

PHYS 155 – Introductory Astronomy

Thursday, 08/31/2006

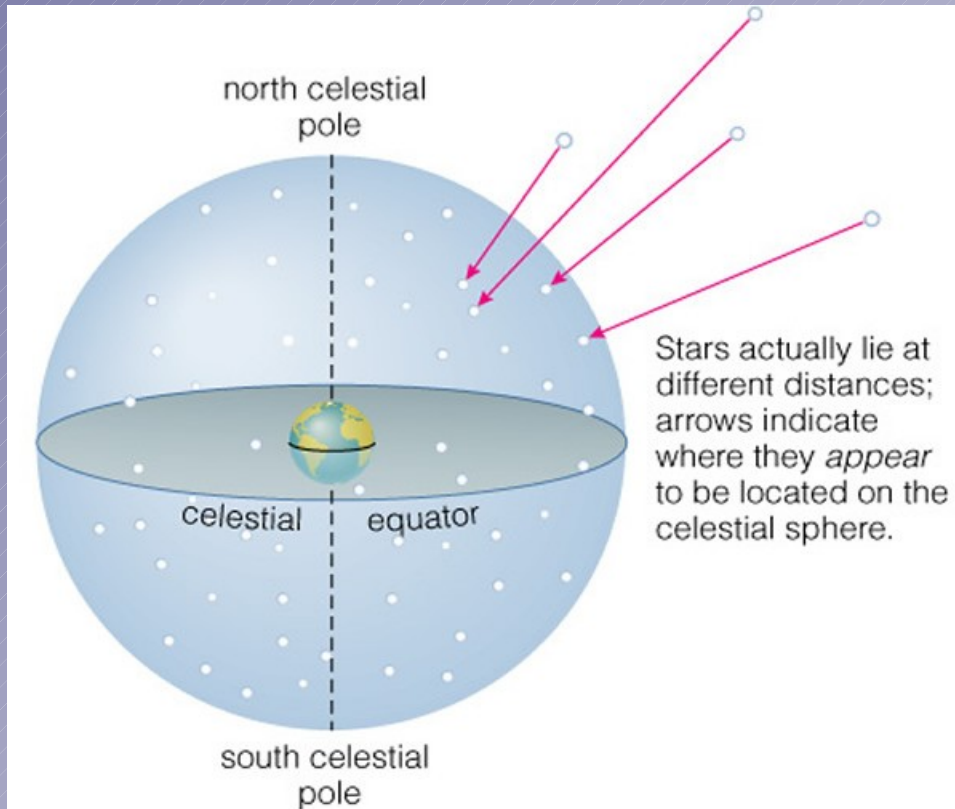
- syllabus, information about the course
<http://astronomy.uconn.edu>

- observing sessions:
Monday – Thursday 9pm, weather permitting
<http://www.phys.uconn.edu/observatory>

Marek Krasnansky

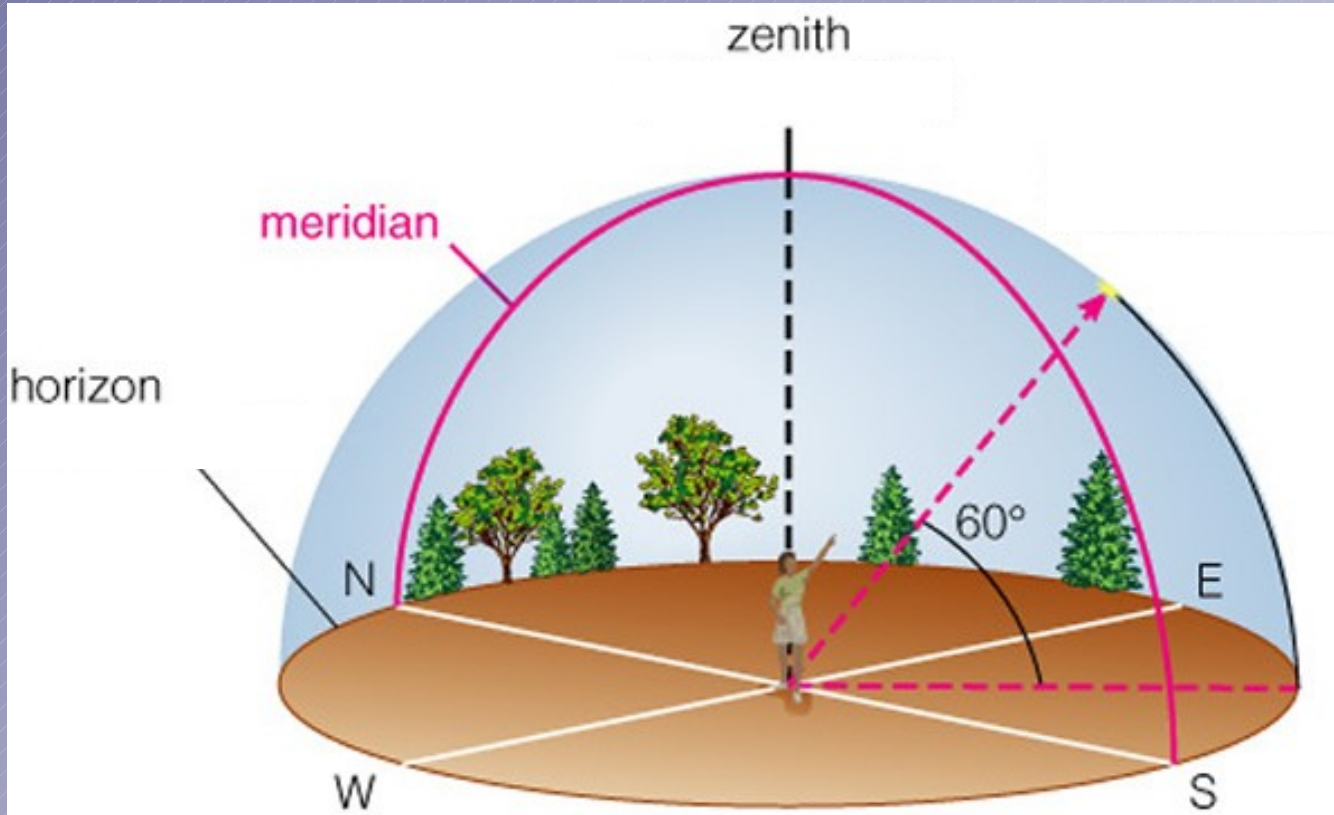
- Celestial sphere
- Zenith, nadir, horizon, meridian, transit
- Celestial equator, ecliptic, Vernal Equinox, north and south celestial poles
- Celestial coordinates
 - Horizon coordinate system:
 - Altitude, azimuth
 - Equatorial coordinate system:
 - Right ascension, declination
- How to use Star Globe
- Local sky

Celestial Sphere



Our lack of depth perception when we look into space creates the illusion that Earth is surrounded by a celestial sphere. In reality, stars that appear very close together in our sky may actually lie at very different distances from Earth.

