



The Celestial Sphere

Part 2

Daily, Seasonal and Annual Motions

Jim Johnson
HAL Virtual AstroSchool
April 28, 2020

Full-screen mode [F11]

Earth, +39°09'12", -77°04'31"

FOV 60°

60 FPS

2020-04-15 20:37:51 UTC-04:00



Part 1 Topics

Celestial Sphere as the Apparent (2D) Universe vs
the Actual (3D) Universe

Angular measurements on the Celestial Sphere

Definitions of Important Points and Circles on the
Celestial Sphere

Celestial Coordinate Systems

Motions of the Celestial Sphere

Diurnal (Day/Night)

Related to the Earth's daily rotation about its axis

At the sidereal rate of rotation, the duration of a Ra/Dec point from meridian to meridian is 23h 56m 4.09s

Seasonal

Related to the tilt of the Earth's axis relative to its orbital plane

About 3 months in duration (Mar, Jun, Sep, Dec)

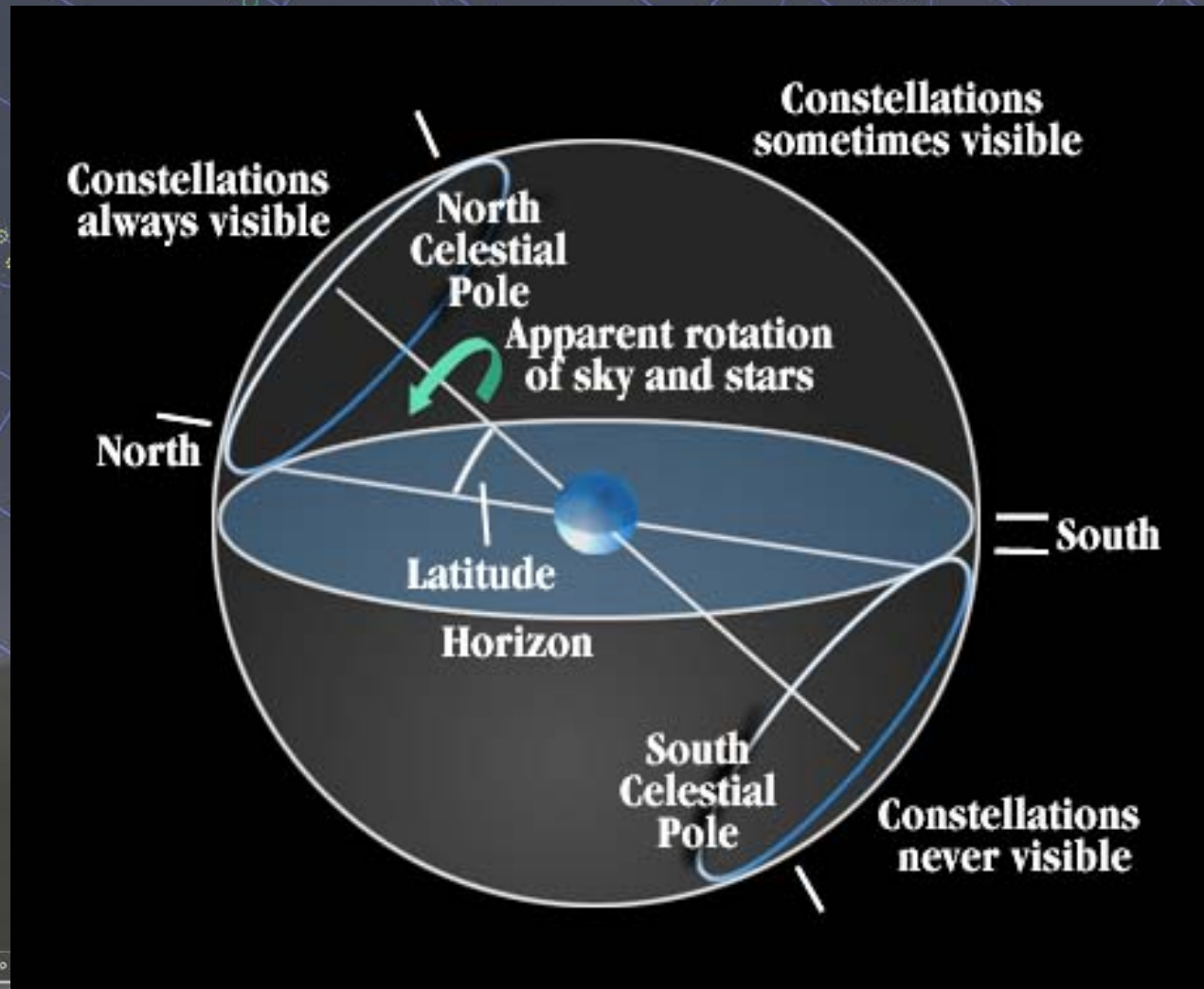
Annual

Related to Earth's annual orbit about the Sun

Due to Earth's movement along its orbital path, it takes an extra 4 minutes for the Sun to transit the meridian

The cumulative effect of the 4-minute intervals^{SW} over the course of a year is for the stars present in the night sky to make one complete rotation

