The Celestial Sphere

Part 1

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HAL Monthly Meeting

April 16, 2020

Topics

Introduction, Approach and Scope

Celestial Sphere as the Apparent Universe vs the Actual Universe

Measurements on the Celestial Sphere

Definitions of Important Points and Circles on the Celestial Sphere

Celestial Coordinate Systems

Introduction, Approach and Scope

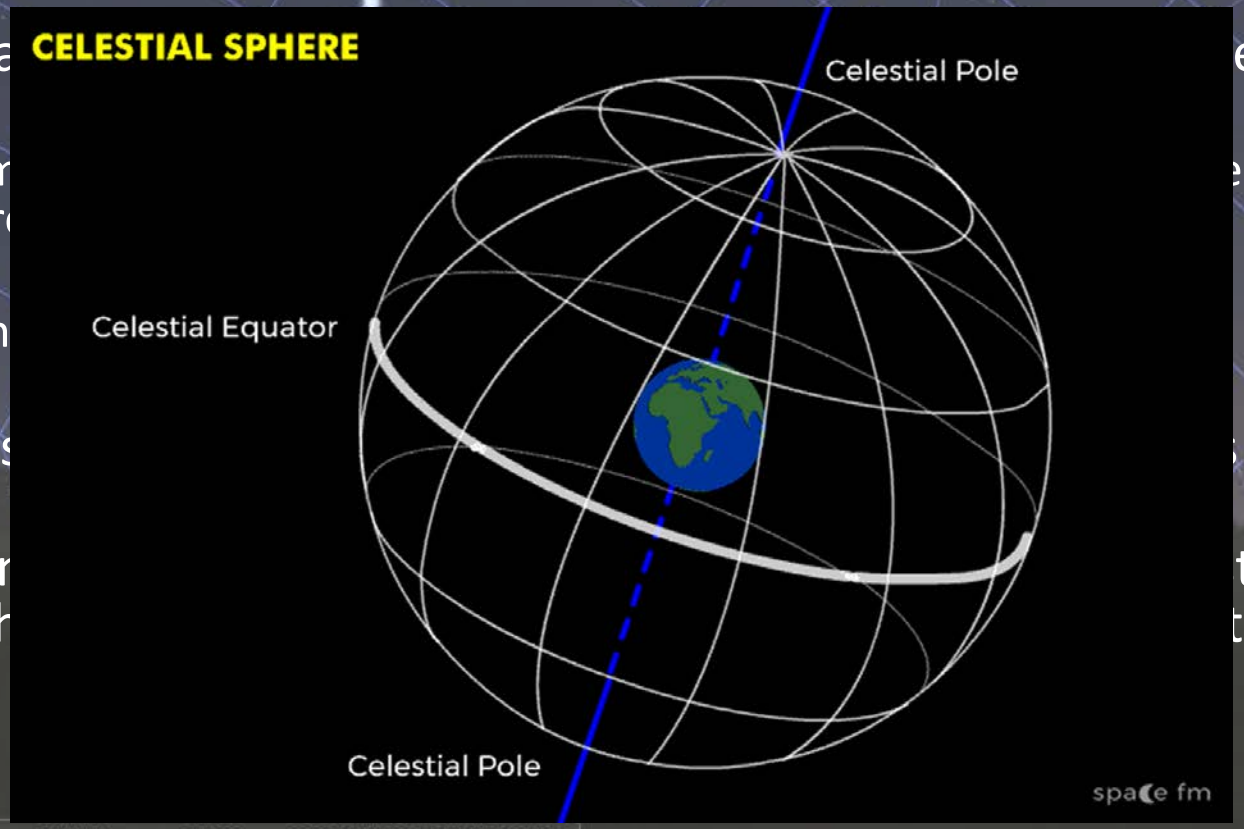
Visualization – imagine a globe of the Earth a larger, clear sphere with stars and constellations

