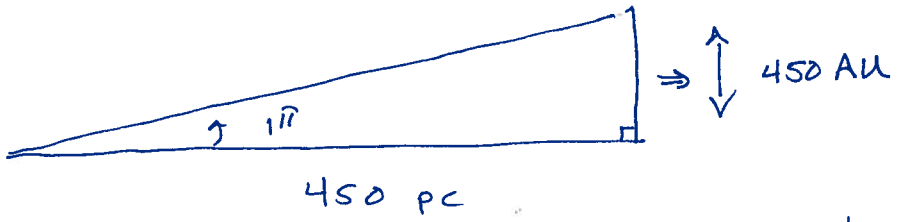
Parallax Example:

Defn.

etc.

So, If distance is in parsecs, then each $1''$ of angular separation corresponds to that many AU at that distance.

Example: The Orion Molecular Cloud is 450 pc from the Sun.



Each $1''$ corresponds to 450 AU at this distance.

Useful conversion:

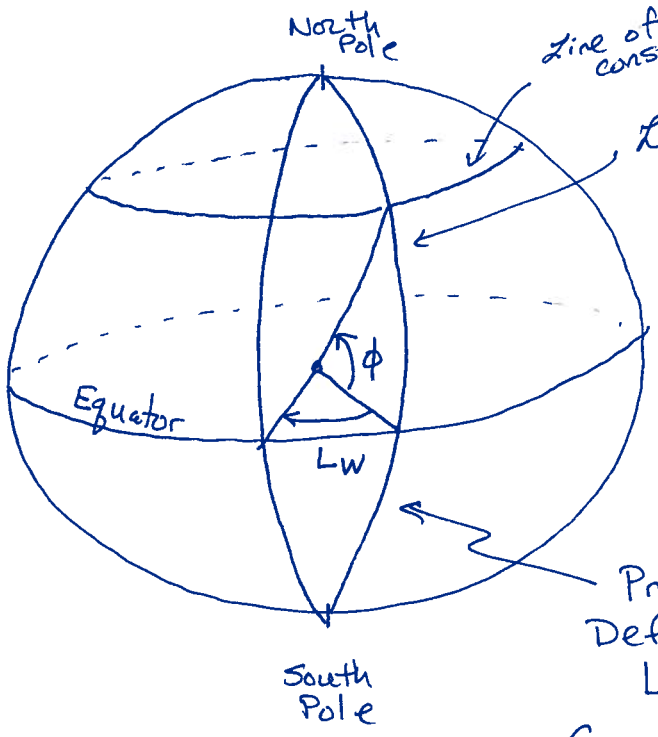
$$1 \text{ pc} = 3.086 \times 10^{18} \text{ cm} \times \frac{1 \text{ AU}}{1.496 \times 10^{13} \text{ cm}} = 206265 \text{ AU}$$

There are a little over 200,000 AU in 1 parsec.

Coordinate Systems

On the surface of the Earth, we use longitude
latitude

(L_W, ϕ)



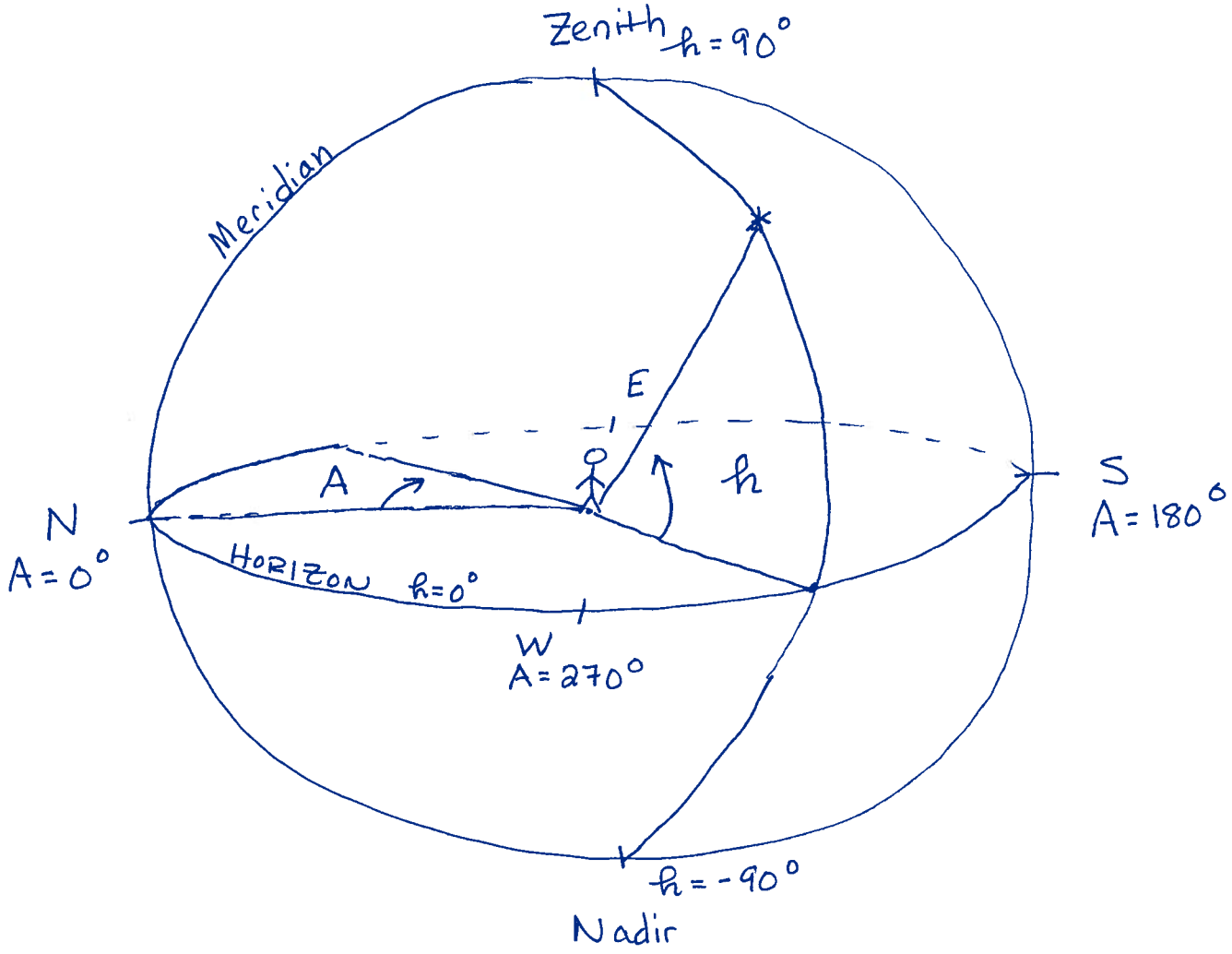
Prime Meridian
Defines
$L_W = 0^\circ$ goes through
Greenwich, England