Diurnal Motion



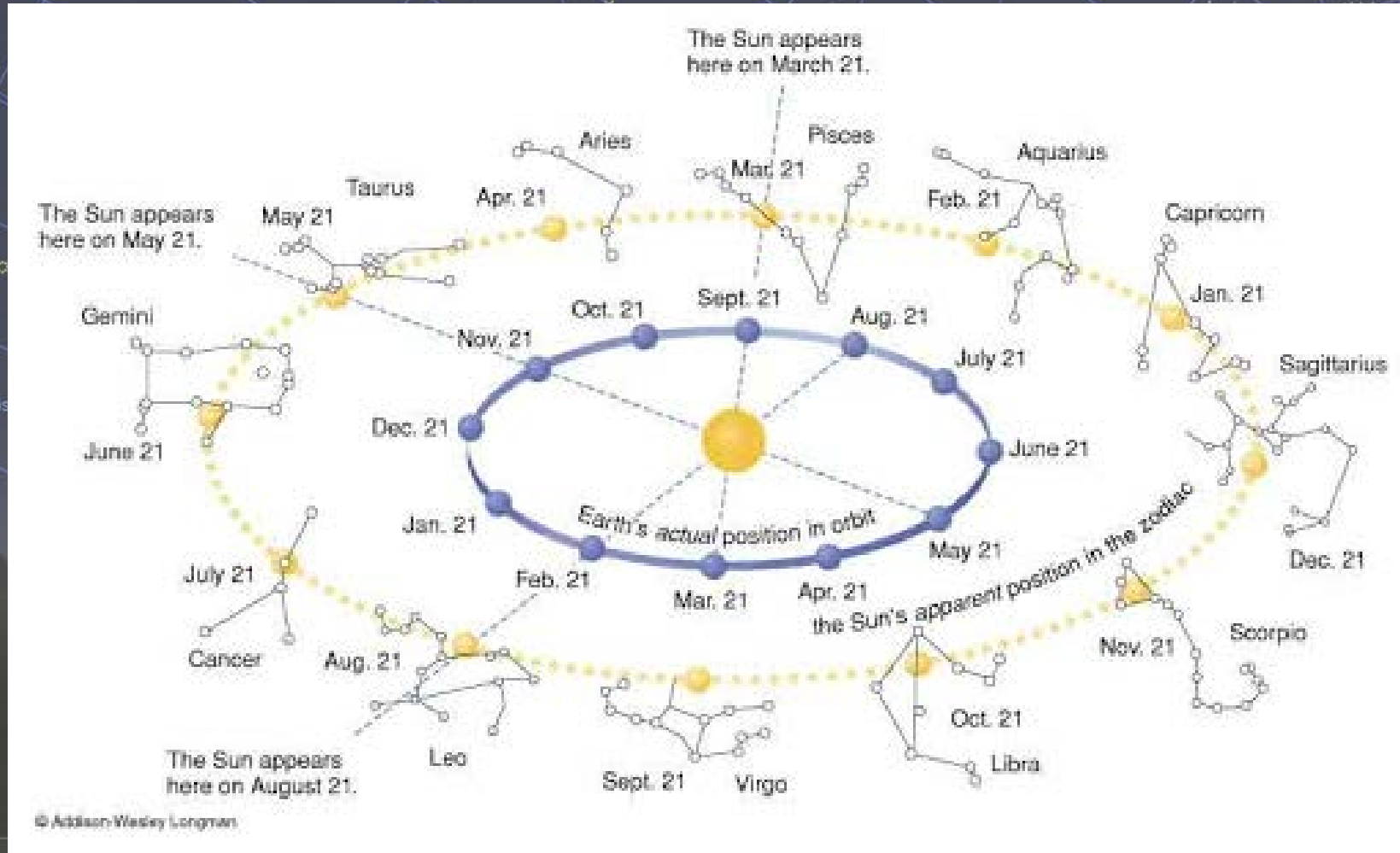
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