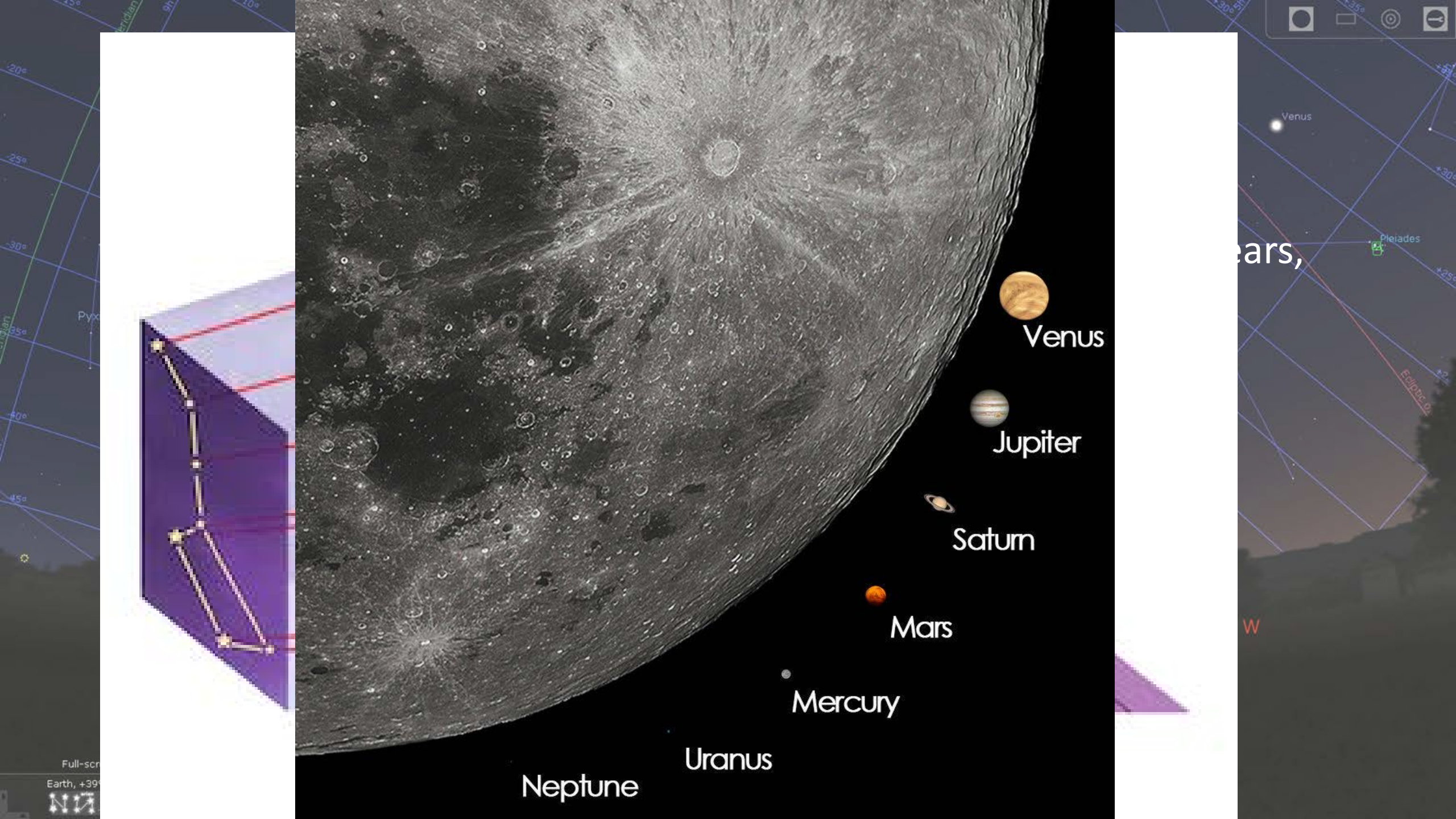
It is critical that a e it:

- Provides a com es of objects on the celestial spher
- Enables astron date or time

Stellarium is a vis

This presentatior tial sphere. The movements of th ts are a complex topic for another day.




