

# Coordinate Systems and Time

## Phys 134

Hipparchus  
129 BC



100 m

$1^\circ$

Tycho Brahe  
1600



5 km

$0,02^\circ$

Modern astrometry  
1966



4000 km

$0,00003^\circ$

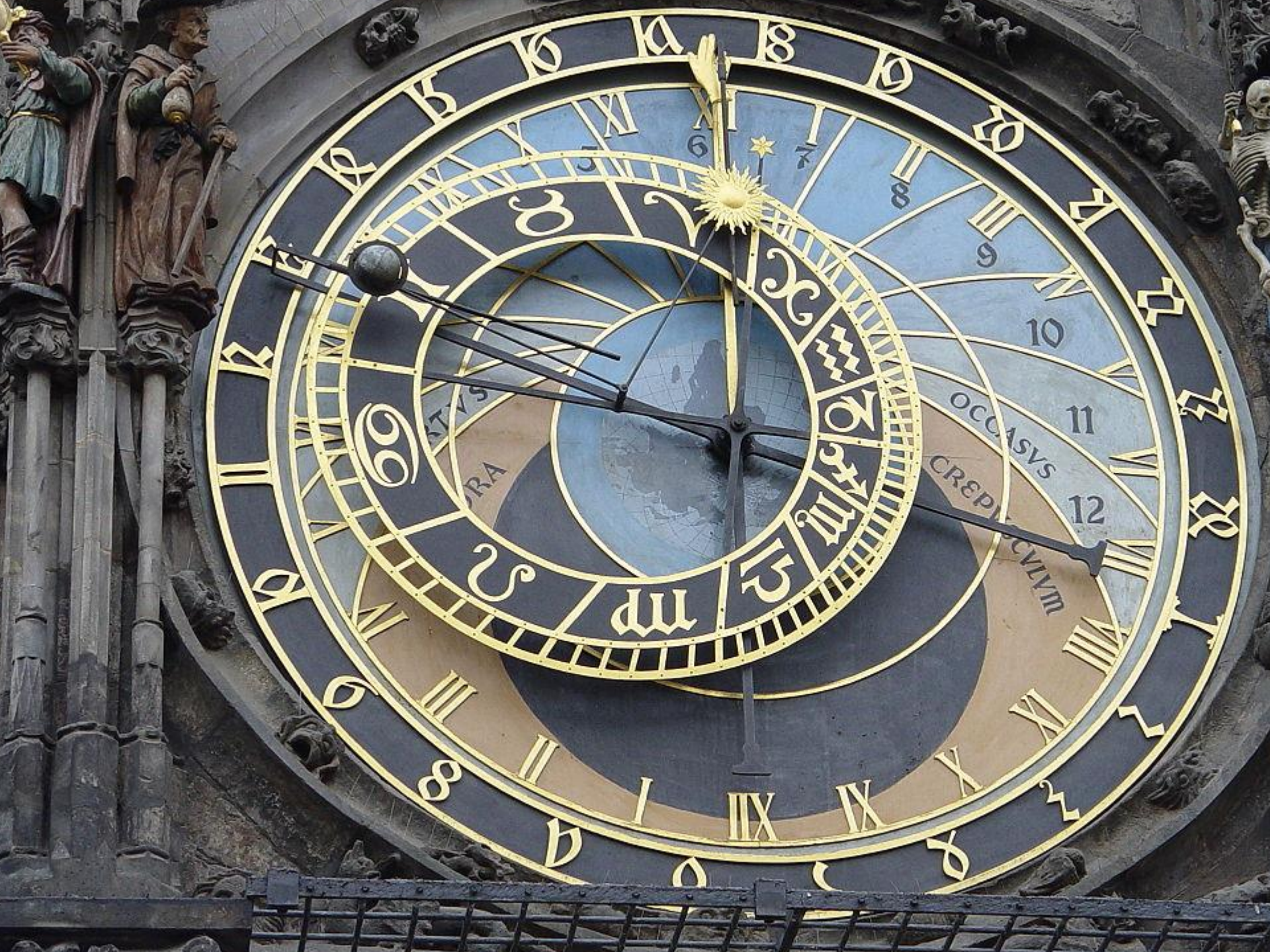
Hipparcos  
1997



380,000 km

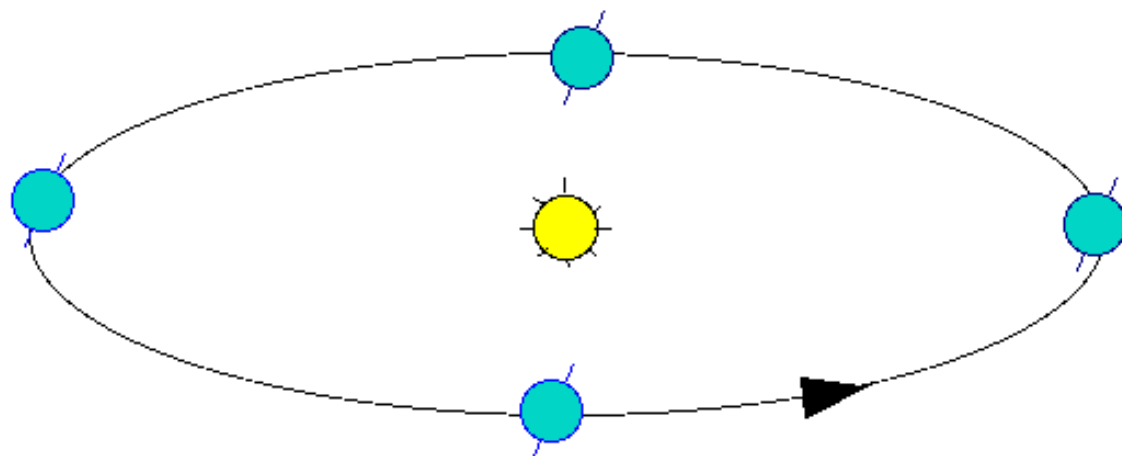
$0,0000003^\circ$





