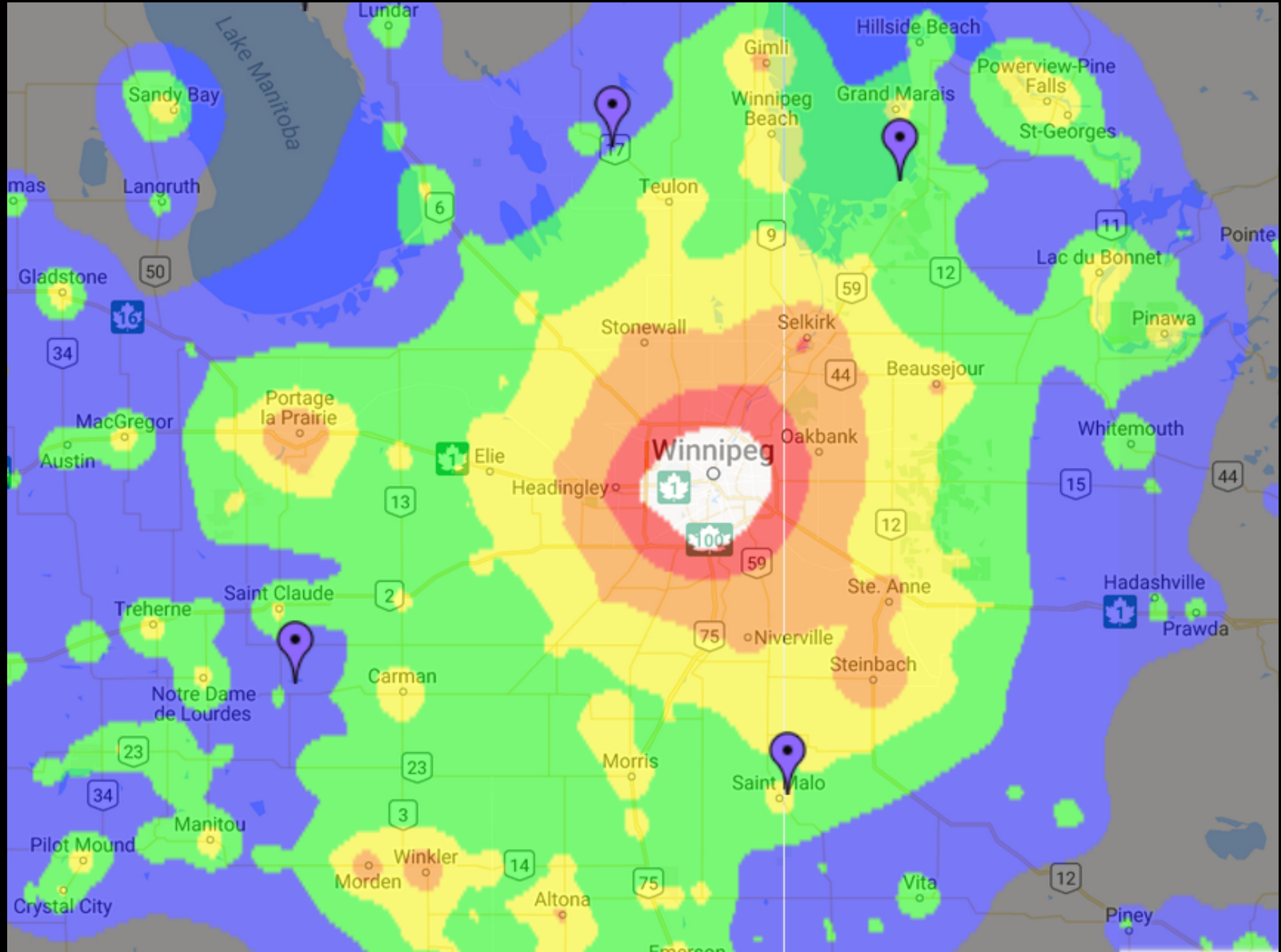
- 93 billion light years in diameter
- 2 trillion galaxies
- 700 sextillion (7×10^{23}) stars



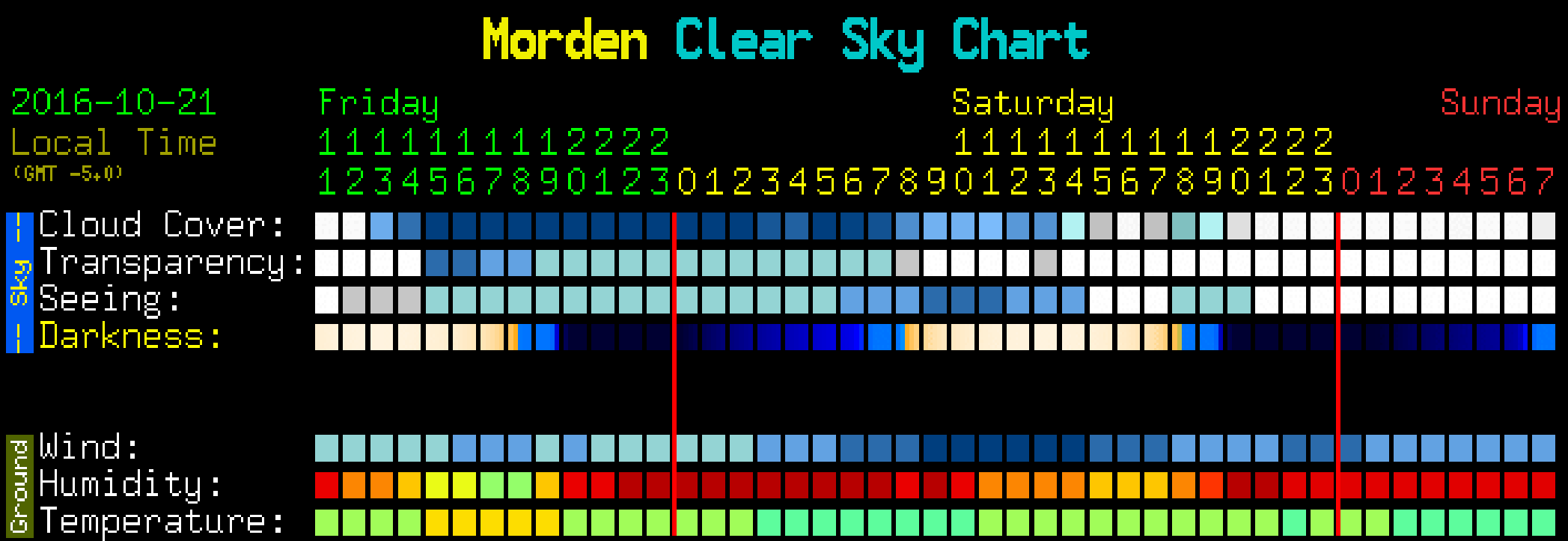
Celebrate the Wonder of the Night Sky!