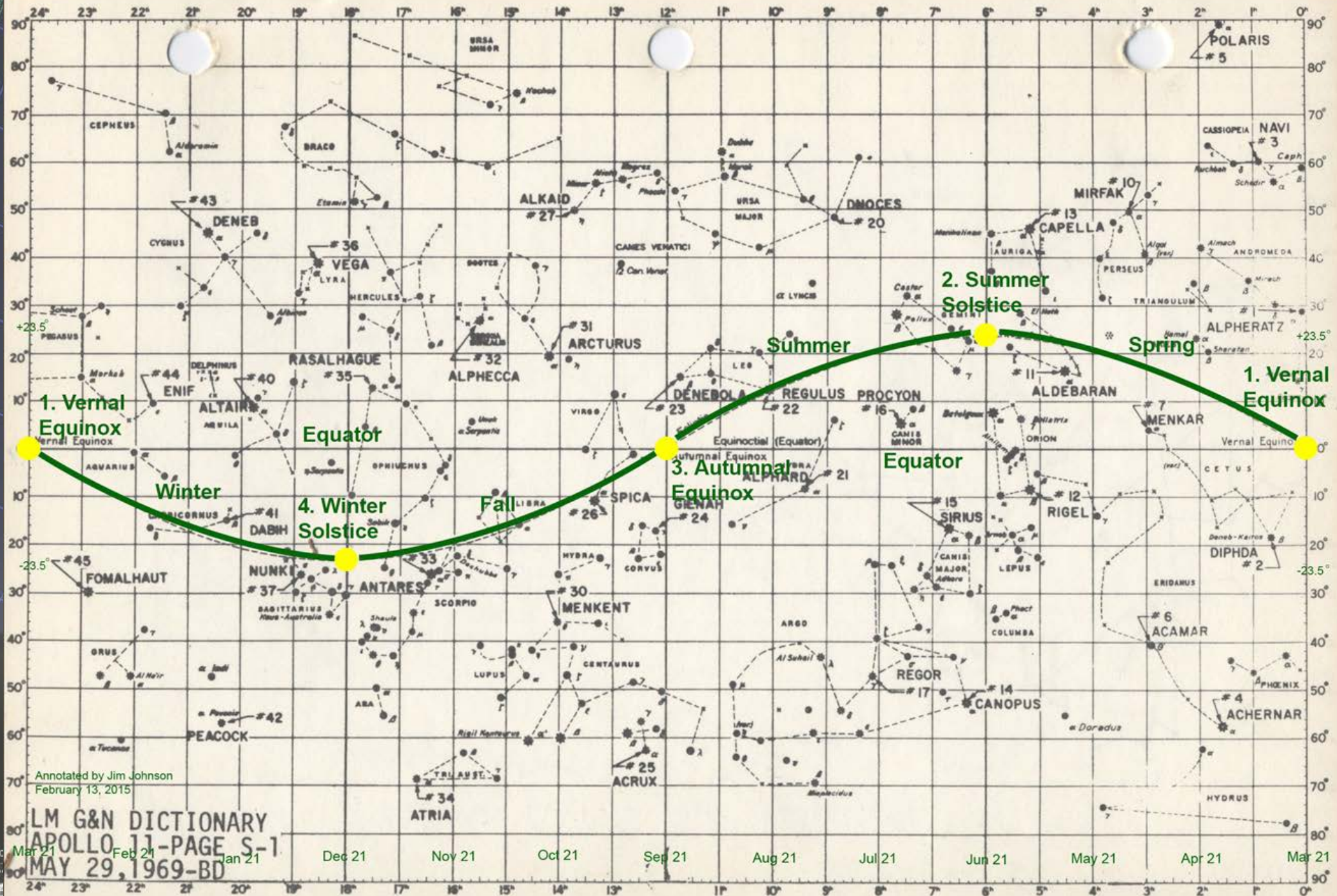
Earth, +39°09'12", -77°04'31"