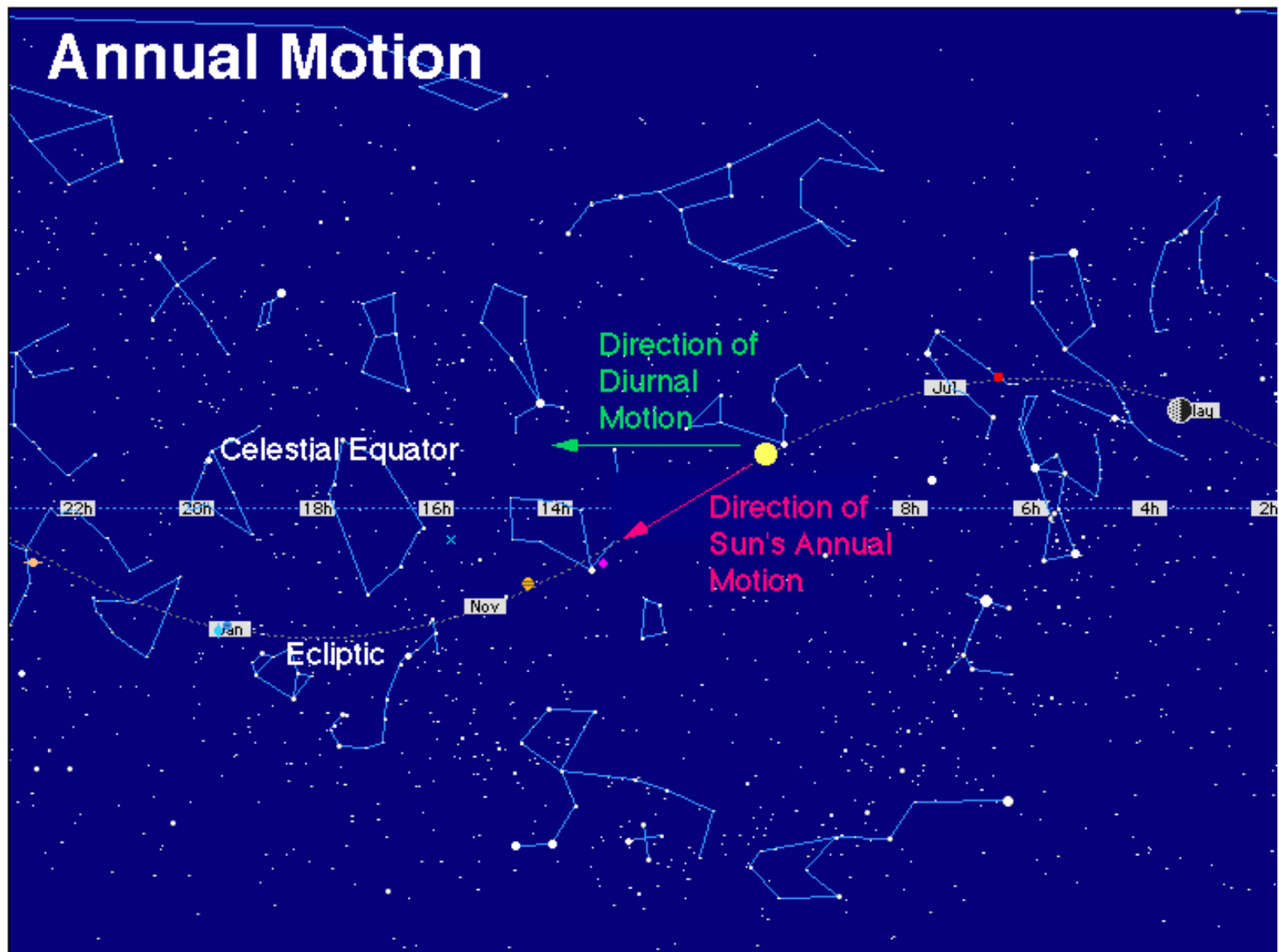


# Revolution

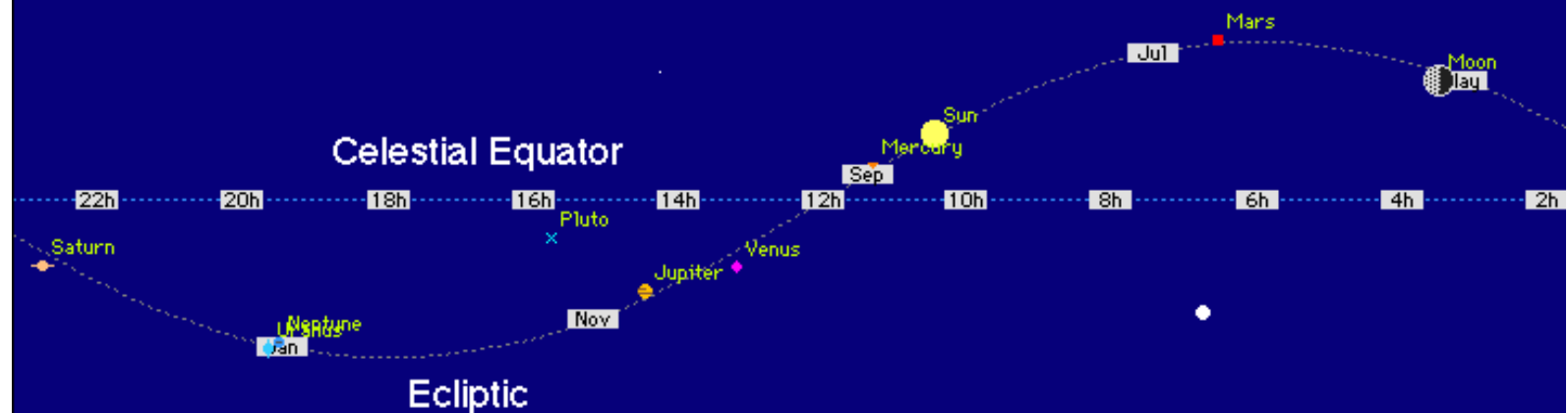


- The Earth Revolves Around the Sun

# Annual Motion

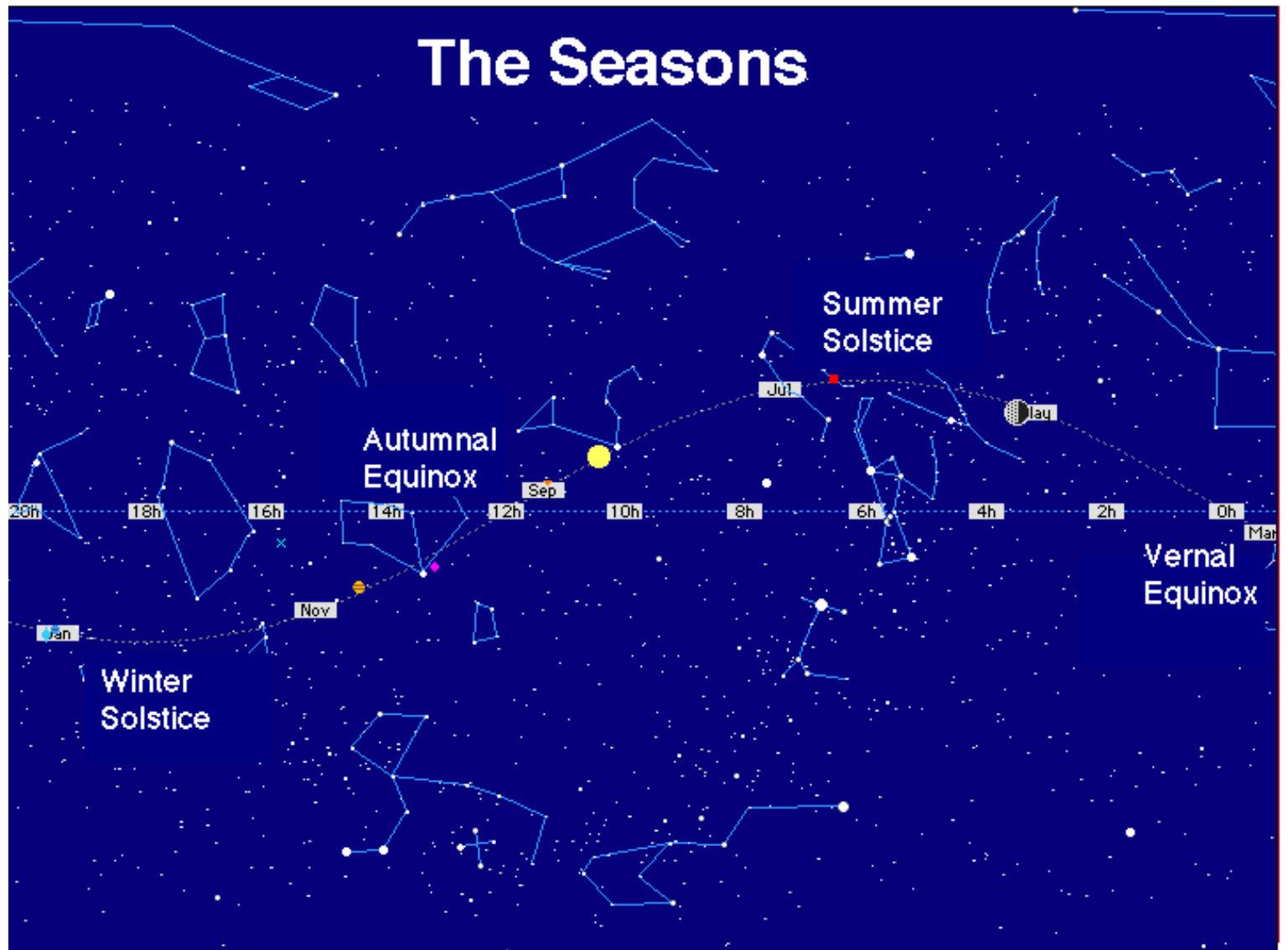


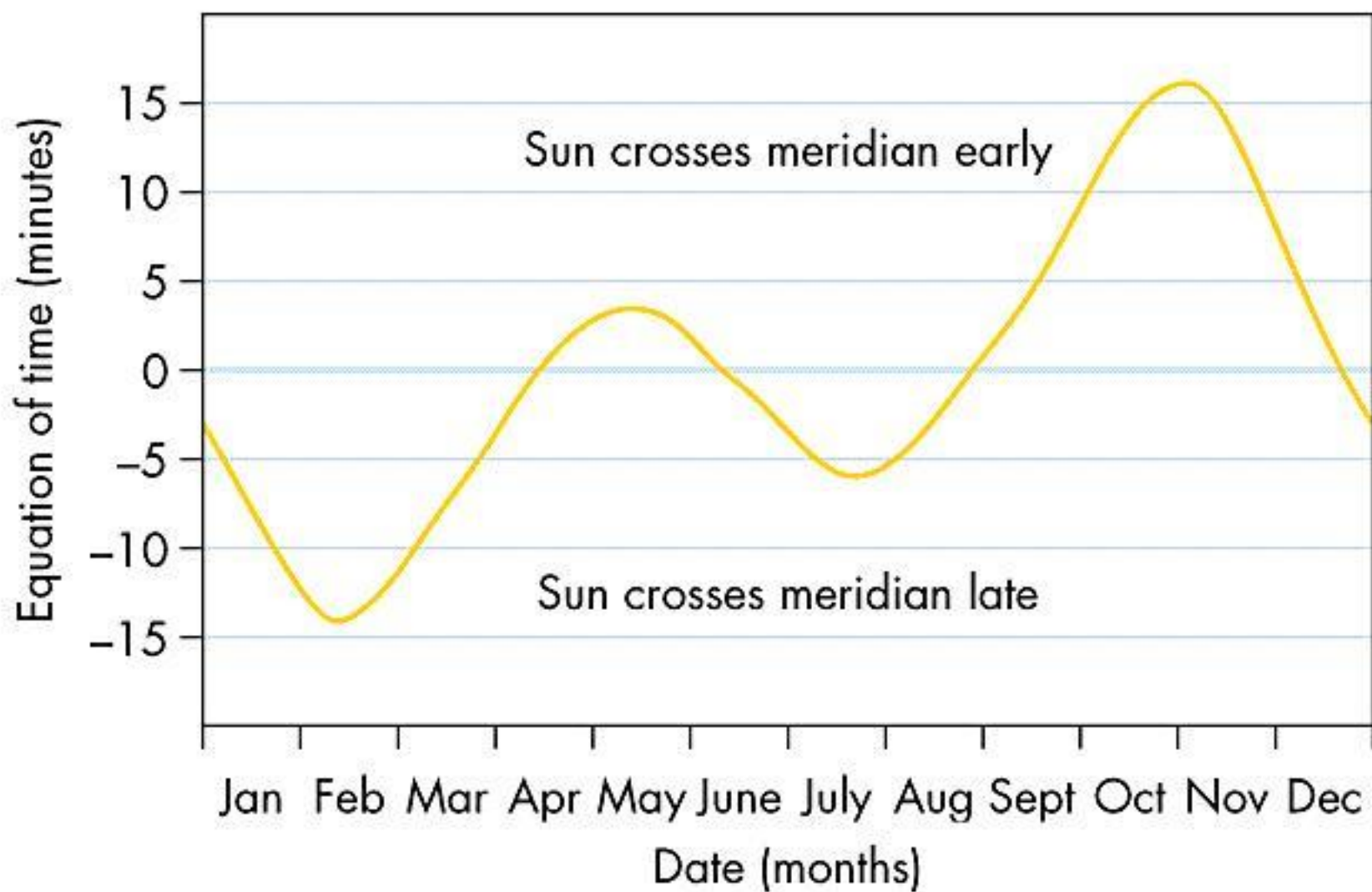
# The Ecliptic



- The Sun, Planets, and Moon are found near the Ecliptic

# The Seasons



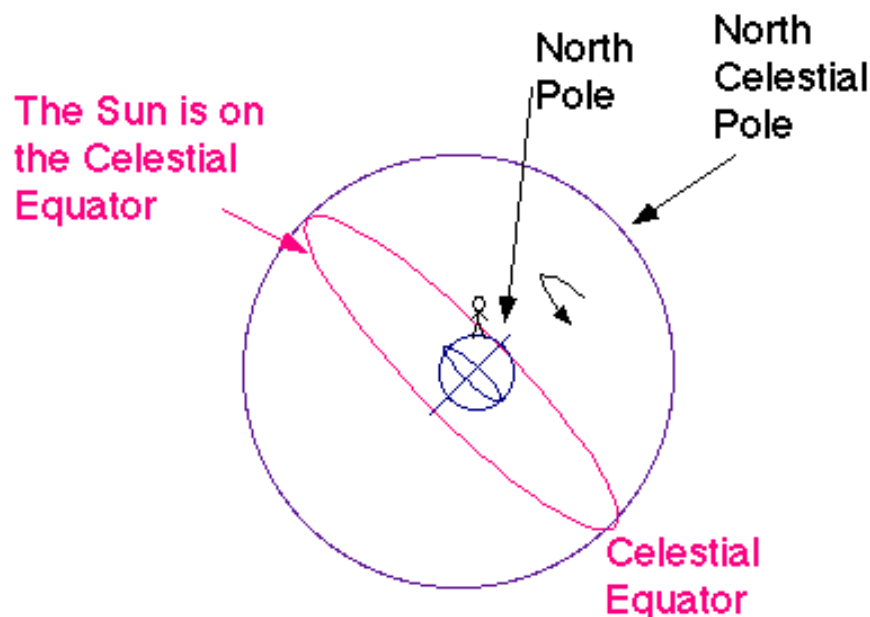