Sky Conditions

Celebrate the Wonder of the Night Sky!


Lake Manitoba
Lundar
Hillside Beach
Gimli
Powerview-Pine Falls
Sandy Bay
Winnipeg Beach
Grand Marais
St-Georges
Langruth
Teulon
Pointe
Lac du Bonnet
Gladstone
Stonewall
Selkirk
Pinawa
Beausejour
Portage la Prairie
MacGregor
Austin
Oakbank
Whitemouth
Elie
Winnipeg
Headingley
Saint Claude
Ste. Anne
Hadashville
Treherne
Niverville
Prawda
Steinbach
Carman
Notre Dame de Lourdes
Morris
Saint Malo
Manitou
Pilot Mound
Winkler
Morden
Vita
Crystal City
Altona
Piney

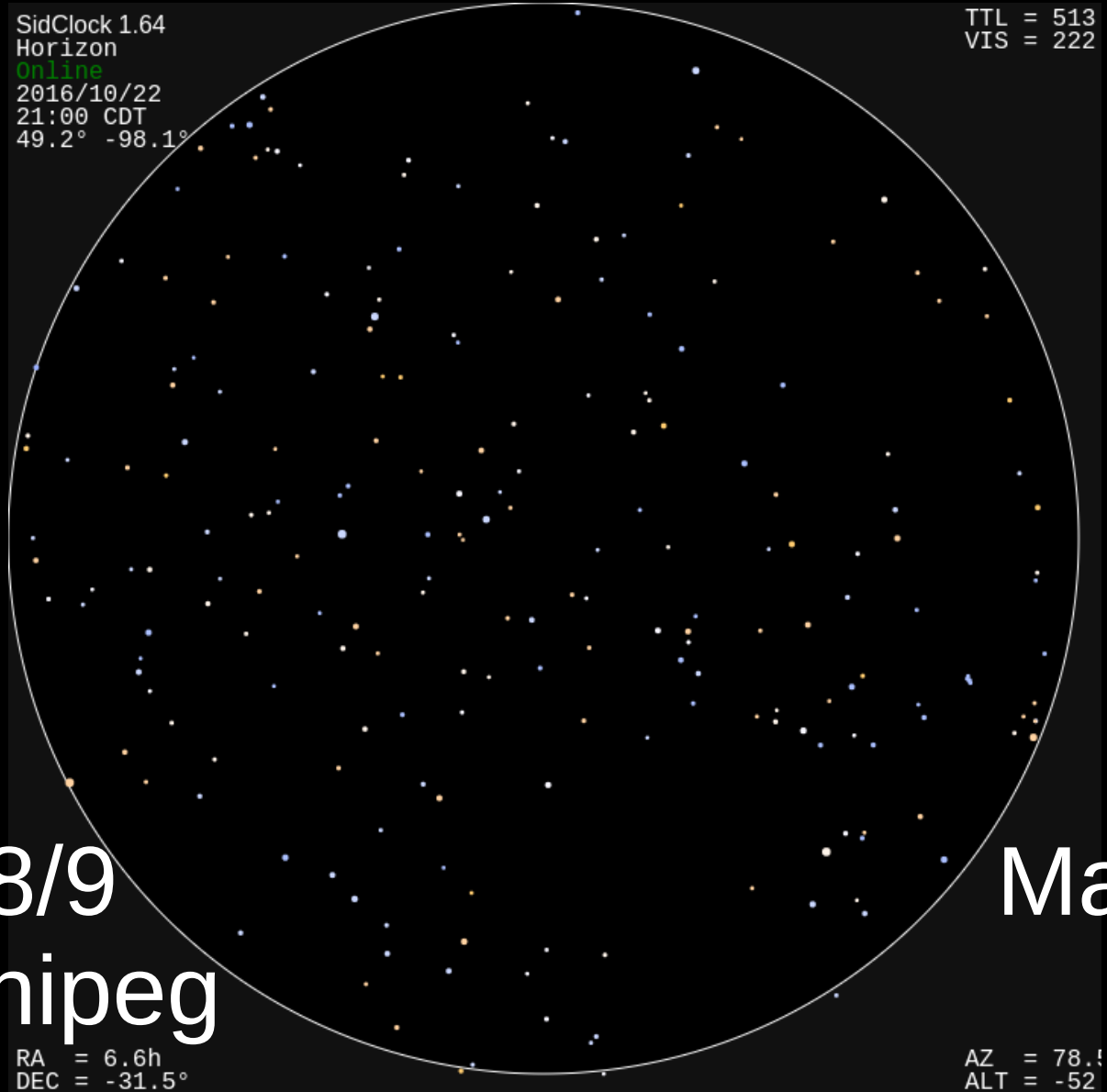
Celebrate the Wonder of the Night Sky!