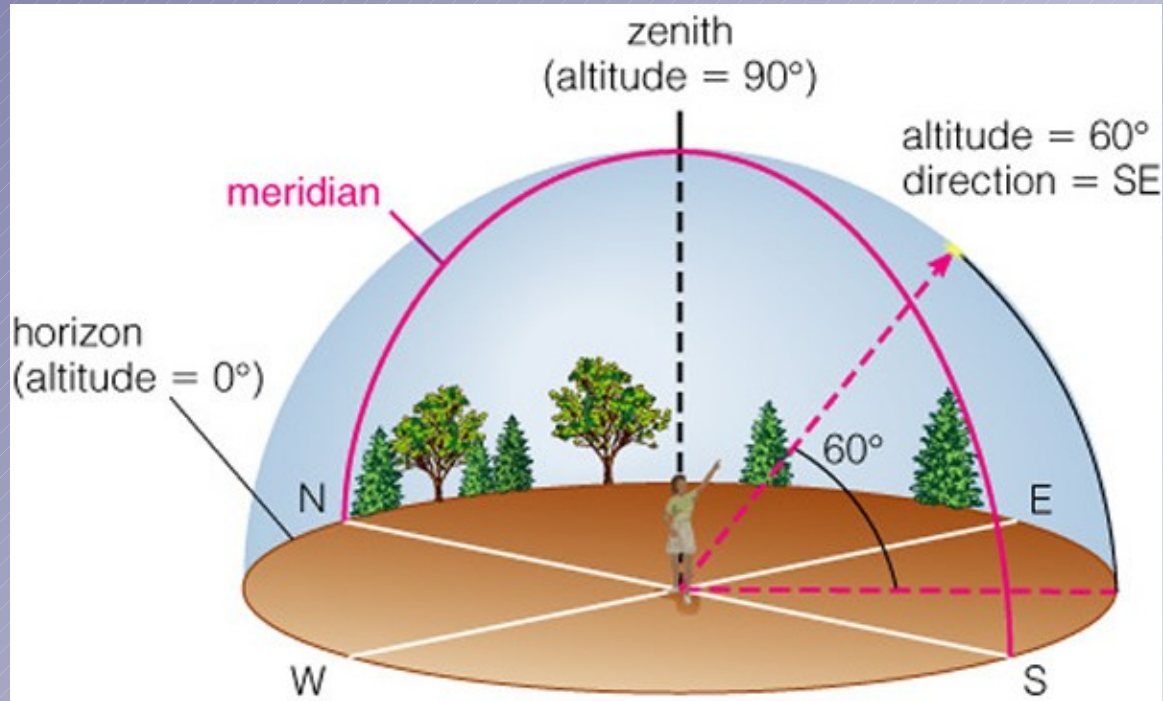
The Dome of the Local Sky



- Zenith
- Nadir
- Horizon
- Meridian
- Transit

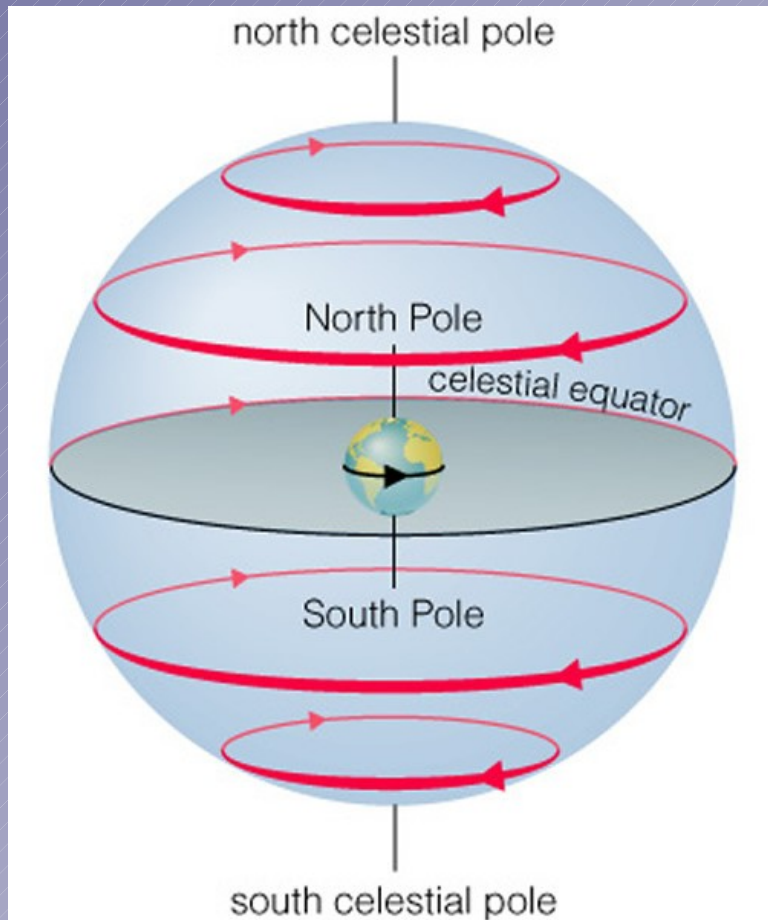
Horizon coordinate system

- coordinates change with time and depend on observer