## Sidereal and Solar Days

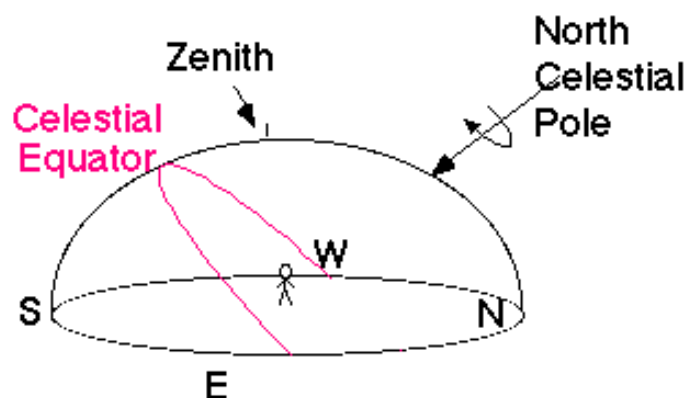
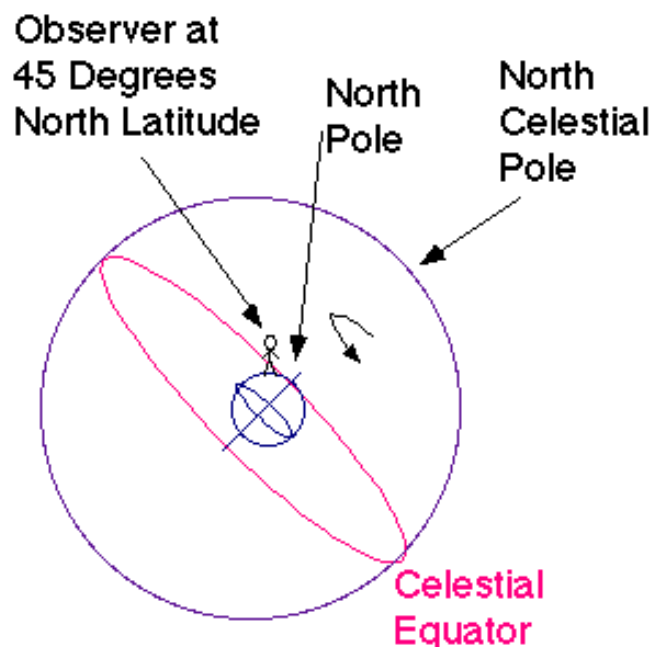
- A Day is One Rotation of the Earth
- A Solar Days is One Rotation of the Earth Measure By the Position of the Sun
- A Sidereal Day is One Rotation of the Earth Measured By the Positions of the Stars