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Annual Motion





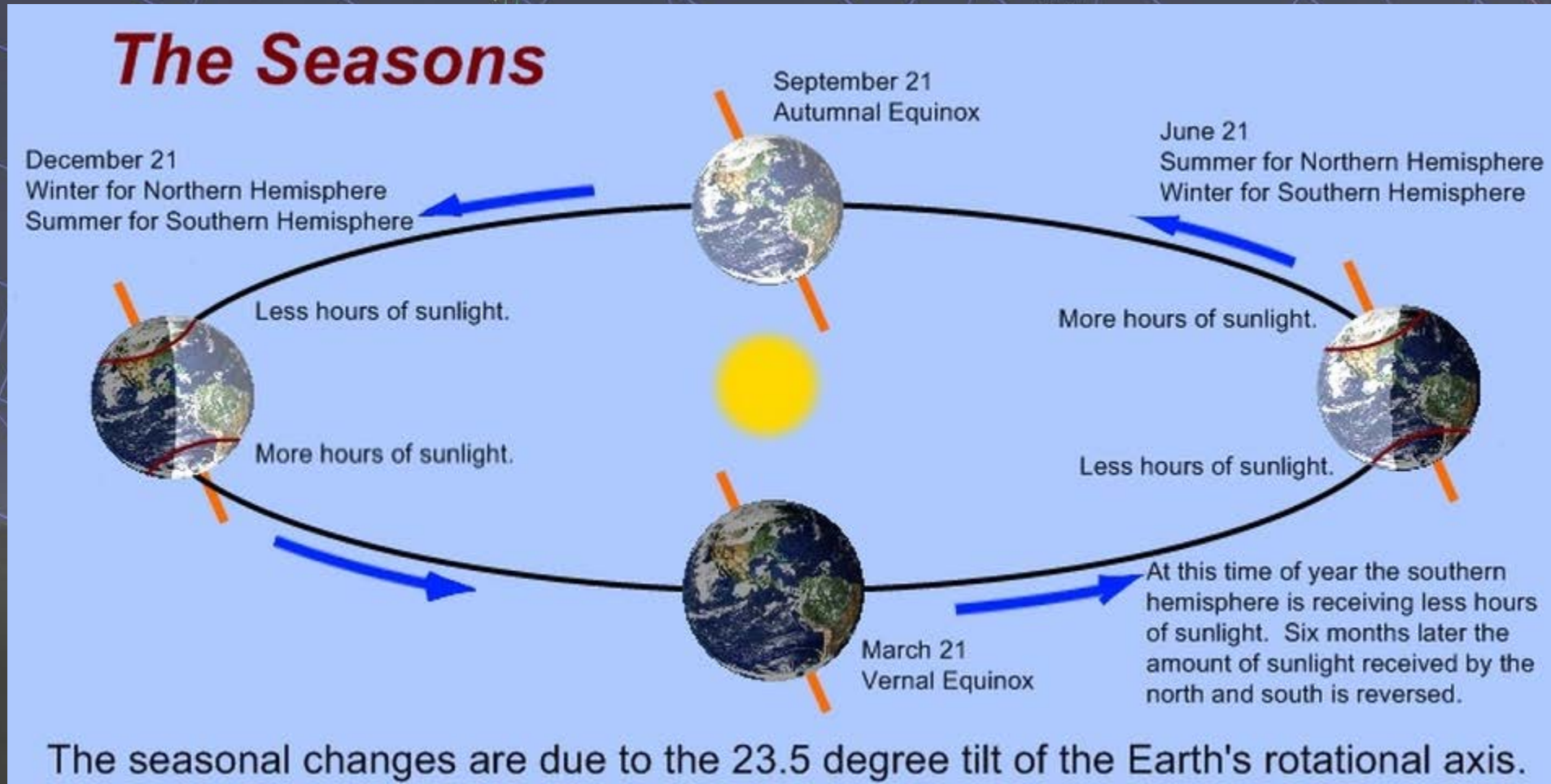
Annotated by Jim Johnson
February 13, 2015