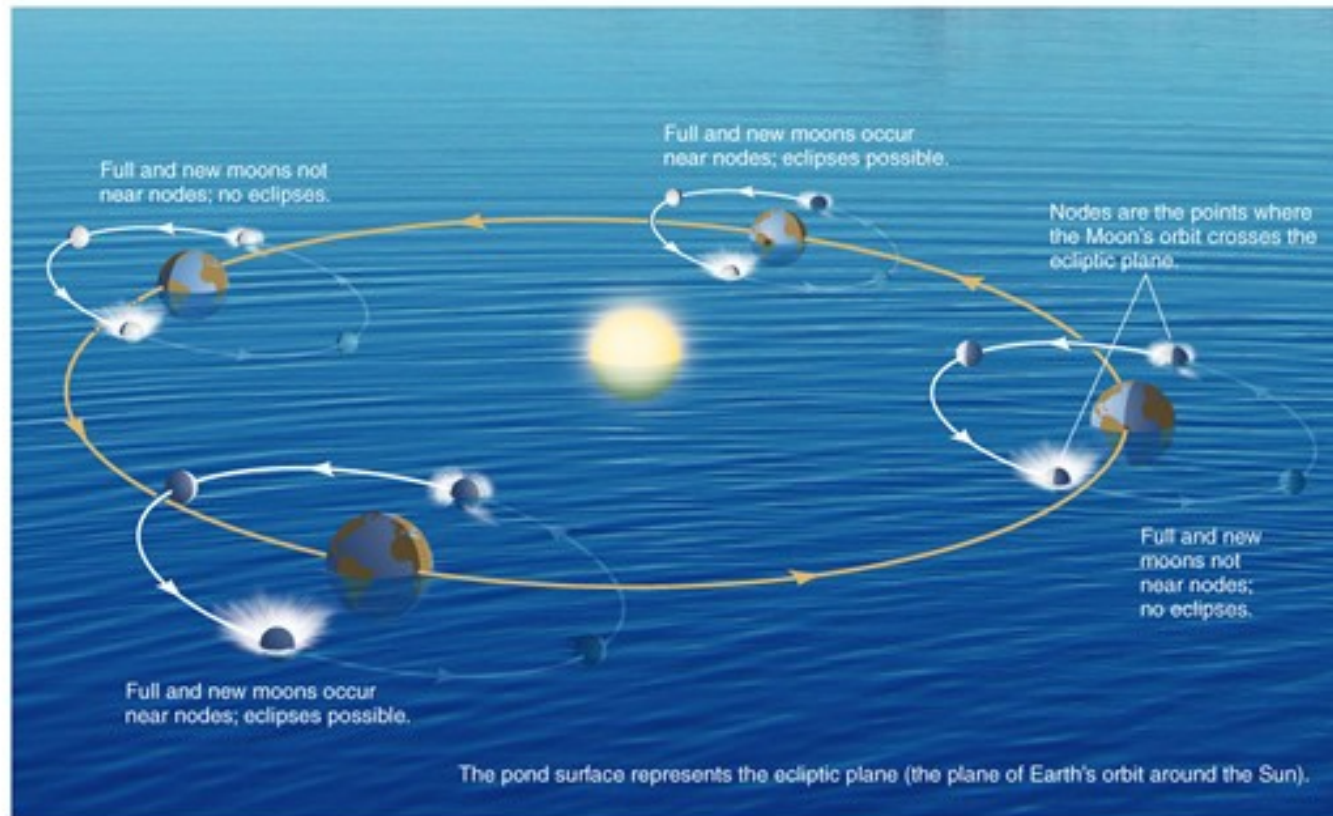
- Azimuth:
 - 0 to 360 degrees around horizon from north towards east
- Altitude:
 - 0 to 90 degrees up from horizon

Points on the Celestial Sphere

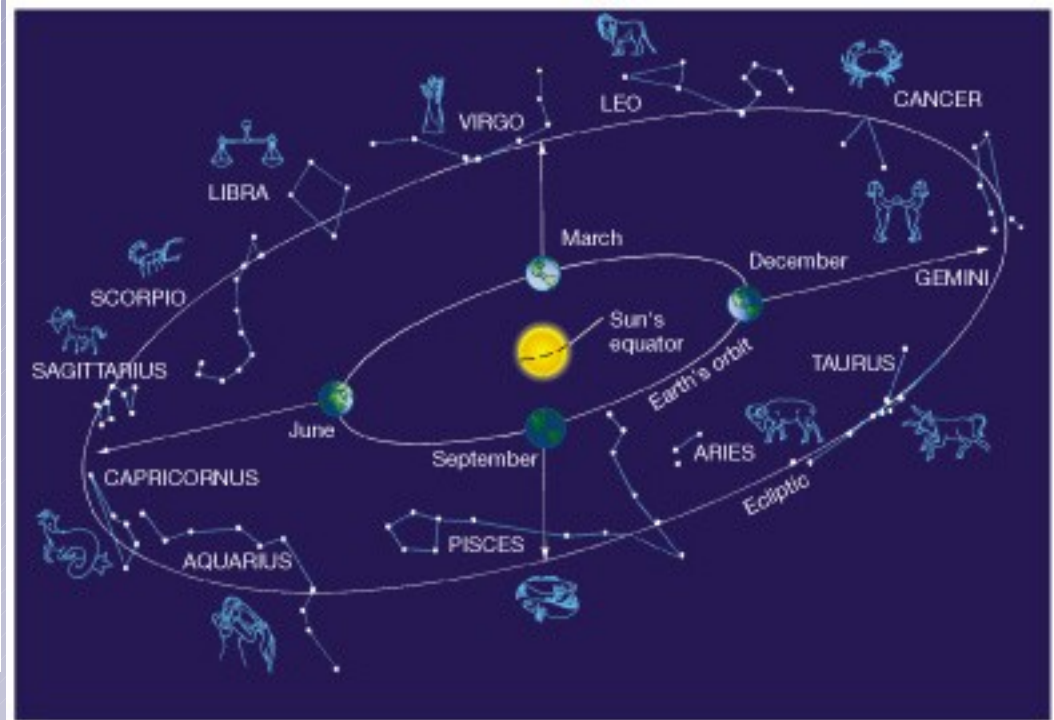
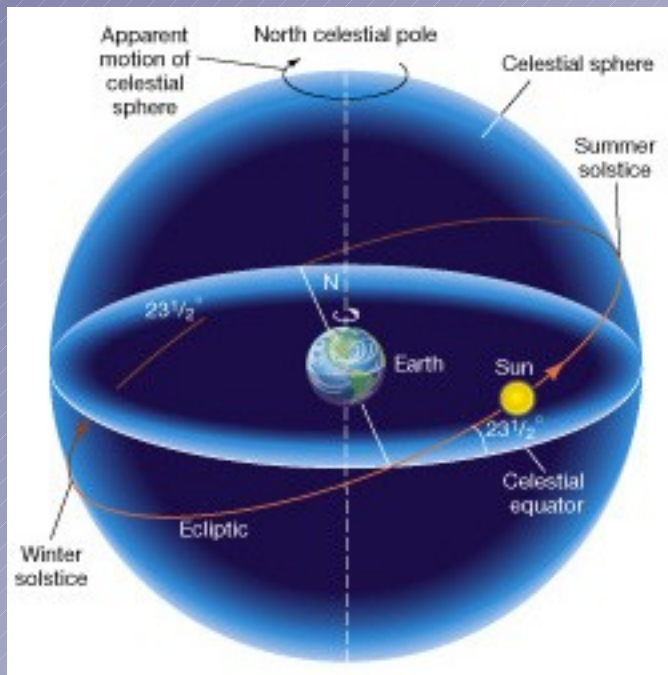