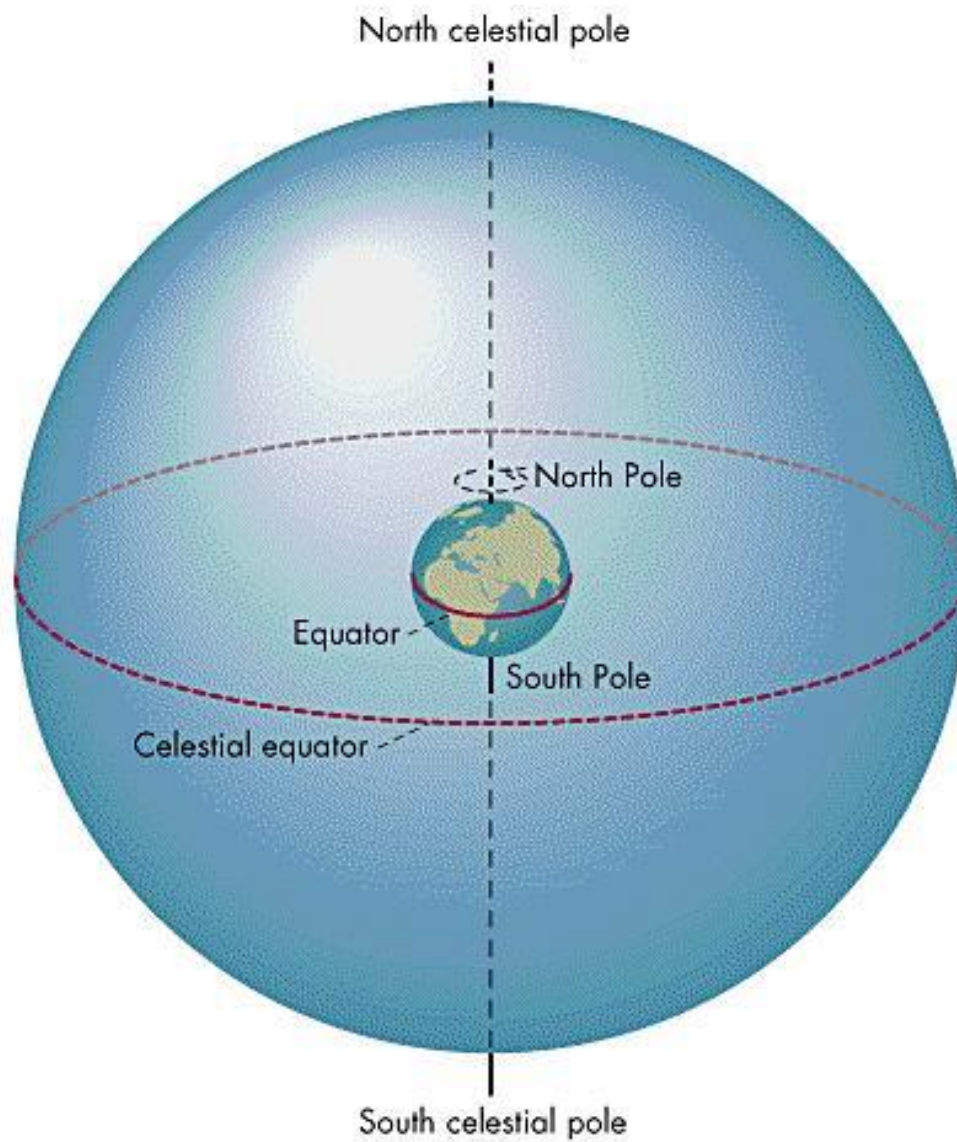
# The Autumnal Equinox

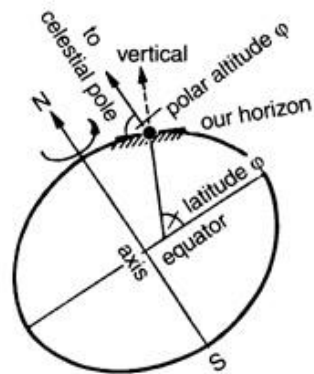
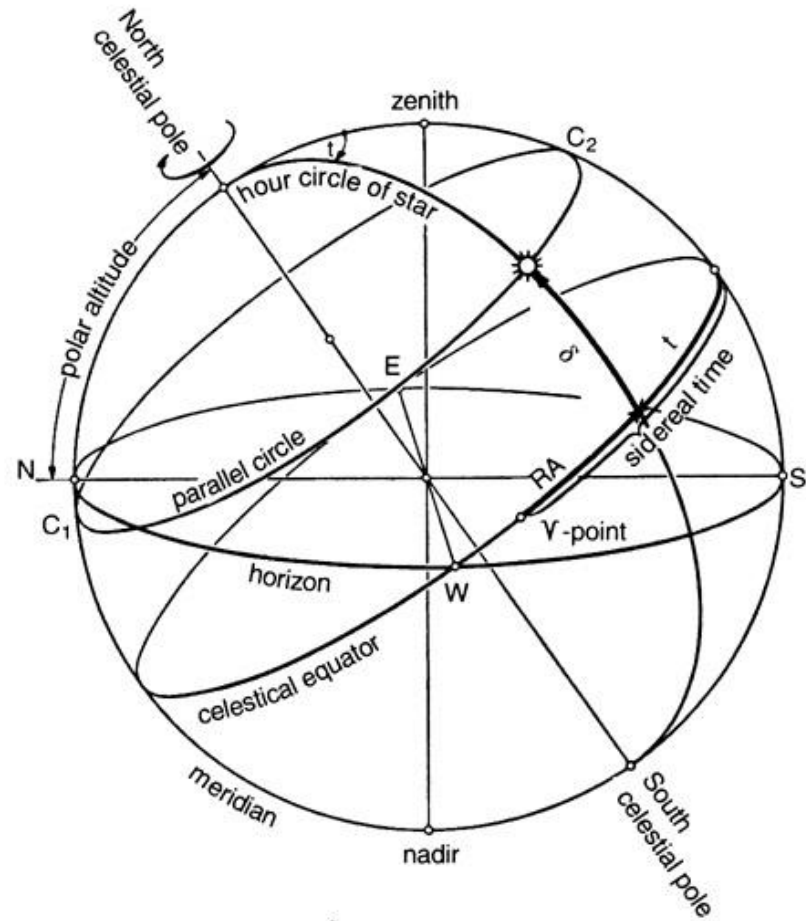


- The Sun Crosses the Celestial Equator Travelling Southward
- The First Day of Autumn (About Sept 23)

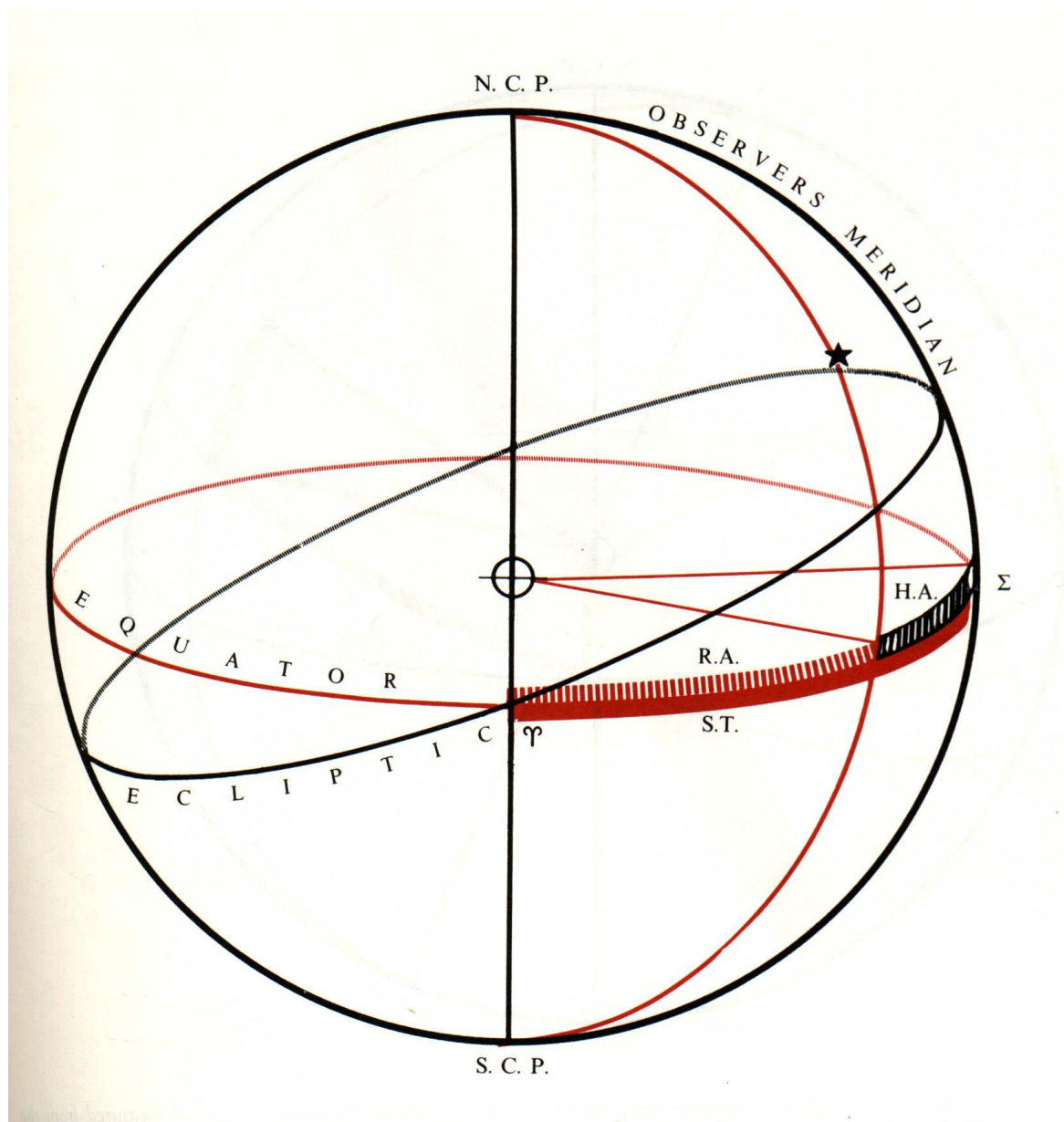
# Between the Equator and the North Pole

