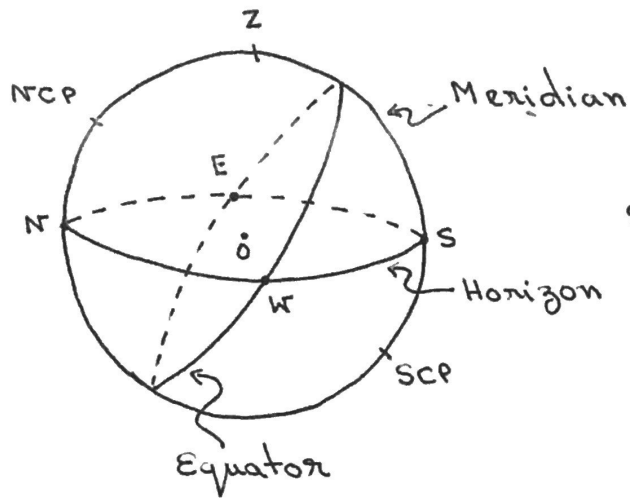


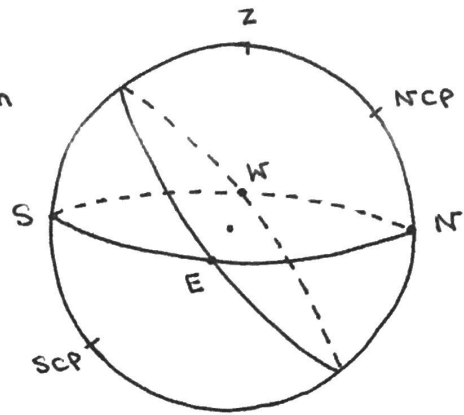
NIGHT SKY

Celestial Sphere

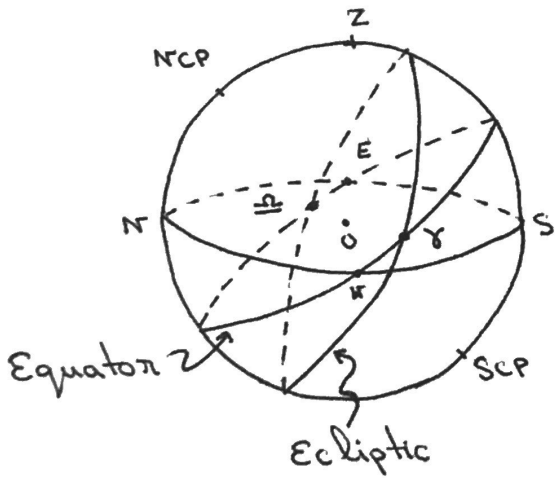
- Horizon : An imaginary circle where the sky meets the earth
- North Celestial Pole [P] : the point about which the whole celestial sphere appears to rotate
- Zenith [Z] : The point directly overhead
- Meridian : A great circle passing through the NCP and the zenith
- Celestial Equator : A great circle 90° from the NCP
- Cardinal Points :
 - North (N) and South (S) Points : Intersection of the horizon and the meridian
 - East (E) and West (W) Points : Intersection of the Horizon and the celestial equator
- A great circle has as its center the observer. (e.g. horizon, celestial equator, meridian). The observer is not at the center of a small circle.
- Altitude : angular distance above the horizon
- Altitude of the celestial pole = Latitude of the observer
- The celestial sphere is divided into 88 constellations. An asterism is a small group of stars (like the Big Dipper).



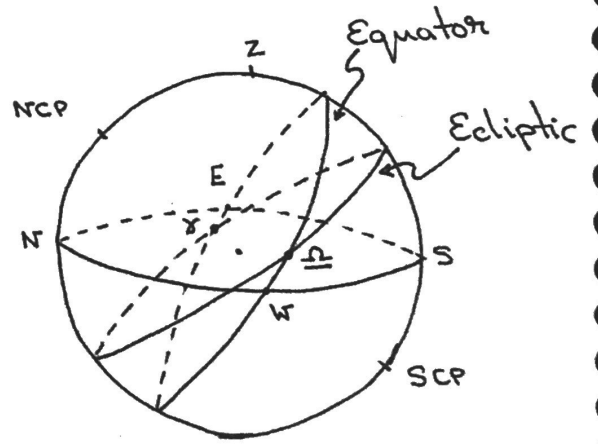
West Facing



East Facing



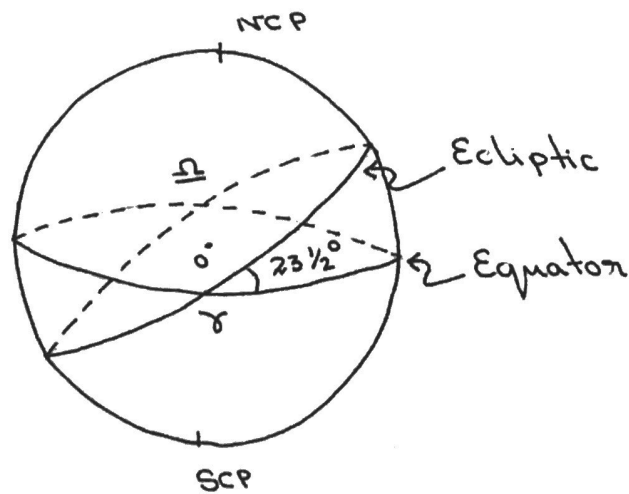
Vernal Equinox.