- North and south celestial poles
- Celestial equator

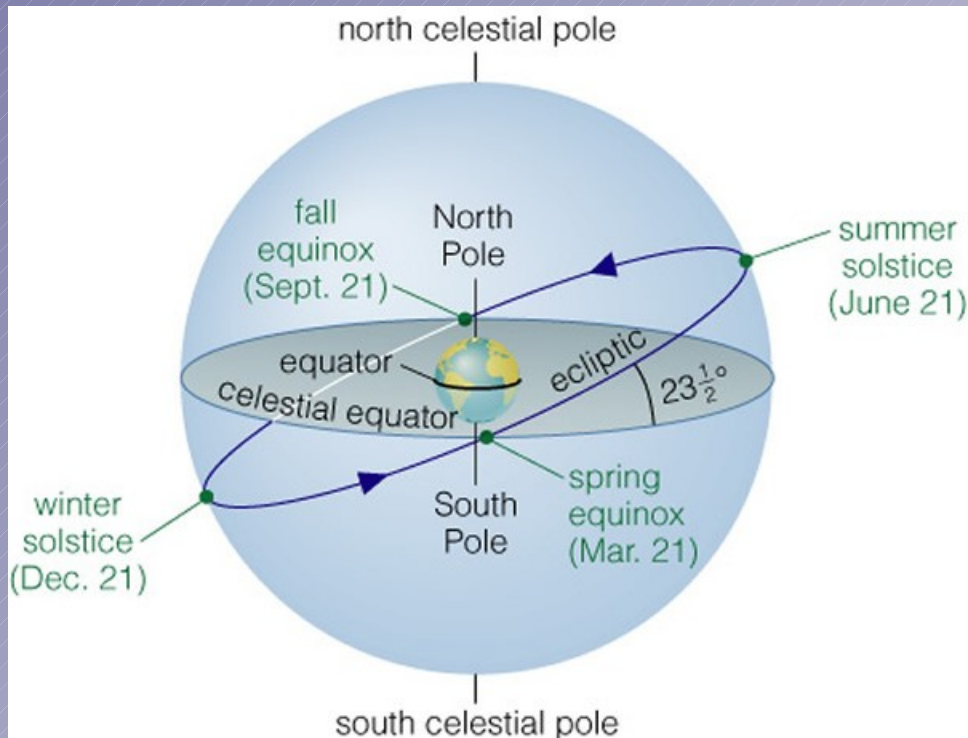
Ecliptic Plane



- **Ecliptic:**
 - The Sun's apparent annual path among the constellations
- **Zodiak Constellations**
 - The constellations on the celestial sphere through which the ecliptic passes



Cardinal Points on the Ecliptic



- Vernal Equinox
- Summer Solstice
- Autumnal Equinox
- Winter Solstice

Equatorial coordinate system

- coordinates fixed with the celestial sphere, time and observer independent

- declination (dec)

- Analogous to latitude, but on the celestial sphere; it is the angular north-south distance between the celestial equator and a location on the celestial sphere.

- Measured in degrees:

- » 0 to 90 – north from celestial equator

- » 0 to -90 – south from celestial equator

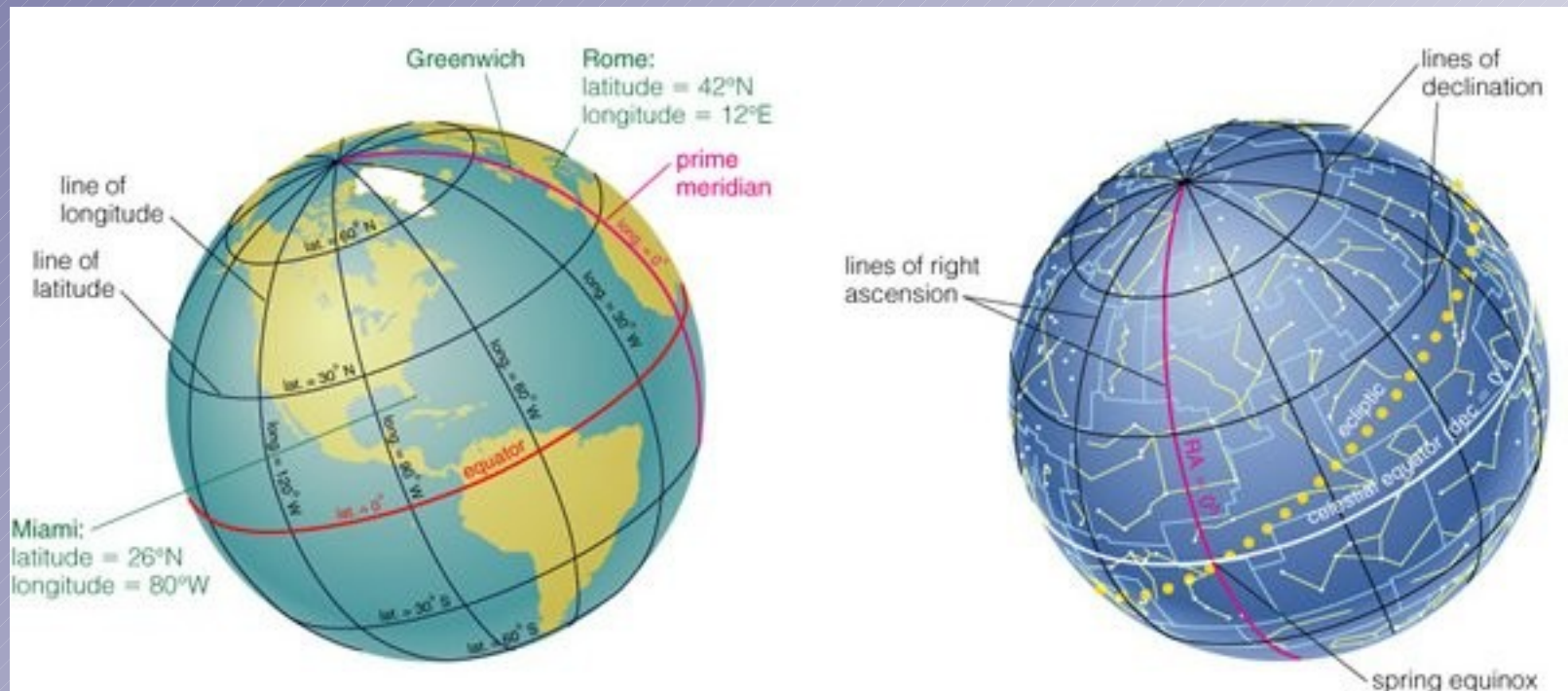
- right ascension (RA)

- Analogous to longitude, but on the celestial sphere; it is the angular east-west distance between the vernal equinox and a location on the celestial sphere.