LM G&N DICTIONARY
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Mar 21 Feb 21 Jan 21 Dec 21 Nov 21 Oct 21 Sep 21 Aug 21 Jul 21 Jun 21 May 21 Apr 21 Mar 21

Full-screen mode
Earth, +39°09'12"

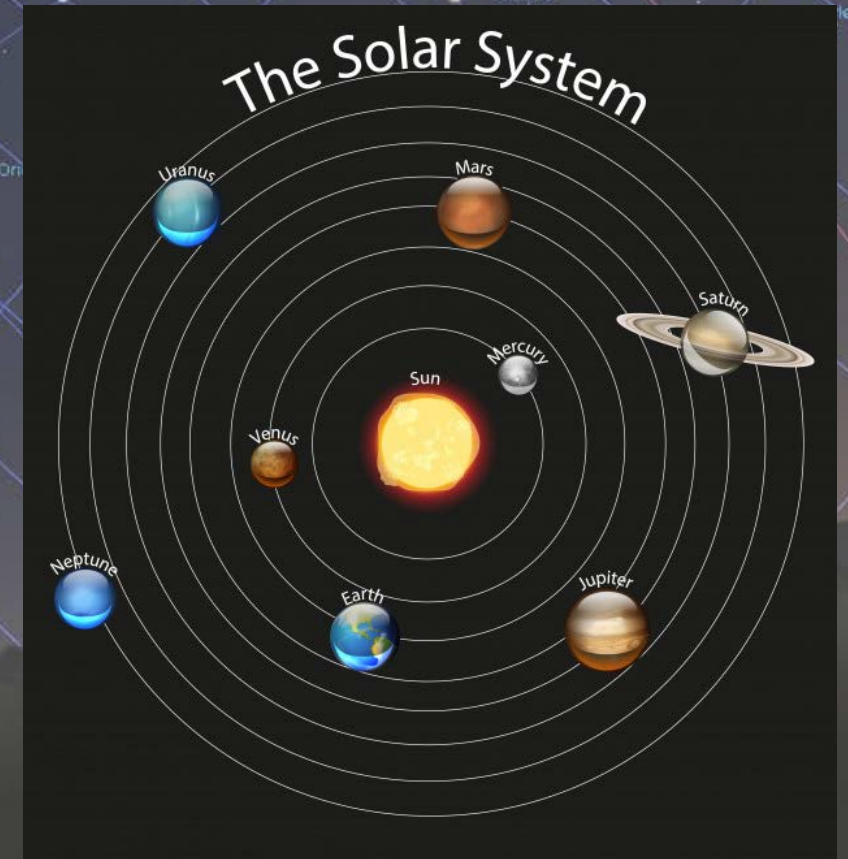
Seasonal Motion



Important Concept – Round and Flat Circles

Consider a solar system schematic, which is often presented in printed material with the Sun at the center with planets' orbits represented by concentric circles. This represents a top down, or face-on view.

Take the printed sheet and view it edge on, and the circles collapse into lines.



Sun, Moon, and Planets - Generally

The Sun and the Ecliptic

A circle on the celestial sphere that marks the Sun's annual path among the fixed stars. The Sun will always be on the ecliptic

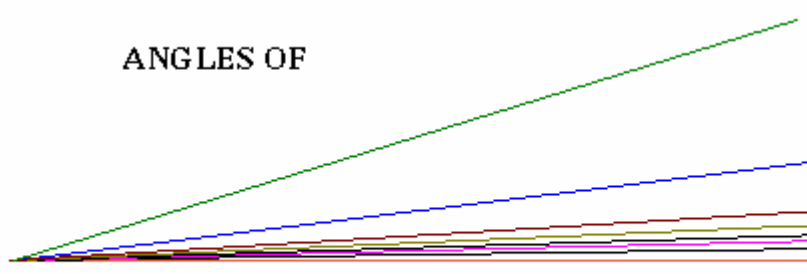
Conversely, it marks the Earth's orbital plane on the celestial sphere