 forecast: A.Rahill data: Environment Canada Environnement Canada

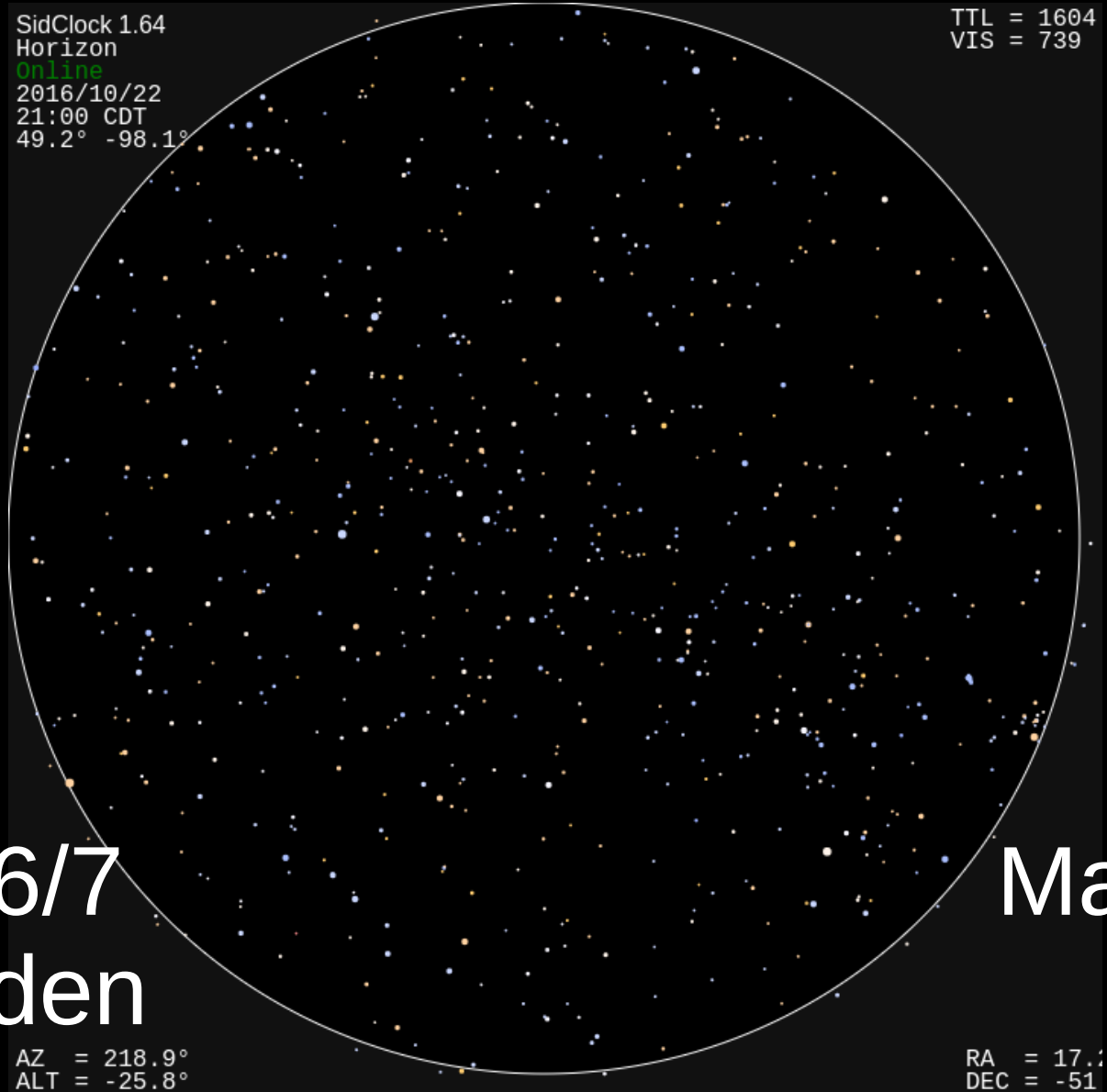
http://www.cleardarksky.com/c/MrdnMBkey.html


9
Inner City sky
7
Suburban/urban transition
5
Suburban sky
3
Rural sky
1
Excellent dark sky site
Rasalhague
Altair
IC 4665
Cebalrai
Sabik
Jupiter
Nunki
NGC 6530
Earth, York, 13m
FOV 60°
27.8 FPS
2008-09-24 20:20:54