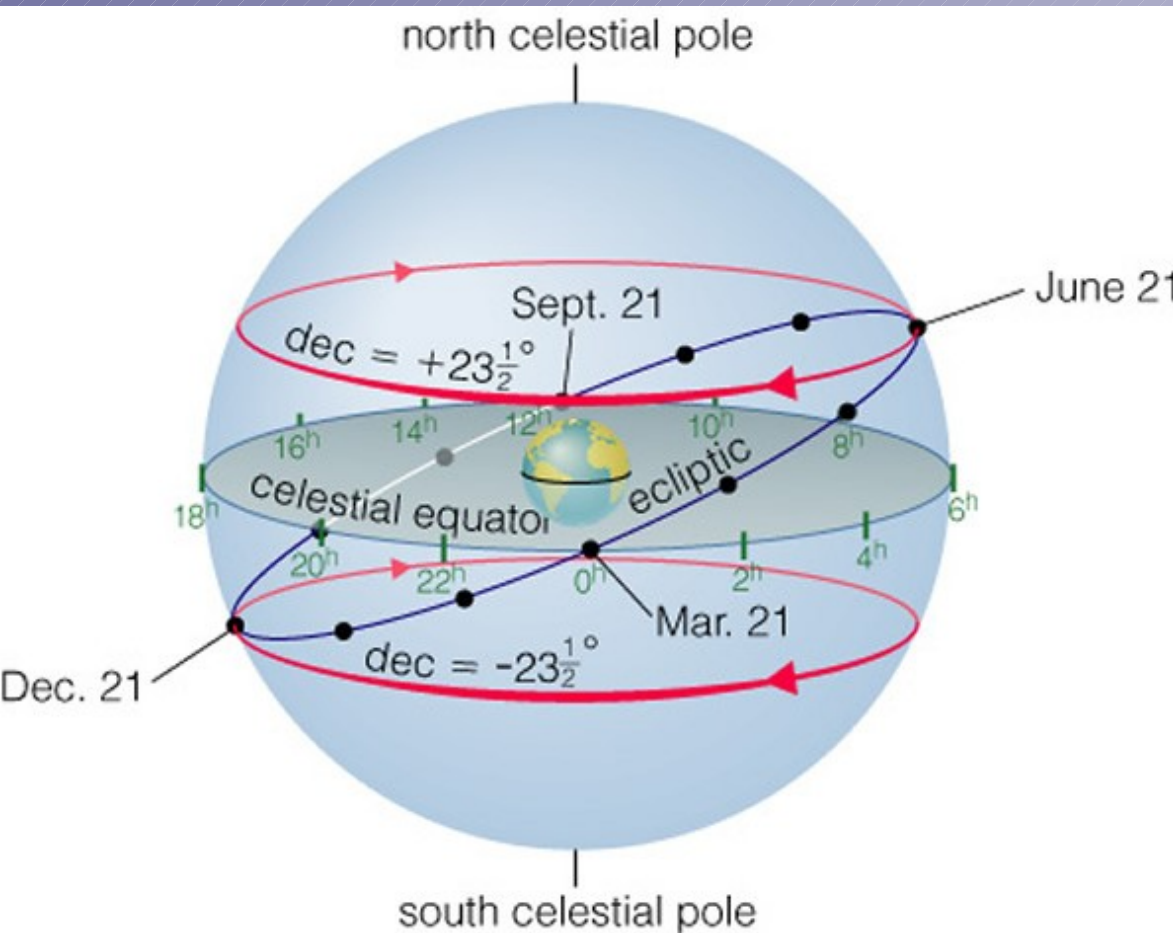
- Measured in hours

- » 0 – 24 from Vernal Equinox towards east

Equatorial coordinate system



RA and Dec of the Cardinal Points on the Ecliptic



Vernal Equinox

- Sun appears on March 21
- $0^h 0^\circ$

Summer Solstice

- Sun appears on June 21
- $6^h 23.5^\circ$

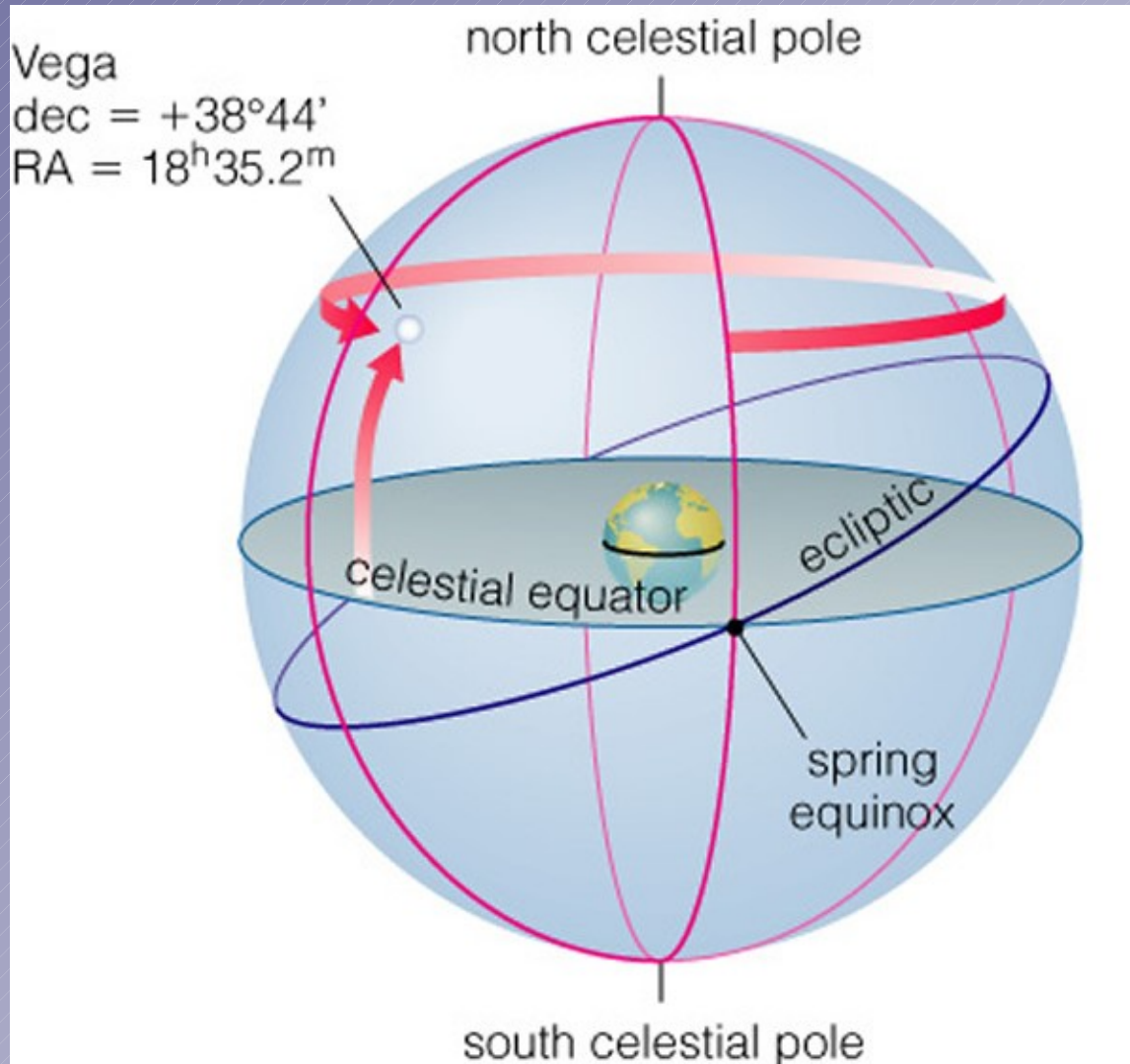
Autumnal Equinox

- Sun appears on Sept. 21
- $12^h 0^\circ$

Winter Solstice

- Sun appears on Dec. 21
- $18^h -23.5^\circ$

Where is Vega?



Its declination tells us that it is $38^{\circ}44'$ north of the celestial equator. We can interpret its right ascension in two ways: As an angle, it means Vega is about 279° (the angular equivalent of $18^{\text{h}}35^{\text{m}}$) east of the vernal equinox; as a time, it means Vega crosses the meridian about 18 hours 35 minutes after the spring equinox.