Venus
Jupiter
Saturn
Mars
Mercury
Uranus
Neptune

Measurements on the Celestial Sphere

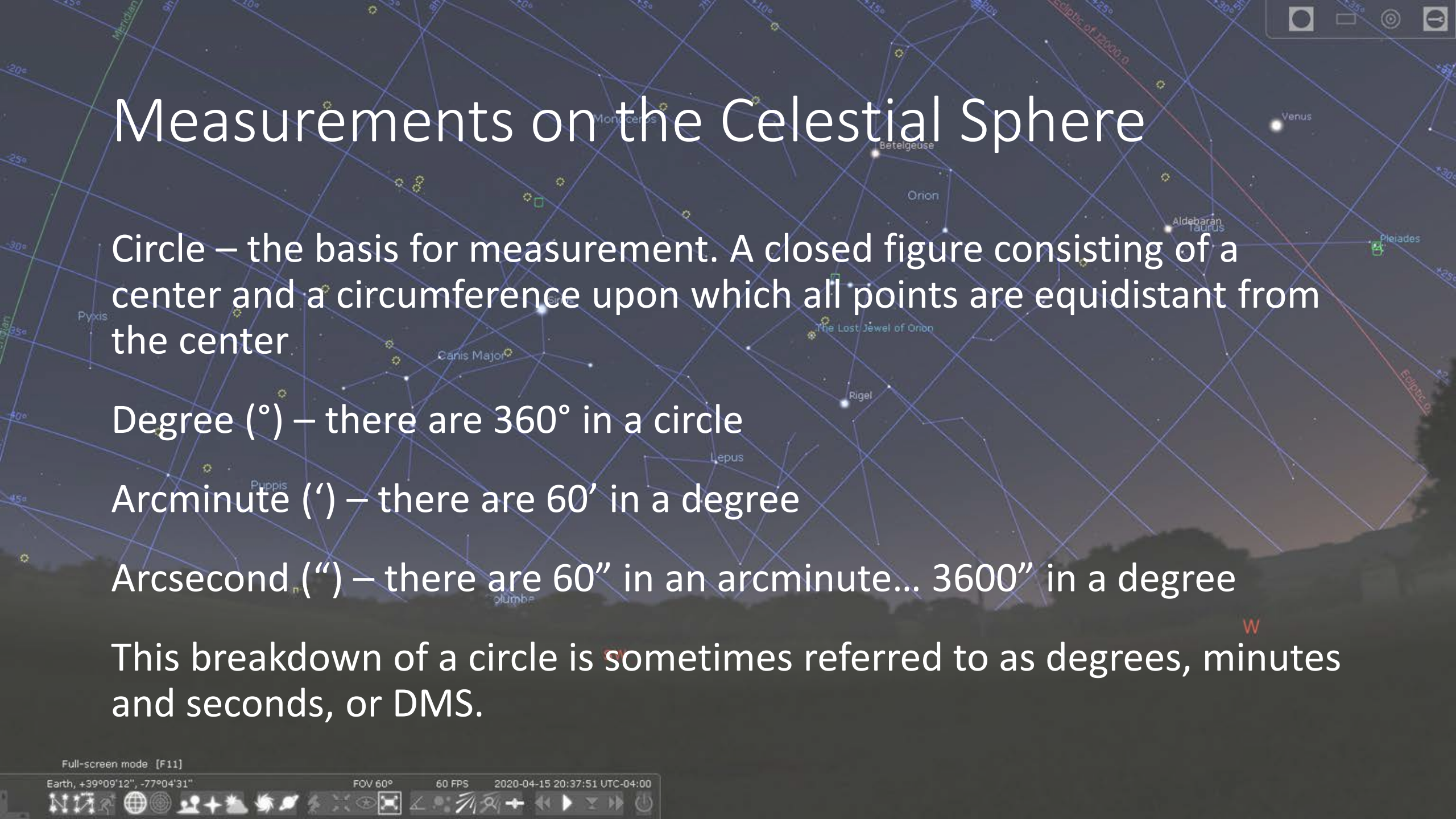
Circle – the basis for measurement. A closed figure consisting of a center and a circumference upon which all points are equidistant from the center

Degree (°) – there are 360° in a circle

Arcminute (‘) – there are 60’ in a degree

Arcsecond (“) – there are 60” in an arcminute… 3600” in a degree

This breakdown of a circle is sometimes referred to as degrees, minutes and seconds, or DMS.