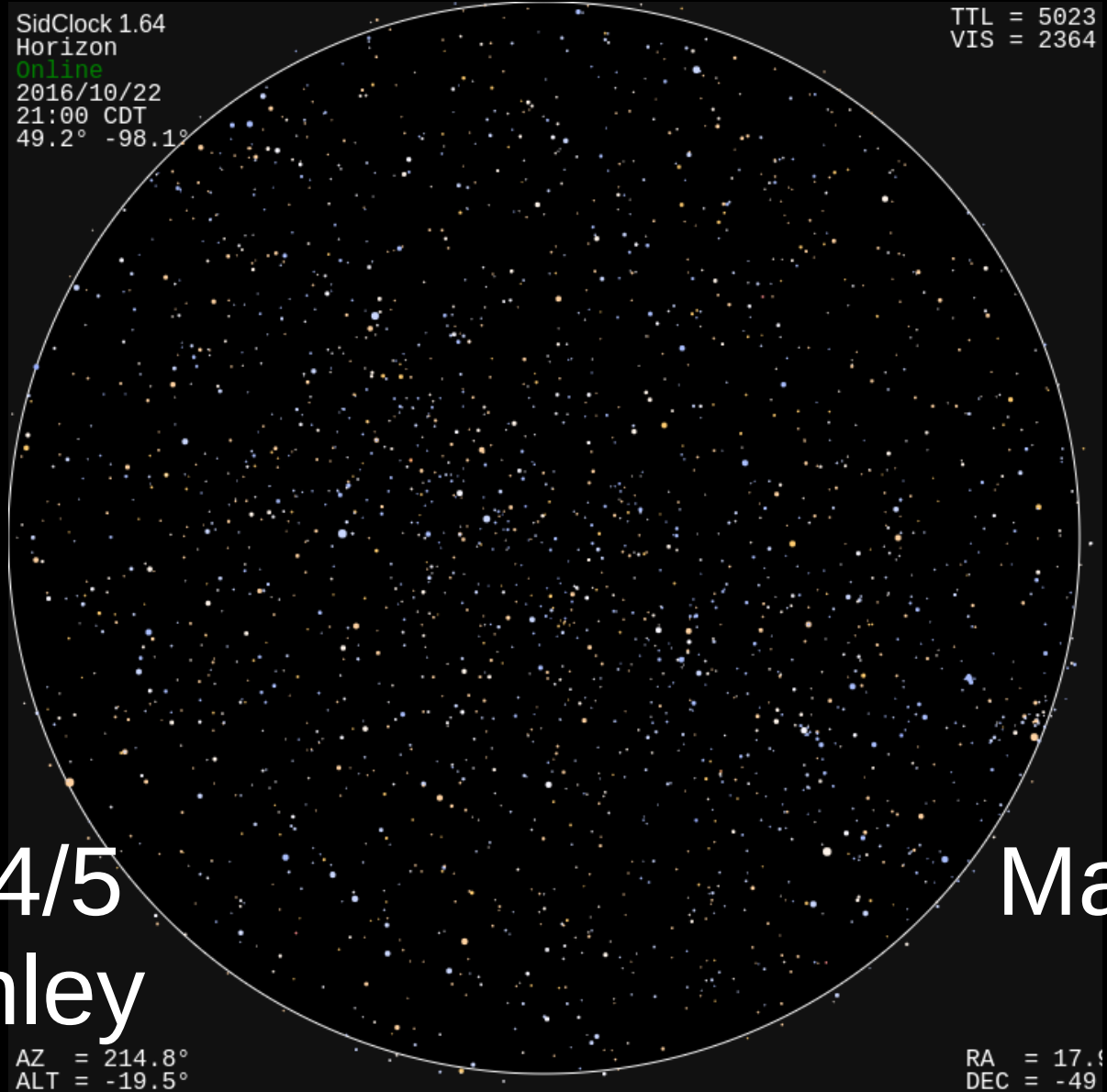
Bortle 8/9
e.g. Winnipeg

Magnitude
4



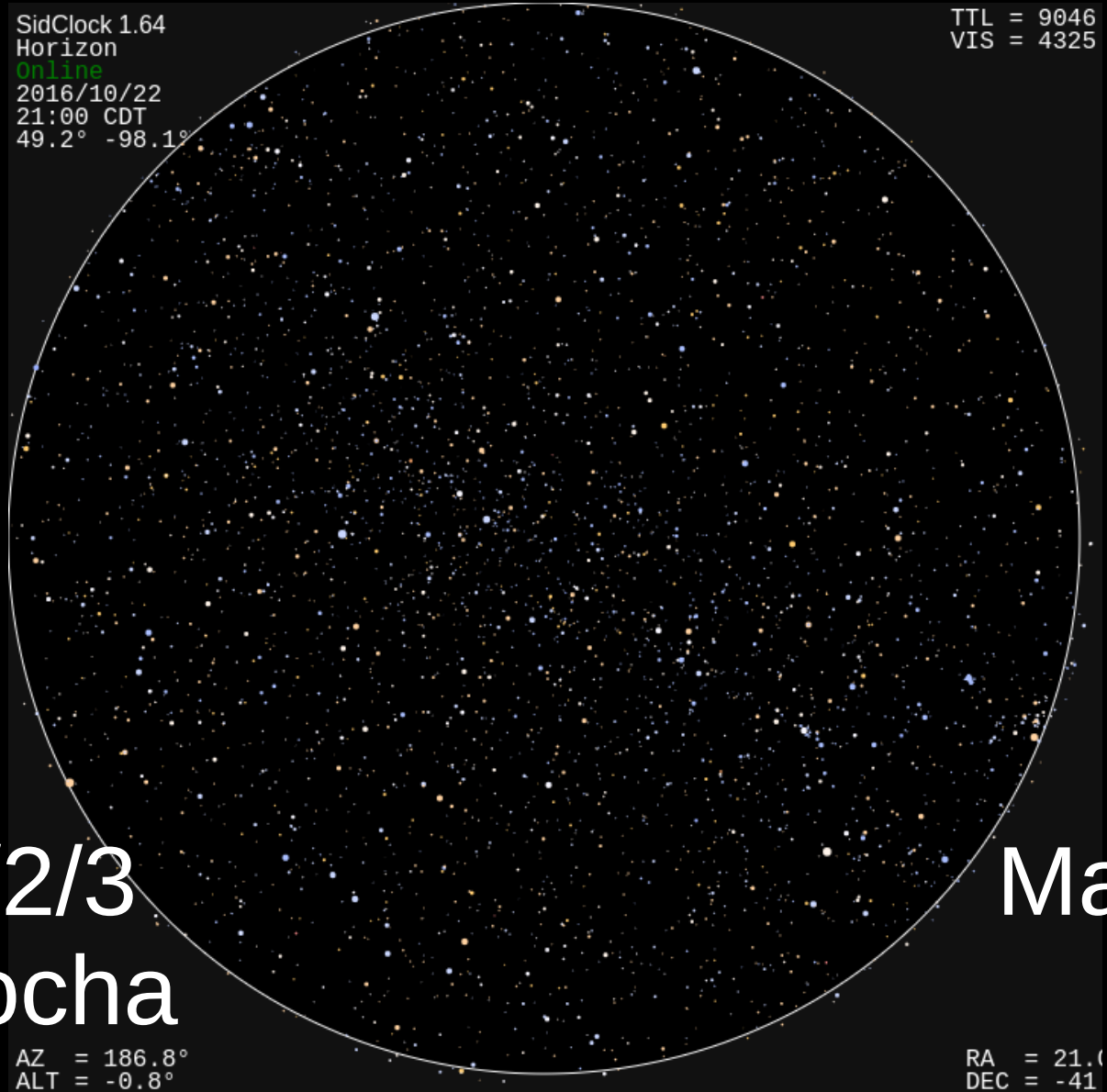
Bortle 5/6/7
e.g. Morden

Magnitude
5



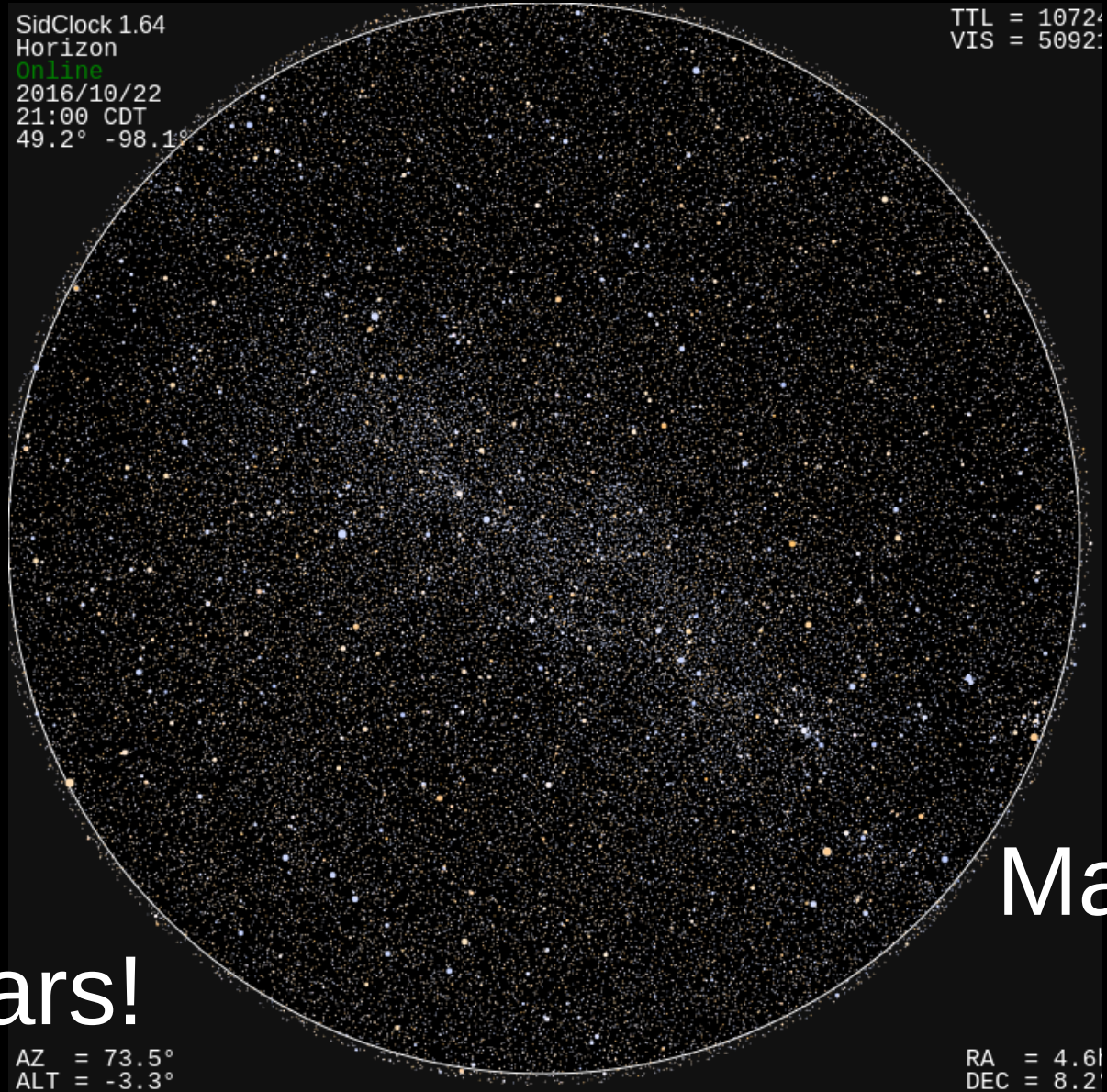
Bortle 3/4/5
e.g. Stanley

Magnitude
6



Bortle 1/2/3
e.g. A Rocha

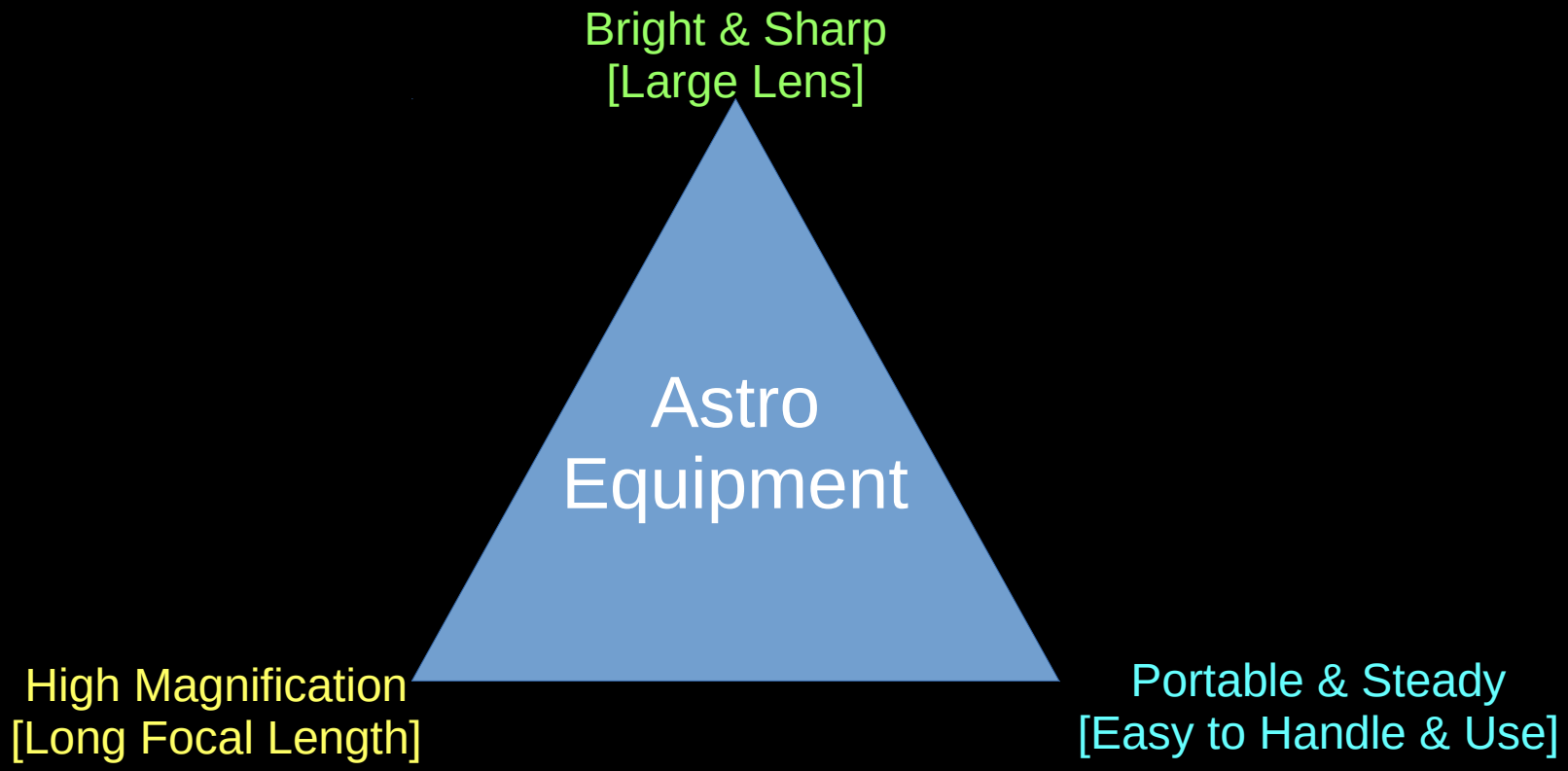
Magnitude
7



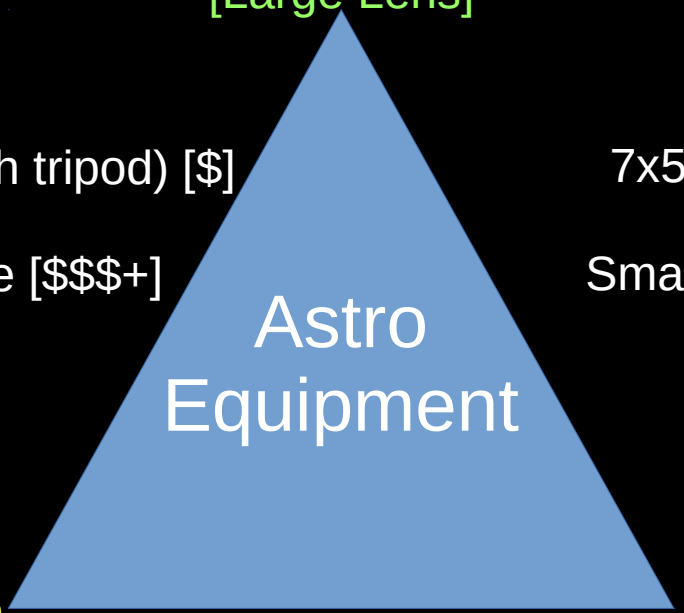