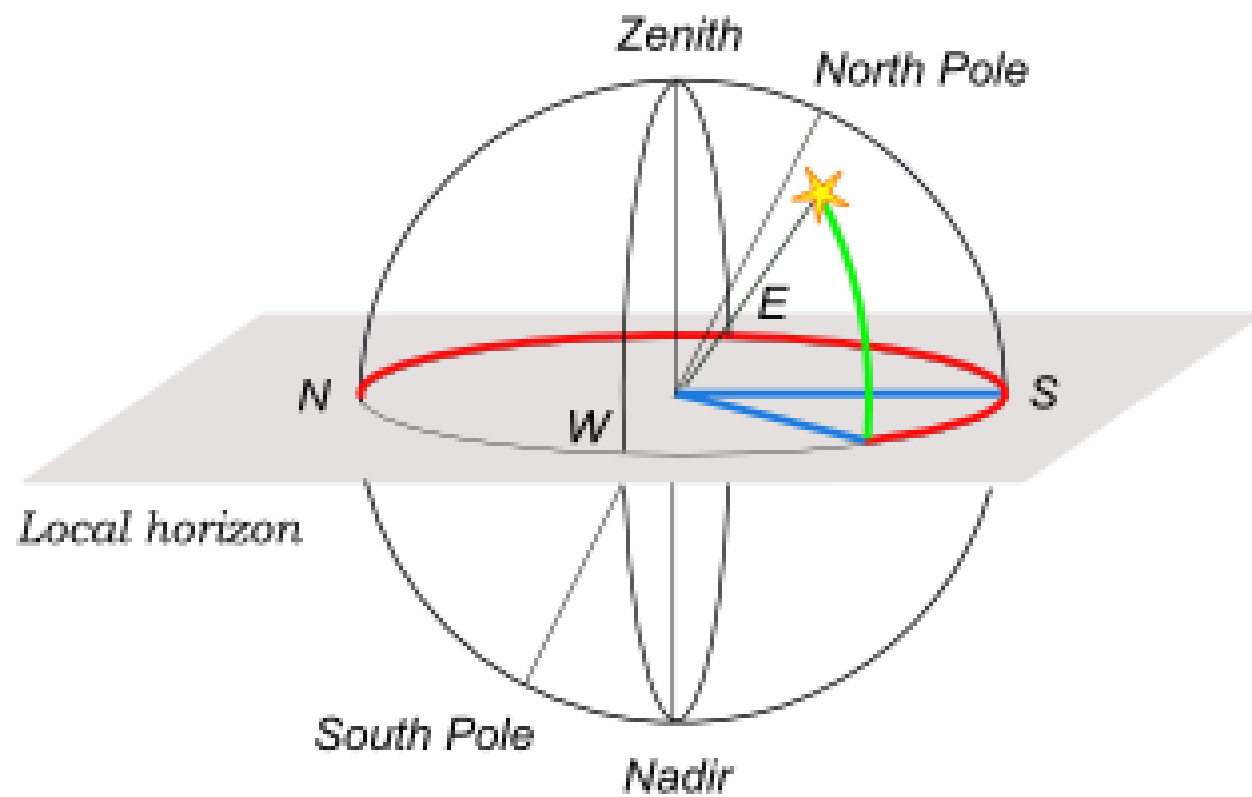




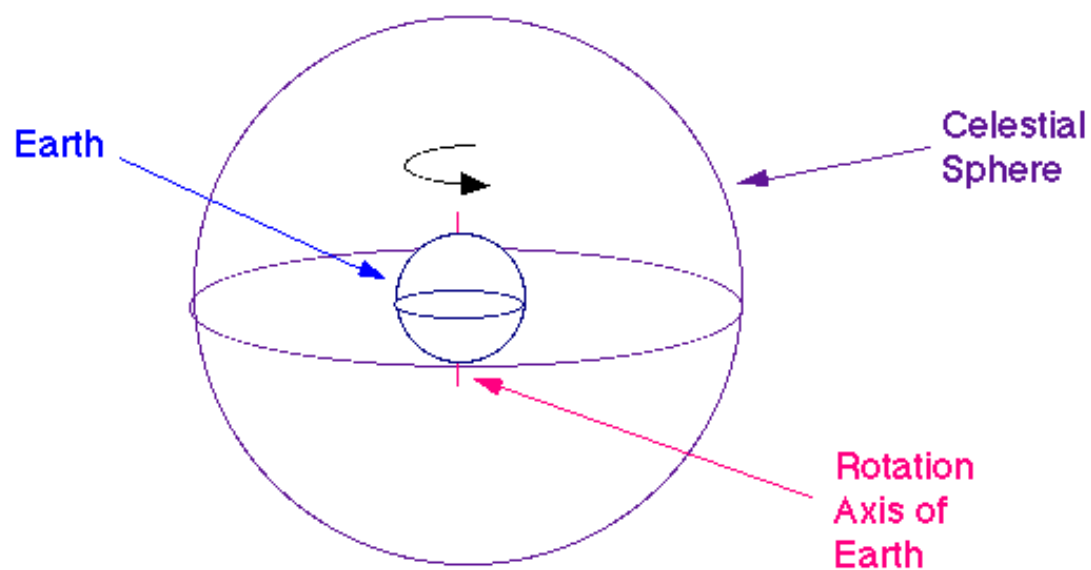






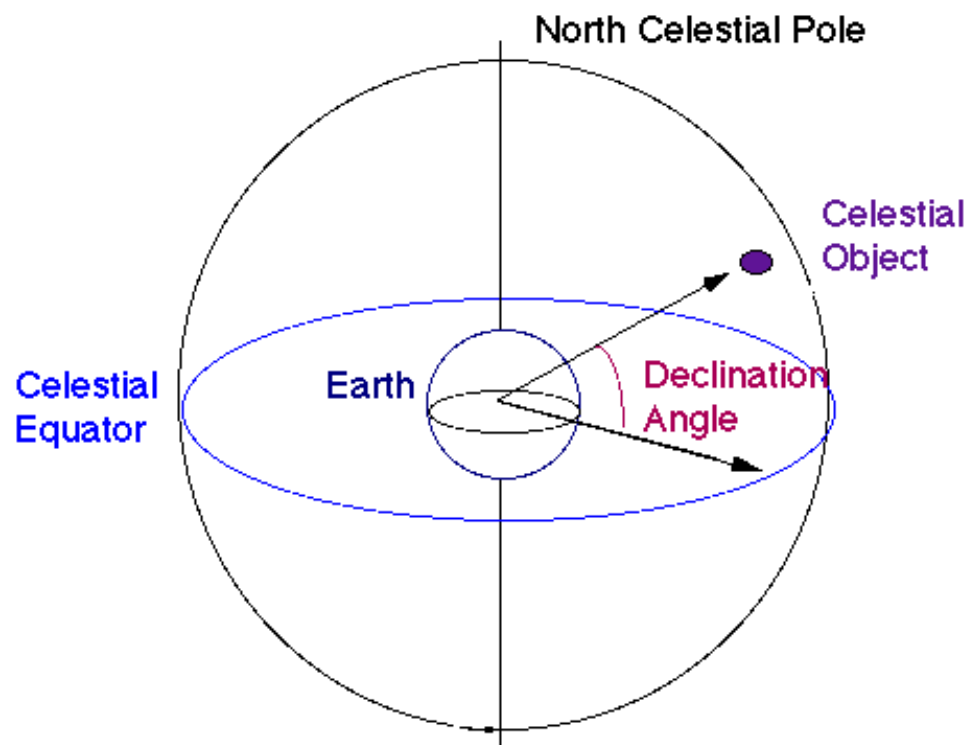


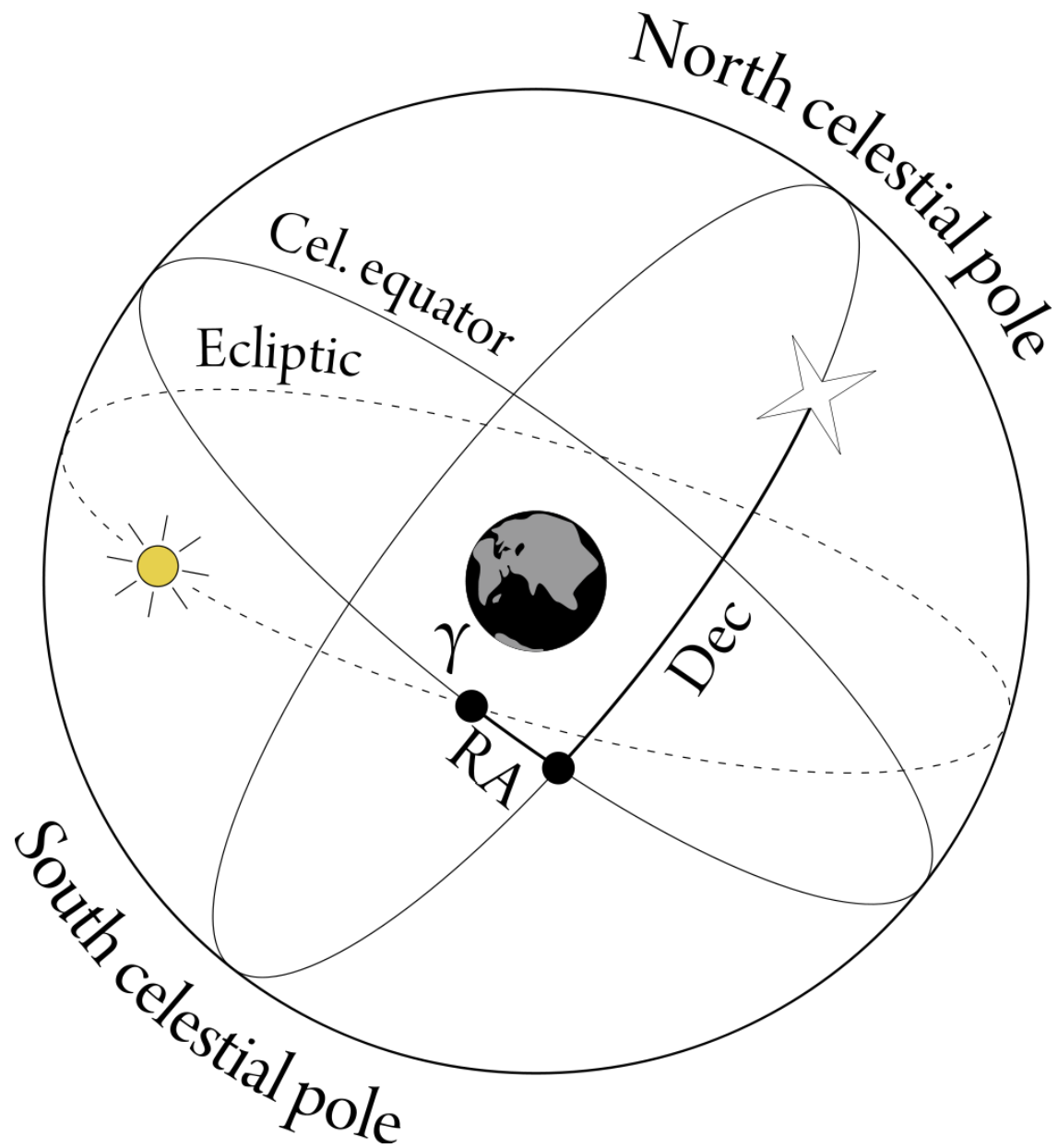
# Rotation



- The Celestial Sphere Does Not Move