Definitions of Important Points and Circles

Horizon – the circle between the sky above and the ground below

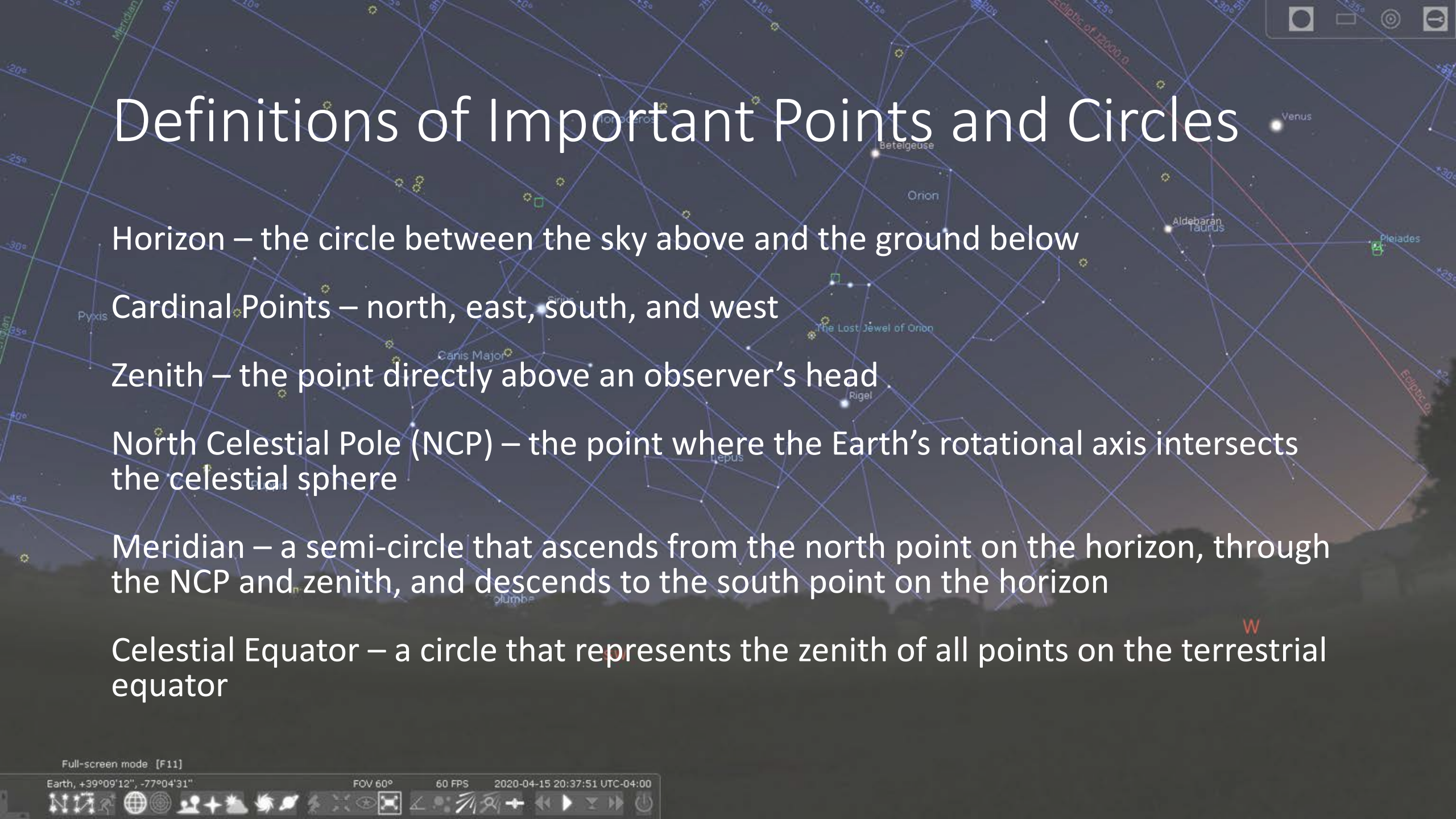
Cardinal Points – north, east, south, and west

Zenith – the point directly above an observer's head

North Celestial Pole (NCP) – the point where the Earth's rotational axis intersects the celestial sphere

Meridian – a semi-circle that ascends from the north point on the horizon, through the NCP and zenith, and descends to the south point on the horizon

Celestial Equator – a circle that represents the zenith of all points on the terrestrial equator



Celestial Coordinate Systems

Coordinate pairs that are used to specify locations of objects on the celestial sphere

There are two systems:

- Altitude/Azimuth (Alt/Az):
  - Both coordinates given in DMS
  - Relative to horizon and cardinal points
- Equatorial
  - Coordinates in right ascension (hours, minutes and seconds, or HMS) and declination (Ra/Dec)
  - Absolute with respect to the ‘fixed’ stars
  - Example: Rigel is located at 5h 14m 32.3s/-8° 12’ 5.9”

The two basic telescope mount types (Alt/Az and Equatorial) are named for the coordinate system for which they are designed

Summary

Advantages of planetarium software over live view phone apps

Described the differences between the conceptual celestial sphere and the actual universe

Demonstrated angular measurements of distances and sizes

Reviewed and demonstrated several key points and circles on the celestial sphere

Discussed two celestial coordinate systems: Alt/Az and Equatorial

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 through 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