Binoculars!

Magnitude 10

Celebrate the Wonder of the Night Sky!



Celebrate the Wonder of the Night Sky!



Bright & Sharp
[Large Lens]

10x50/15x70 Binoculars (with tripod) [$]
or
Medium/Large Telescope [$$$+]

7x50 Binoculars [$]
or
Small Telescope [$$+]

High Magnification
[Long Focal Length]

Portable & Steady
[Easy to Handle & Use]

NOT A GOOD CHOICE!!!

Celebrate the Wonder of the Night Sky!

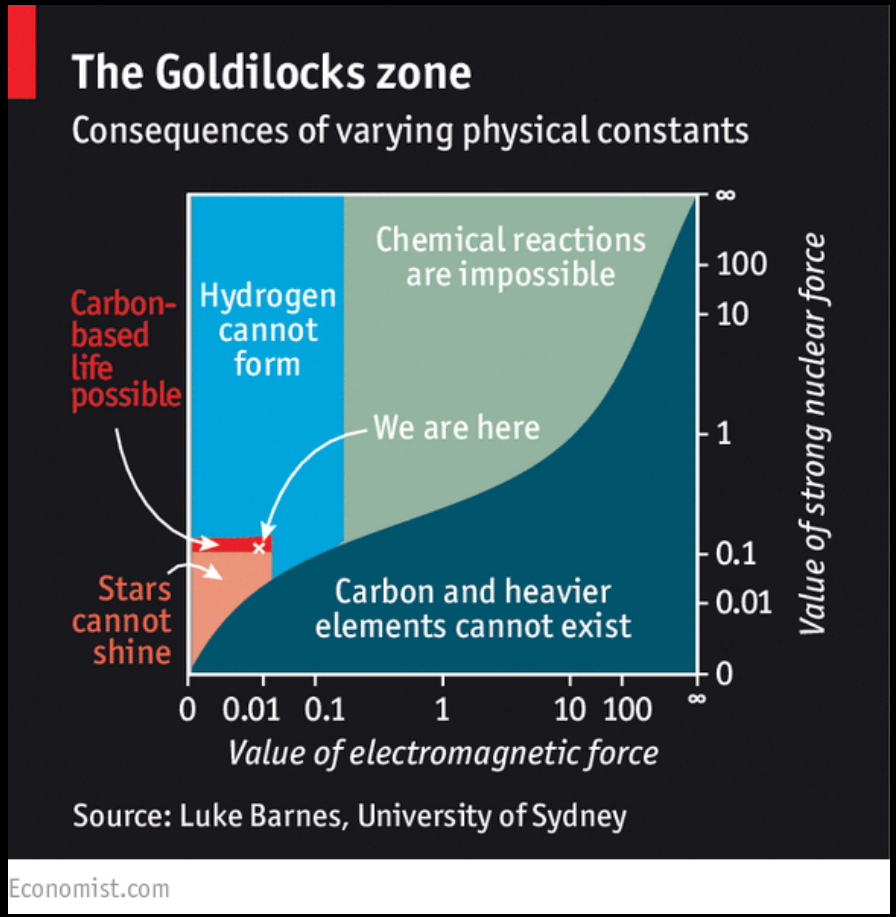
Astronomy Tips

- Learn some constellations/objects
- Find a safe dark location
- Check the weather ahead of time
- Dress appropriately
- Bring binoculars and flashlight
- Use paper or cell/tablet sky map
- Watch out for bugs
- Enjoy the experience!