- The Earth Rotates Inside the Celestial Sphere

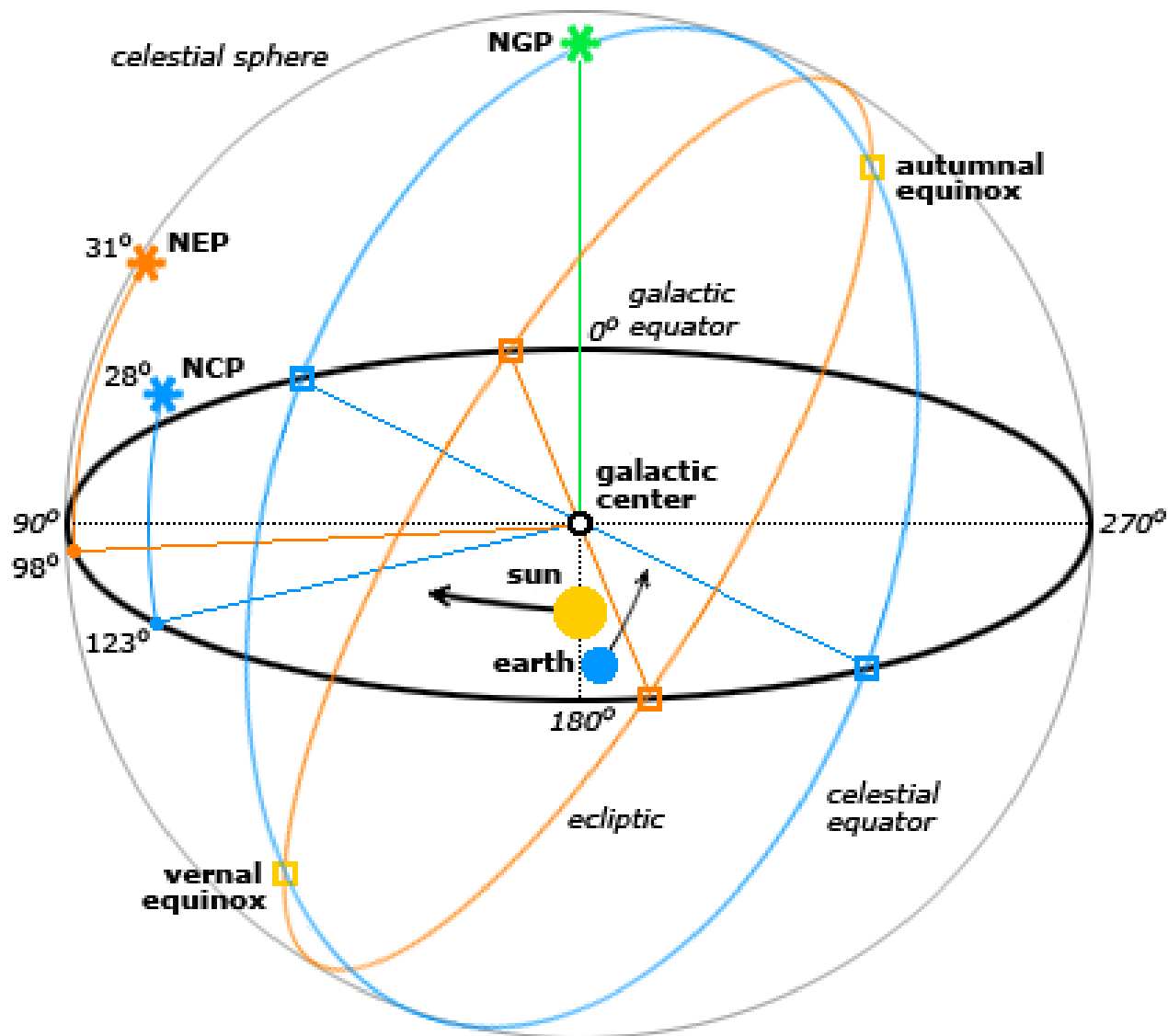
# Declination







# Galactic Coordinates



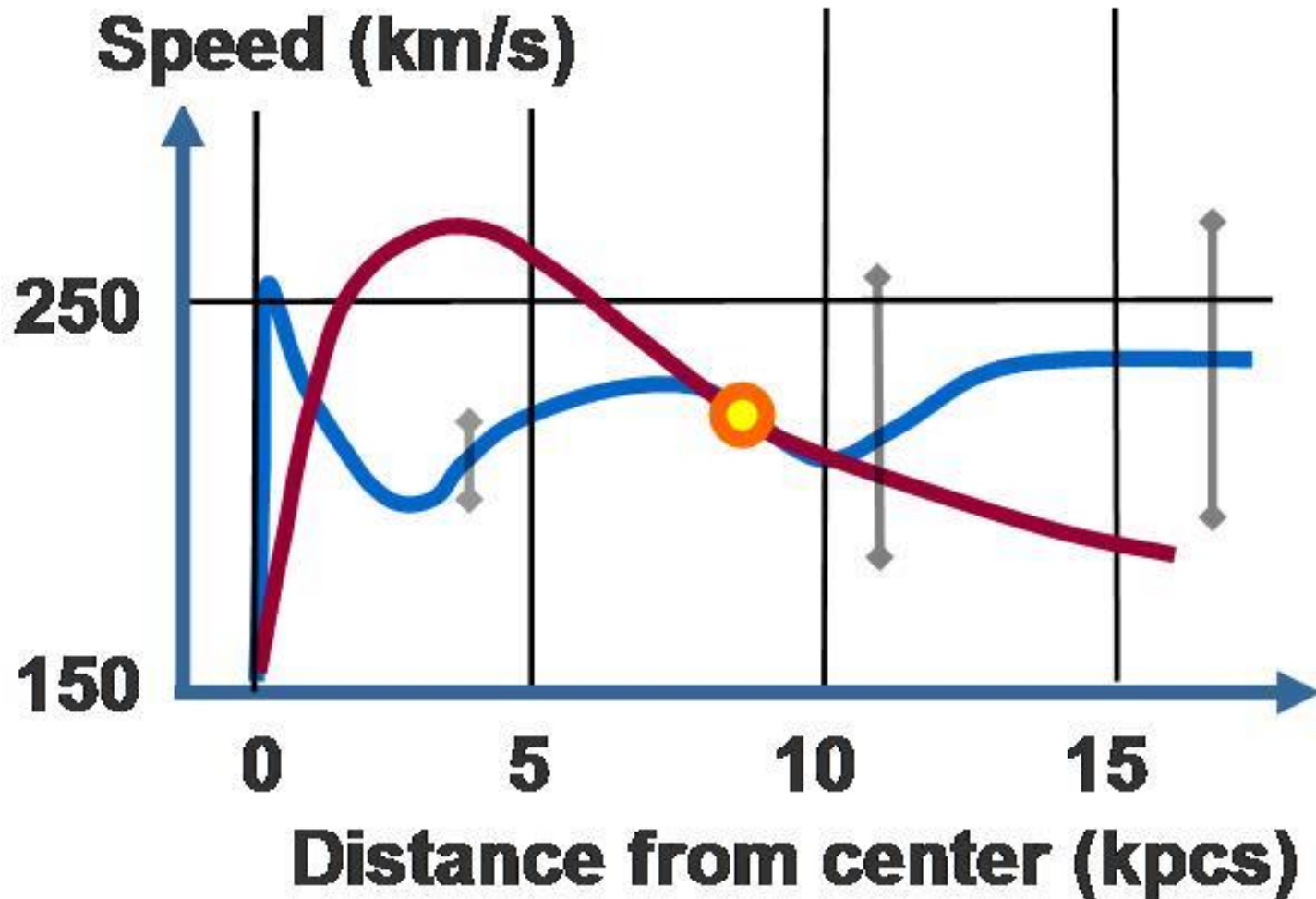
# Stellar Speed vs Distance from Galactic Center