Autumnal Equinox.

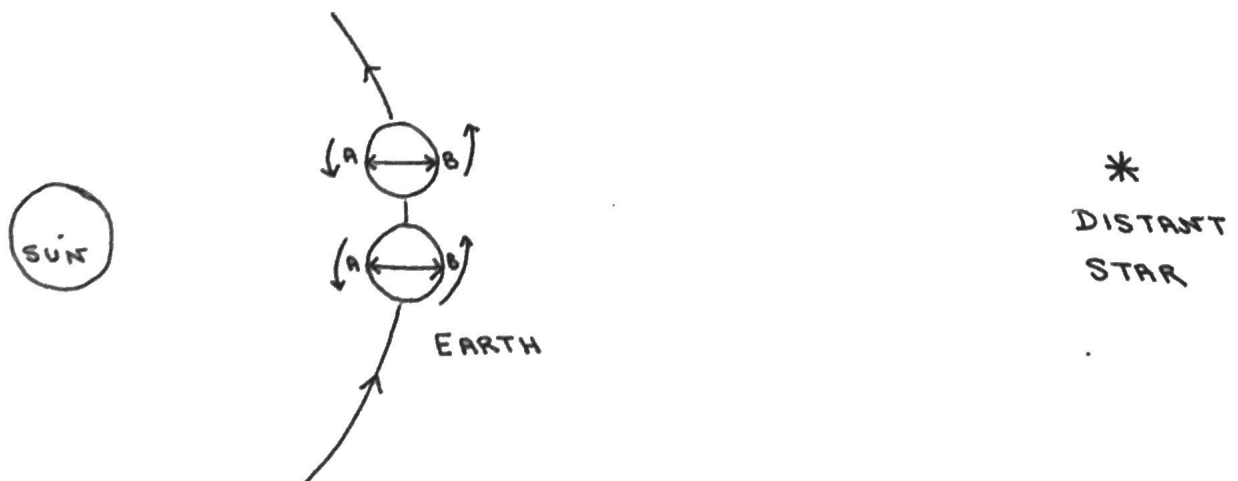
Path of the stars

- Most stars rise in the east and set in the west
- Some stars close to the north celestial pole neither rise nor set - called circumpolar stars
- Sidereal Time = time kept by stars
- A sidereal day is the time between two successive passages of a star across the meridian
- 1 sidereal day = $23^{\text{h}} 56^{\text{m}} 04^{\text{s}}$
But 1 solar day = 24^{h}
- Stars rise ~ 4 minutes earlier every day
 ~ 2 hours earlier every month
- 366 sidereal days = 365 solar days



Path of the Sun

- With respect to the background stars the sun moves west to east [$\sim 1^\circ$ / day]. The sun's path is a great circle called the ecliptic.
- The ecliptic is tilted to the equator by $23 \frac{1}{2}^\circ$
- The ecliptic intersects the celestial equator at
 - (i) Vernal Equinox [γ] : the sun moves from south of the equator to the north
 - (ii) Autumnal Equinox [Ω] : the sun moves from the North of the equator to the south
- Vernal Equinox : 1st day of Spring : 22 Mar
 Summer Solstice : 1st day of Summer : 22 June
 Autumnal Equinox : 1st day of Fall : 22 Sept
 Winter Solstice : 1st day of Winter : 22 Dec
- Zodiac : 12 constellations along the ecliptic
- Solar Time : the time kept by the sun
- 1 solar day : The average time between two successive passages of the sun across the meridian.
- Why is the solar day longer than the sidereal day?
 Because the earth revolves in the same sense as it rotates.



Coordinate System

- To find the position of a city on the earth we need 2 numbers - longitude and latitude
- To find the position of a star on the sky we need 2 numbers - right ascension (= longitude) and declination (= latitude).
- Right ascension is measured from the vernal equinox (west to east along the equator). It ranges from 0 hours to 24 hours [$360^\circ = 24h$]
- Declination is measured from the celestial equator either north (+ve values) or south (-ve values). It ranges from 0° to $+90^\circ$ in the northern hemisphere and 0° to -90° in the southern hemisphere.

- Position of the sun

	R.A.	Dec
Vernal Equinox	0h	0°
Summer Solstice	6h	$+23 \frac{1}{2}^\circ$
Autumnal Equinox	12h	0°
Winter Solstice	18h	$-23 \frac{1}{2}^\circ$

- When is the best time to observe a star ?

When the star is overhead (on the meridian) at midnight. [The difference in right ascension of the star and the sun is 12 hours]

- Which stars are circumpolar?

Stars having declinations $> (90^\circ - \text{latitude})$
 [True for the northern hemisphere]