Celebrate the Wonder of the Night Sky!

Closing

Celebrate the Wonder of the Night Sky!



Fine Tuning Example

- What if we tweaked just two of the fundamental constants? This figure shows what the universe would look like if the strength of the strong nuclear force and the value of the fine-structure constant were higher or lower than they are in this universe. The small, white sliver represents where life can use all the complexity of chemistry and the energy of stars. Within that region, the small “x” marks the spot where those constants are set in our own universe.

Celebrate the Wonder of the Night Sky!

"The extraordinary fine-tuning of the laws and constants of nature, their beauty, their discoverability, their intelligibility—all of this combines to make the God hypothesis the most reasonable choice we have. All other theories fall short."

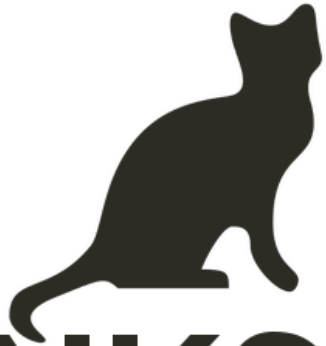
Robin Collins
Mathematics, Physics, and Philosophy

Celebrate the Wonder of the Night Sky!

The heavens proclaim the glory of God. The skies display his craftsmanship. Day after day they continue to speak; night after night they make him known. They speak without a sound or word; their voice is never heard. Yet their message has gone throughout the earth, and their words to all the world.
[Psalm 19:1-4 NLT]

Celebrate the Wonder of the Night Sky!

WEB	darethehair.duckdns.org
EMAIL	darethehair@gmail.com
YOUTUBE	darethehair1
TWITTER	@darethehair



THANKS FOR LISTENING!

IT'S

TIME FOR QUESTIONS!

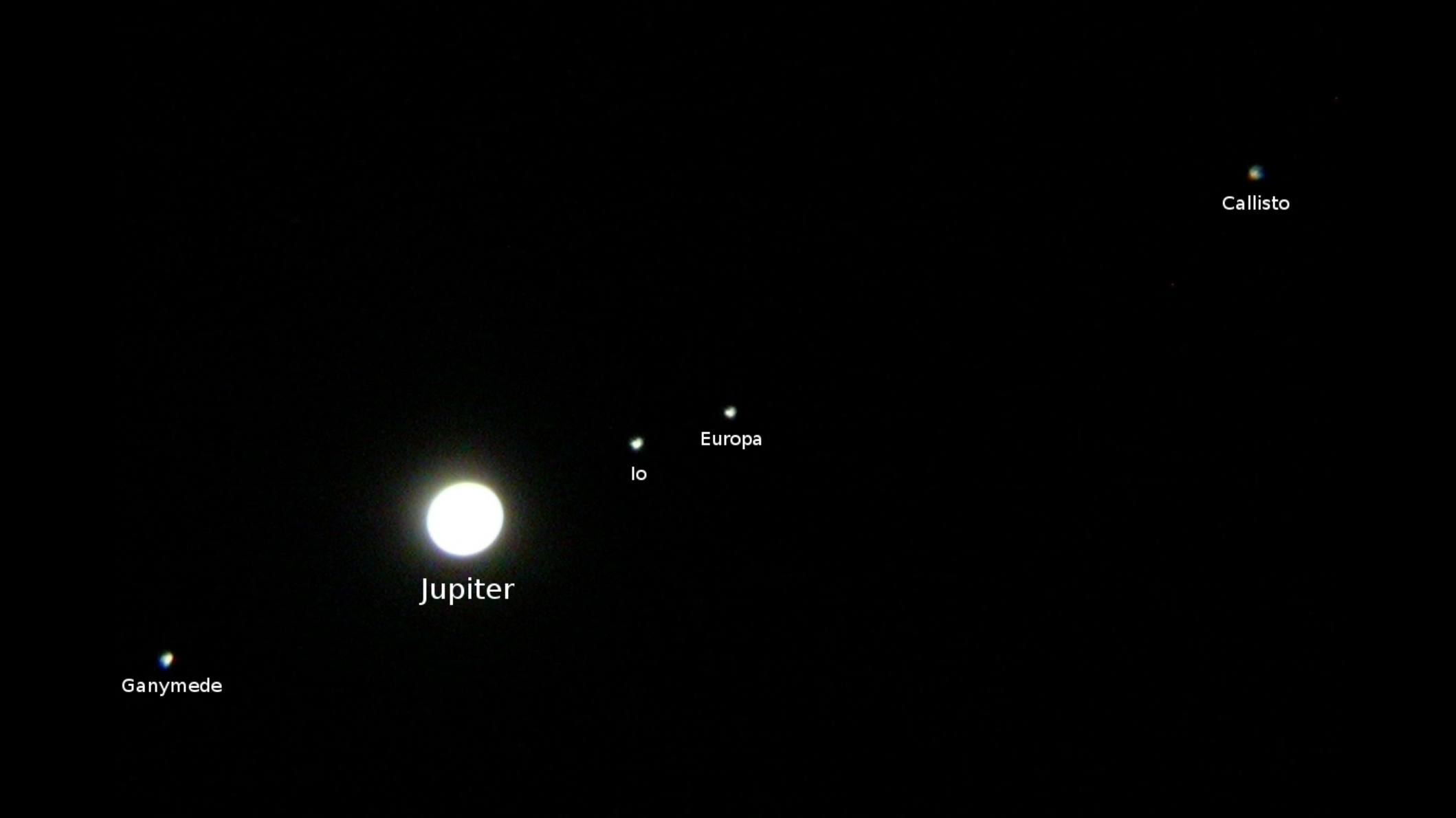
Celebrate the Wonder of the Night Sky!