RED: Uniform mass distribution model

Blue: Measured (note much higher speed at large distance)

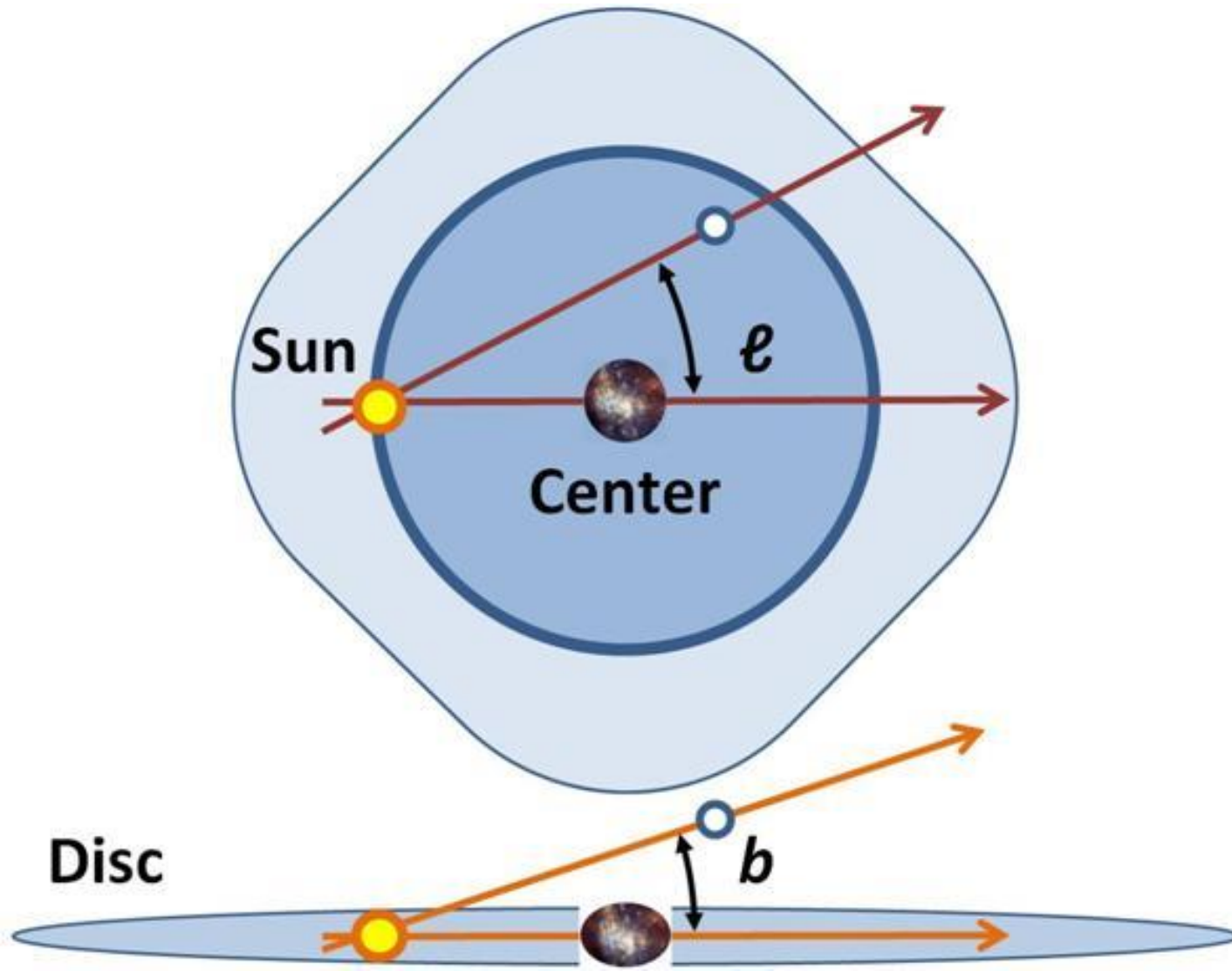
→ Dark Matter

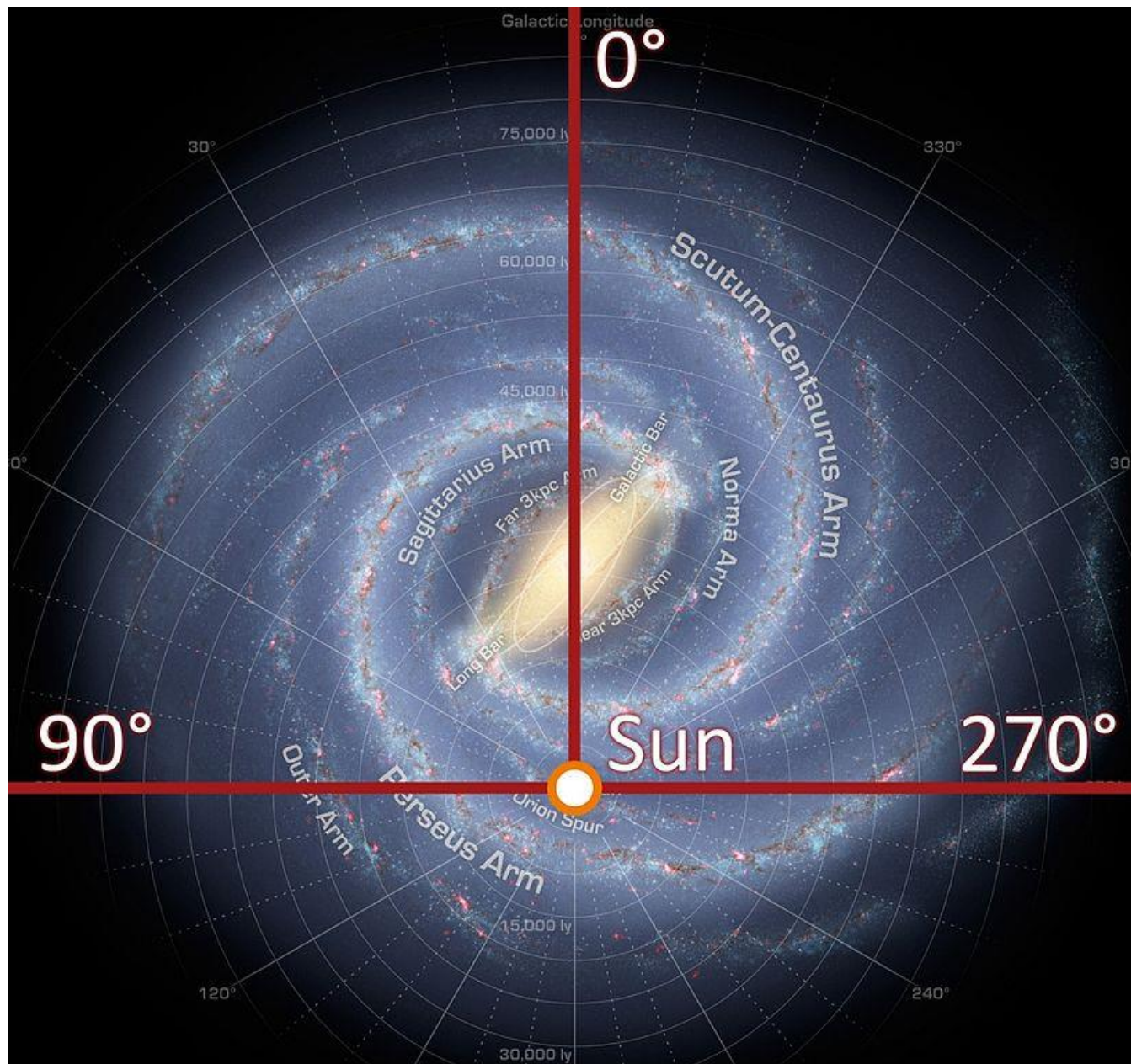
Yellow: Distance of our Sun from galactic center