Understanding Local Skies

Sidereal time

Time measured according to the position of stars in the sky rather than the position of the Sun in the sky. See also local sidereal time

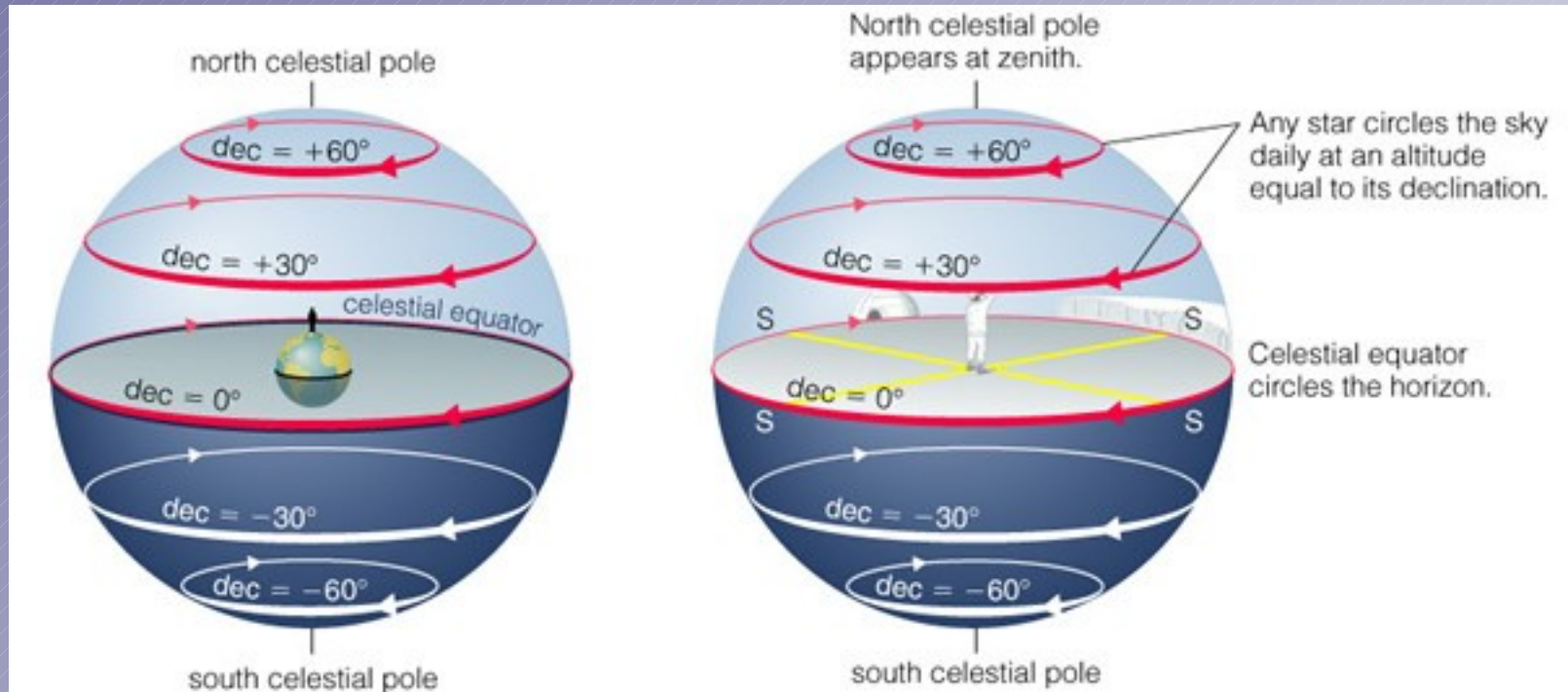
3 classes of stars:

circumpolar north - always visible

circumpolar south - never visible

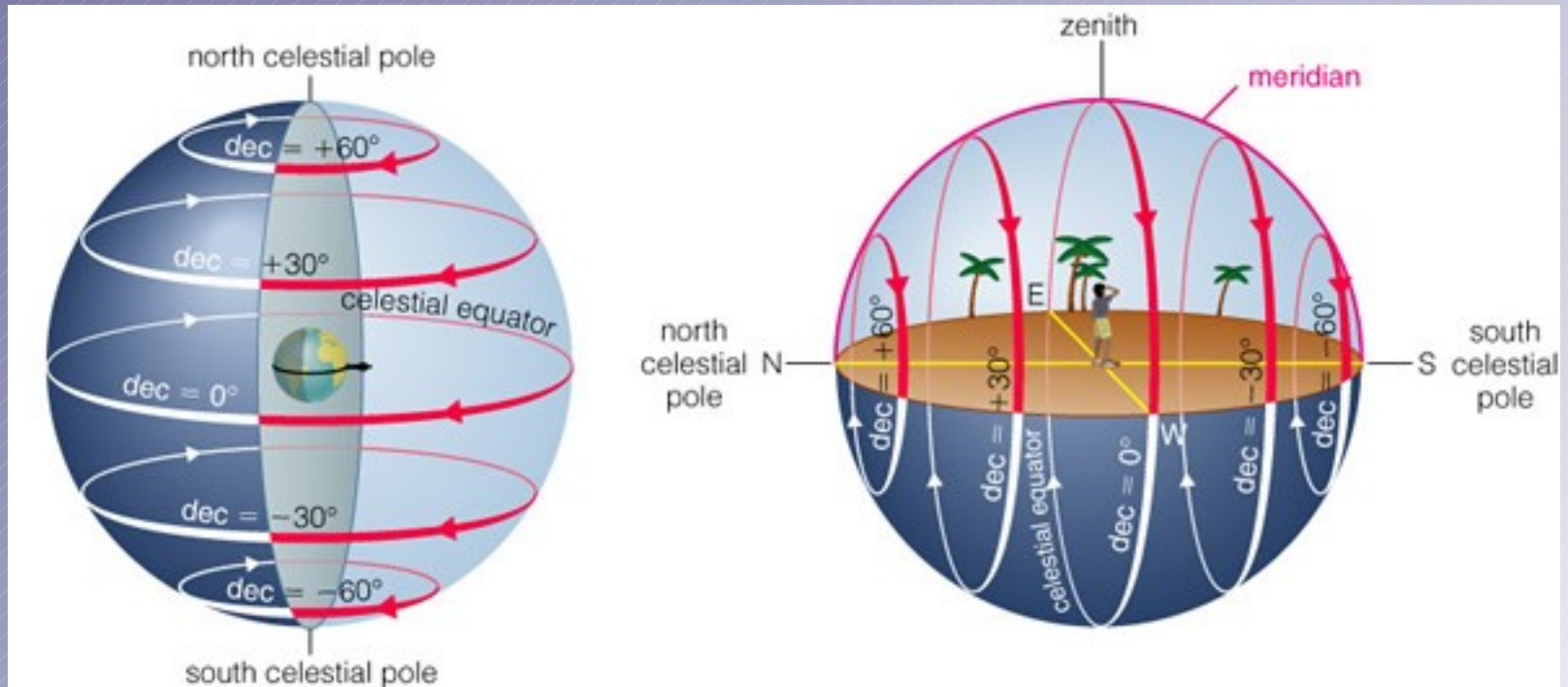
rising and setting

Understanding Local Skies



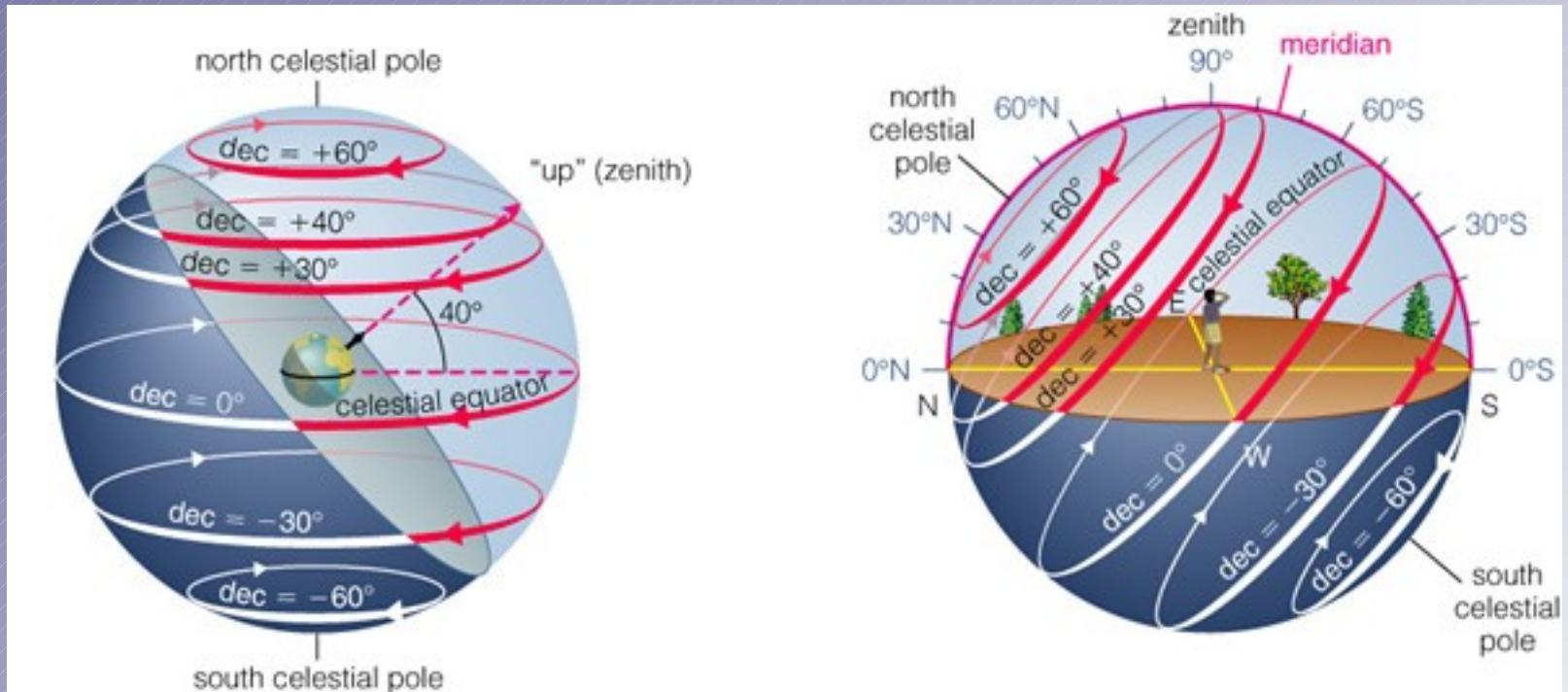
The sky at the North Pole.