Bonus

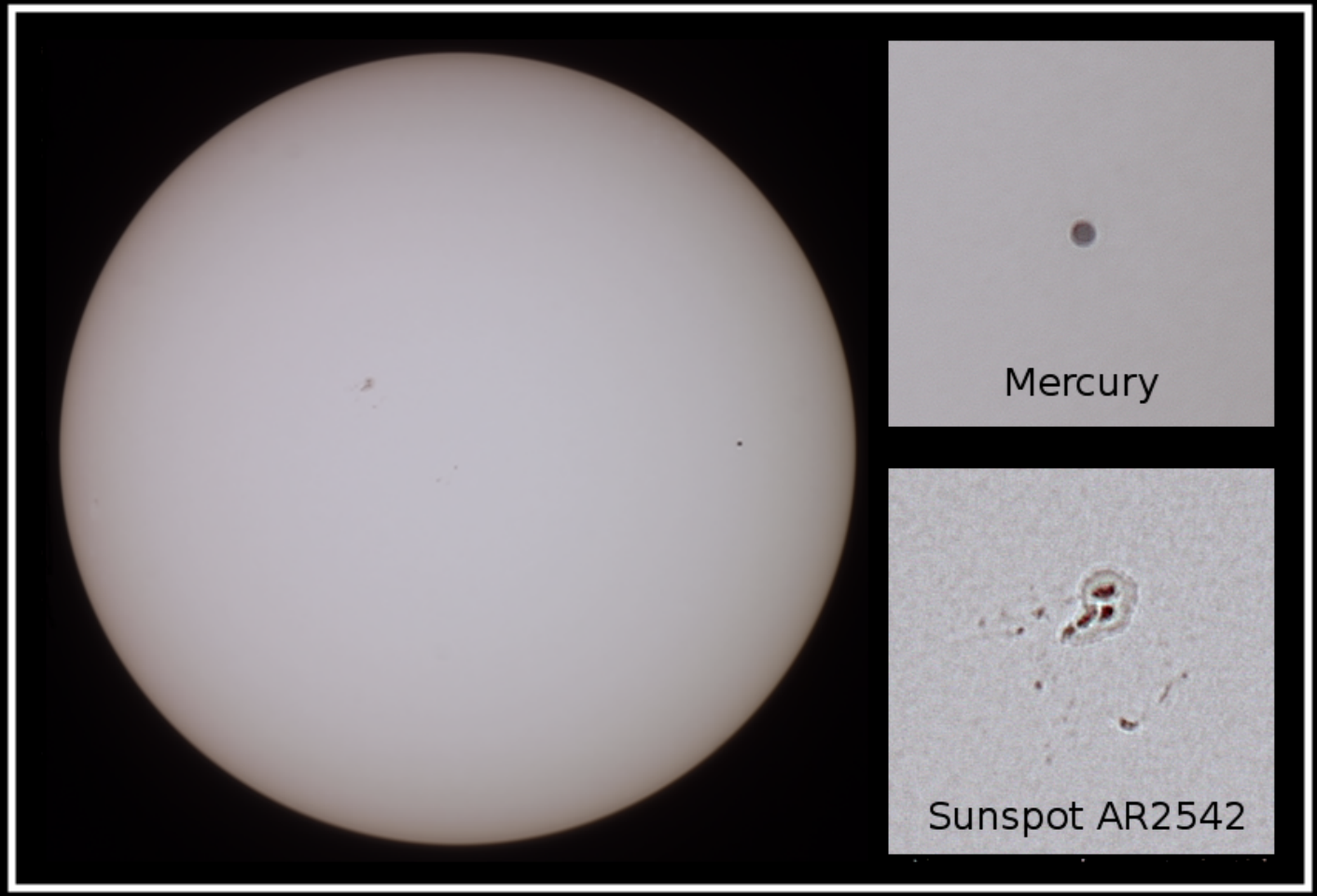
Celebrate the Wonder of the Night Sky!

"Astronomy leads us to an unique event, a universe which was created out of nothing and delicately balanced to provide exactly the conditions required to support life. In the absence of an absurdly-improbable accident, the observations of modern science seem to suggest an underlying, one might say, supernatural plan."

Arno Penzias
American physicist, radio astronomer and Nobel laureate in physics


Callisto
Europa
Io
Jupiter
Ganymede

Transit of Mercury
2016/05/09 Morden, Manitoba, Canada



Transit of Venus
Internal Ingress
June 5, 2012 17:21:41 CDT
Morden, Manitoba, Canada

Celebrate the Wonder of the Night Sky!

		
Mars Manual Bright Zoom 5/394 seconds F4.2 ISO100 20mm	Mars Manual Bright Zoom 5/394 seconds F4.2 ISO100 20mm	Mars ManuaMars Manual 1/99 seconds F4.2 ISO100 20mm

Celebrate the Wonder of the Night Sky!

Saturn 2032mm-1600iso-1/8s-f/14 before using Registax

Saturn 2032mm-1600iso-1/8s-f/14 before using Registax (1056 frames)

Celebrate the Wonder of the Night Sky!

Deep Sky

Orion Nebula (M42)
2015/10/22 Morden, Manitoba, Canada

Pleiades (M45)
2015/09/13 Morden, Manitoba, Canada

Andromeda Galaxy (M31)
2014/10/26 Morden, Manitoba, Canada

Celebrate the Wonder of the Night Sky!

Galaxies/Nebula/Star Cluster Catalogs

M (Messier): 103 (now 110) numbered objects by Charles Messier in 1760s to ignore while searching for comets

C (Caldwell): 109 numbered objects by Patrick Moore in 1995

NGC (New General Catalog): 7840 numbered objects by Royal Astronomical Society in 1888

IC (Index Catalogue): Added additional 5,286 galaxies, nebulae, and star clusters discovered between 1888 and 1907

Celebrate the Wonder of the Night Sky!

- Name: Andromeda Galaxy
- Messier: M31
- New General Catalog: NGC224

The Messier Objects