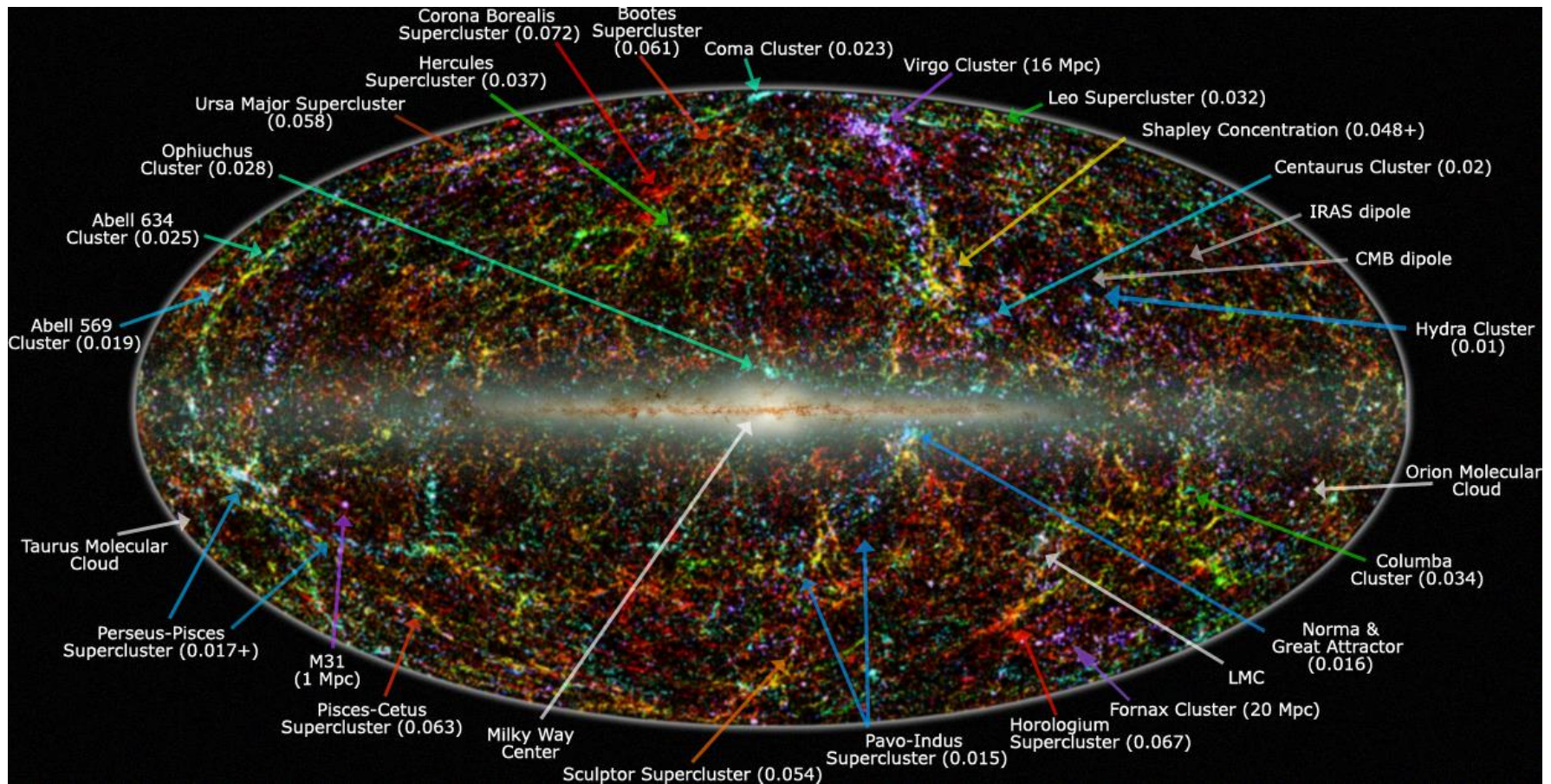
# Galactic Coordinates

Gal longitude ( $l$ ), Latitude ( $b$ )

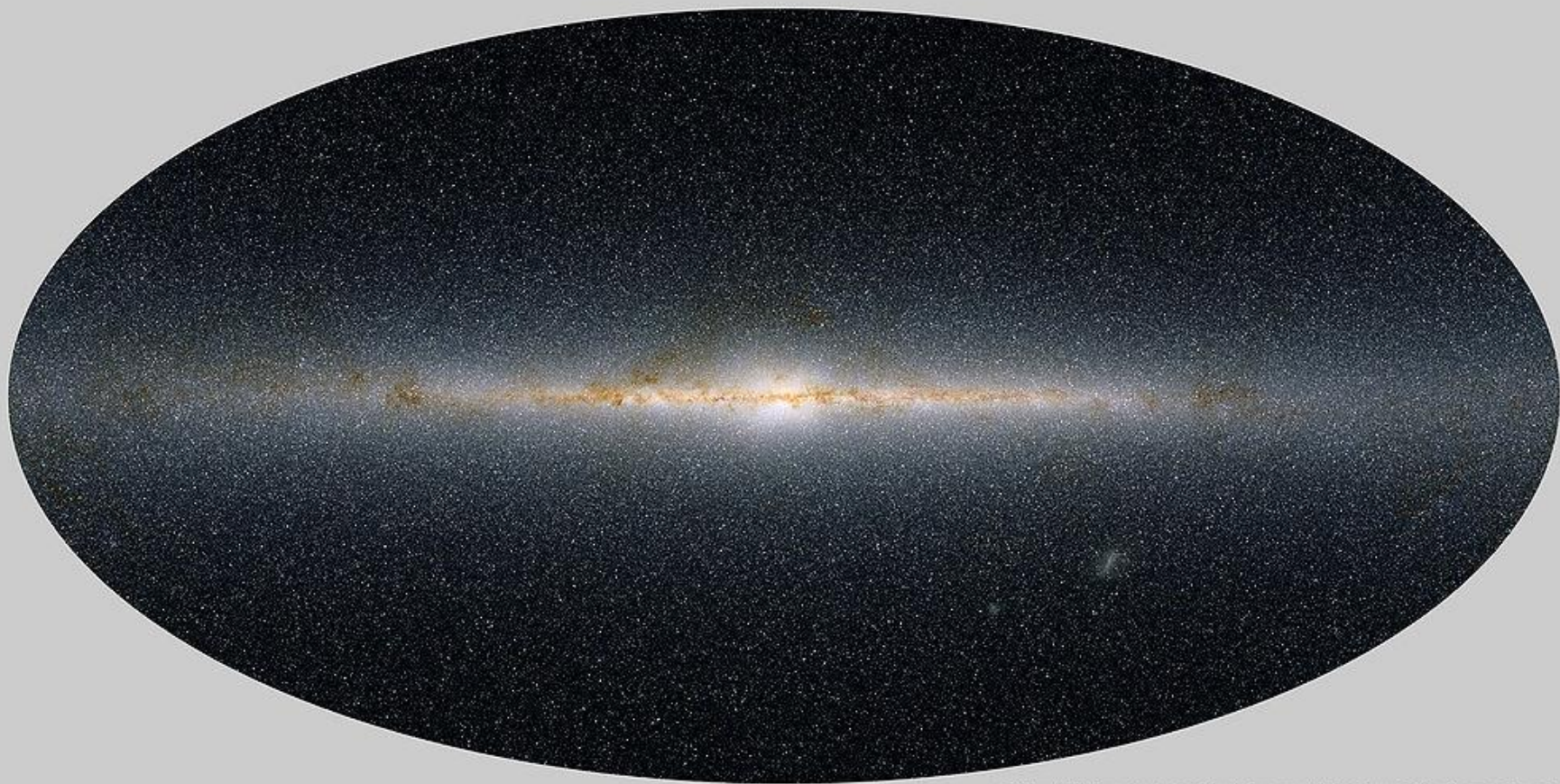












Two Micron All Sky Survey Image Mosaic: Infrared Processing and Analysis Center/Caltech & University of Massachusetts