Understanding Local Skies



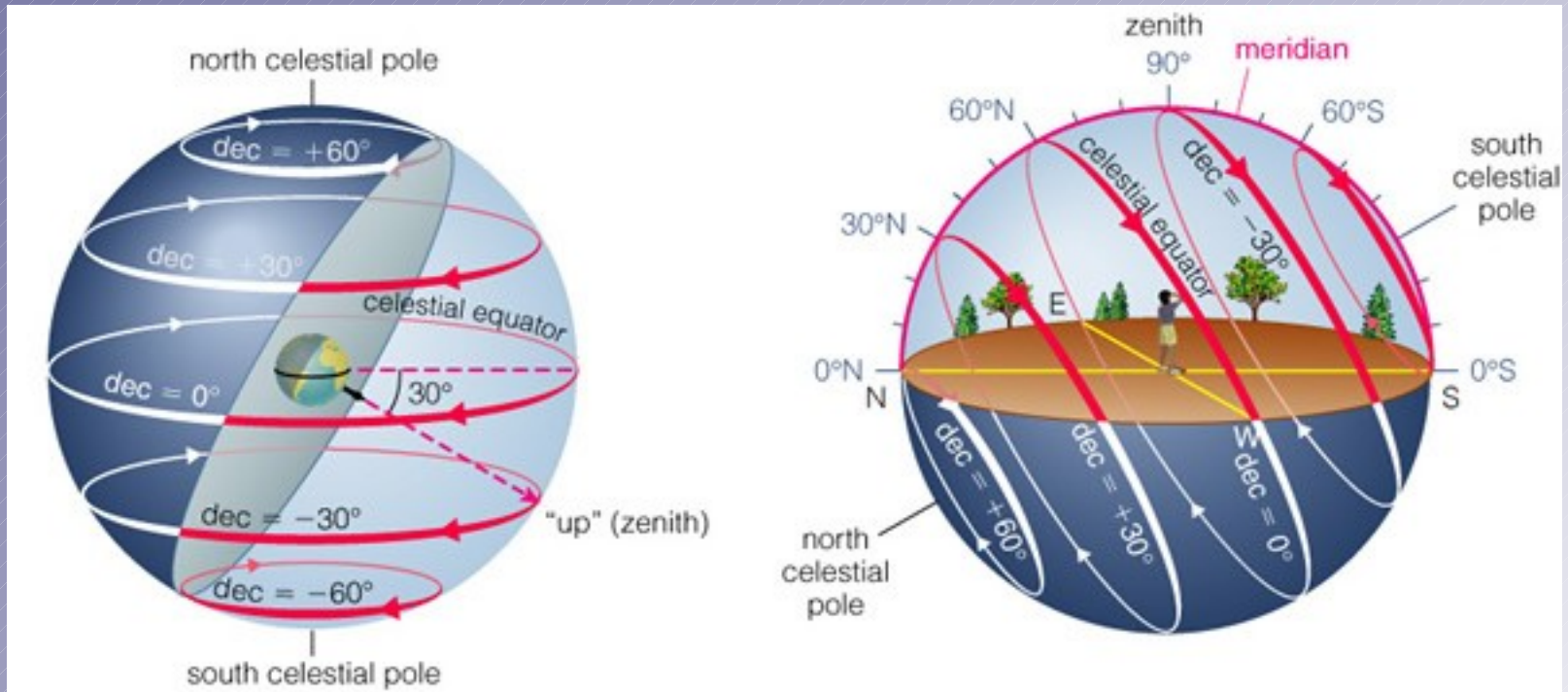
The sky at the equator

Understanding Local Skies



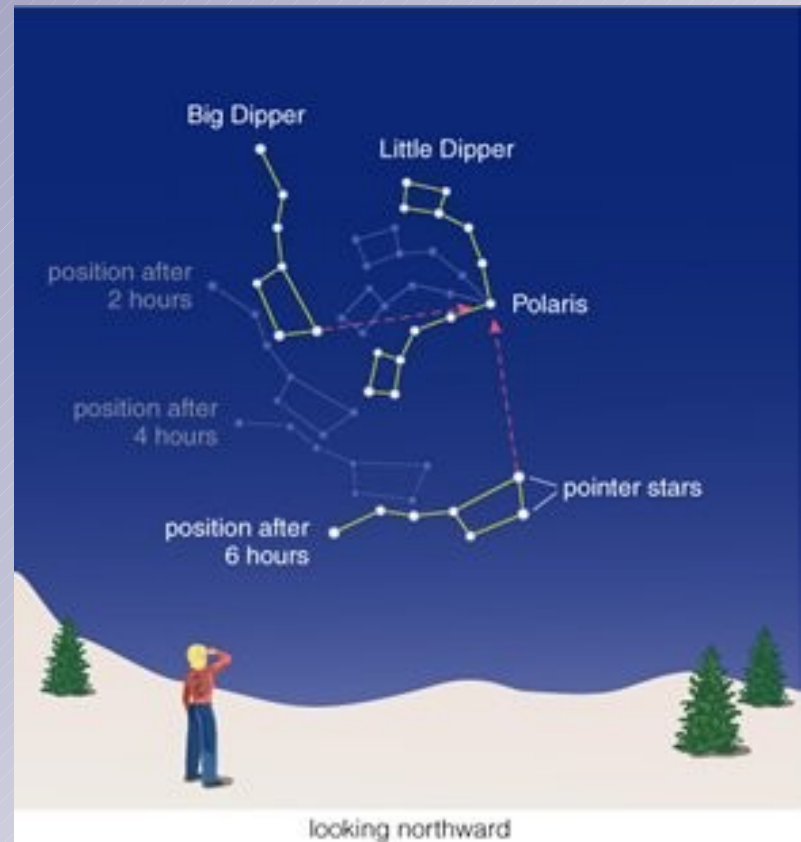
The sky at 40°N latitude.

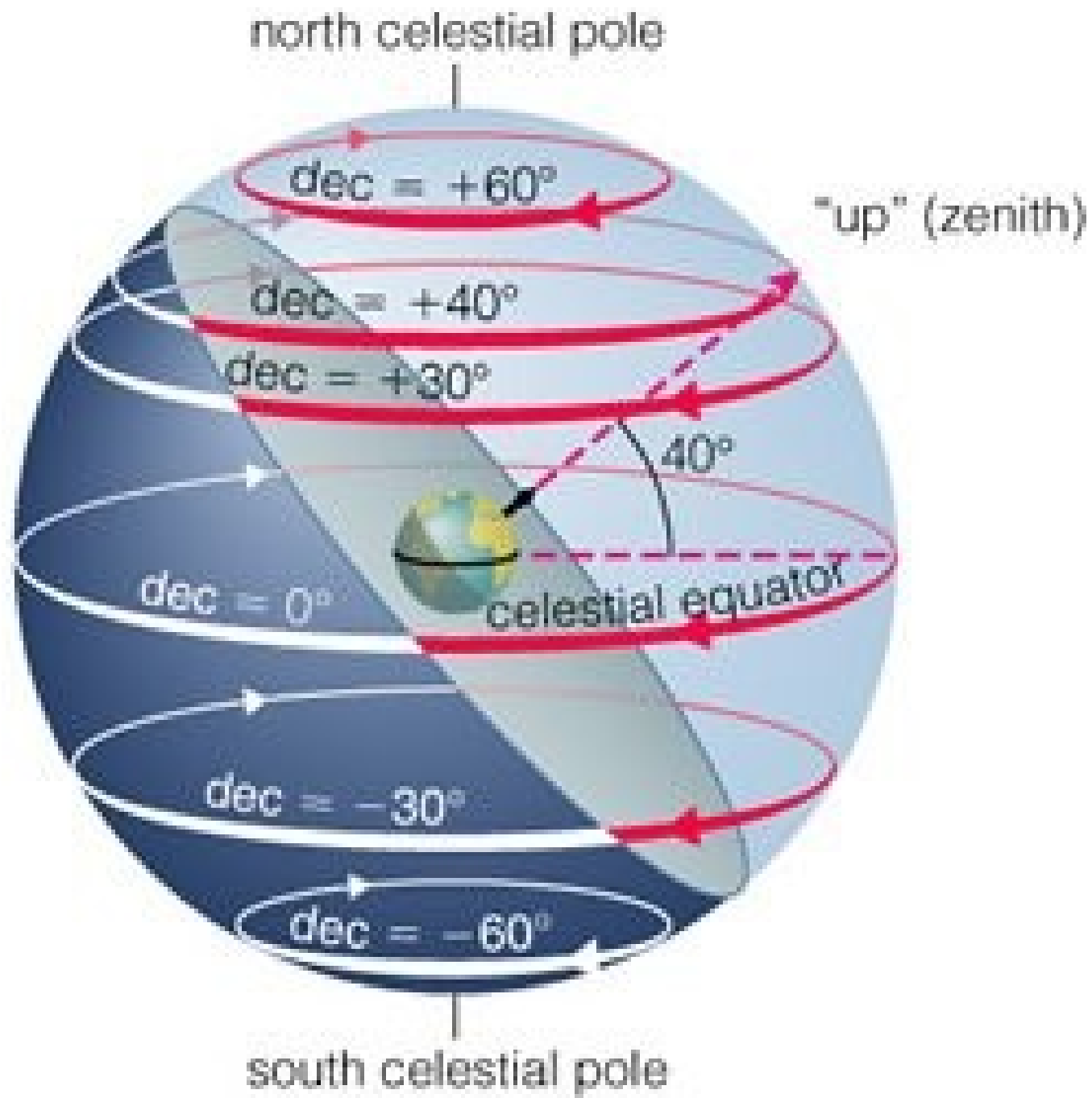
Understanding Local Skies



The sky at 30°S latitude.

The altitude of the celestial pole in your sky is equal to your latitude.





Examples

What is the altitude and azimuth of the rising sun on September 21?

Sept. 21 – sun rises due east

→ Altitude 0° , Azimuth 90°

What is its RA and Dec?

Sept. 21 – sun is in the fall equinox

→ RA 12h, Dec 0°

Examples

What is the maximum altitude and the azimuth of the sun on September 21 in Storrs?

Sun is the highest at noon local time – due south
→ Azimuth 180°

Sun is in the fall equinox – on the celestial equator
→ Altitude 48°