The Moon and the major planets

These orbital planes are at various inclinations relative to Earth's orbital plane

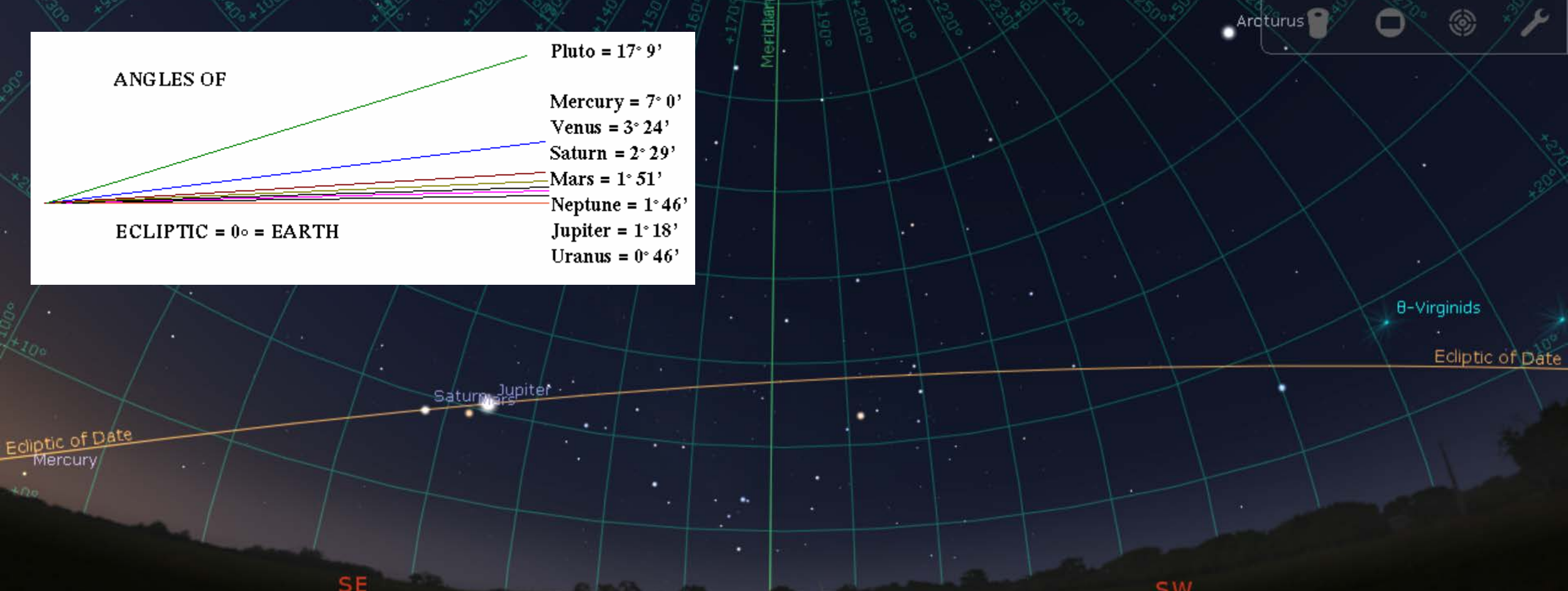
The inclination a body's orbital plane determines the maximum distance, in degrees, that the body can vary north or south from the ecliptic

ANGLES OF



ECLIPTIC = 0° = EARTH

- Pluto = 17° 9'
- Mercury = 7° 0'
- Venus = 3° 24'
- Saturn = 2° 29'
- Mars = 1° 51'
- Neptune = 1° 46'
- Jupiter = 1° 18'
- Uranus = 0° 46'



SE

S

SW

Date and Time X

Date and Time				Julian Day					
2020	-	3	-	24	6	:	16	:	58

Parting Words

Both the celestial sphere and planetarium apps are tools in the astronomer's tool kit. Just like all of the other tools, one must have a thorough understanding of how they work in order to use them effectively. Moreover, repetition and frequency of use are the best ways to build this understanding. Being able to use tools effectively will ease frustration and increase one's enjoyment of our hobby.

Clear skies!
Jim Johnson

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Questions?