Horizon System

(Alt - Az)

Azimuth, Elevation or Altitude

(A, h)

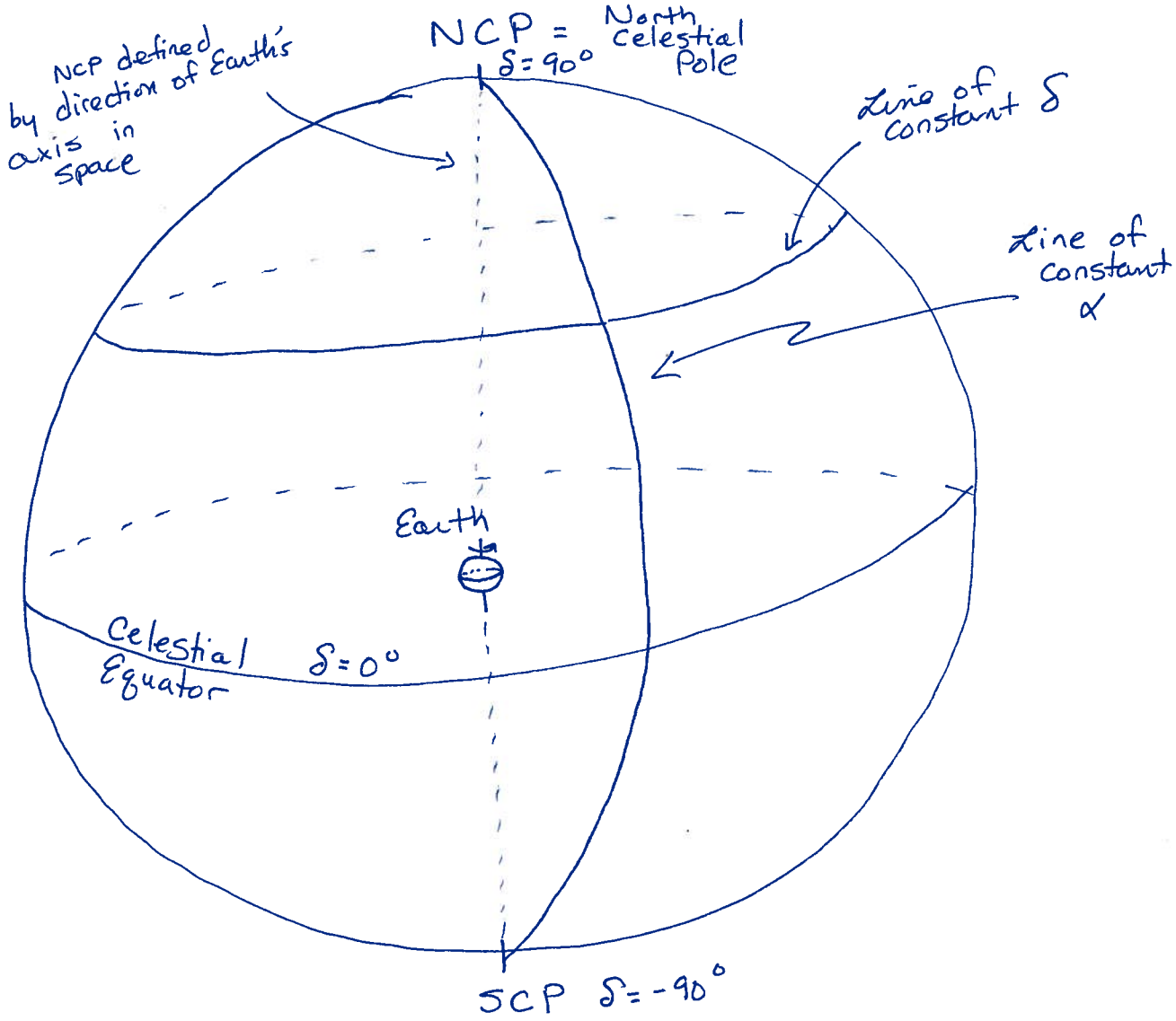


This is the coordinate system for an observer on the surface of the Earth.

Equitorial System

Right Ascension, Declination

(α, δ)



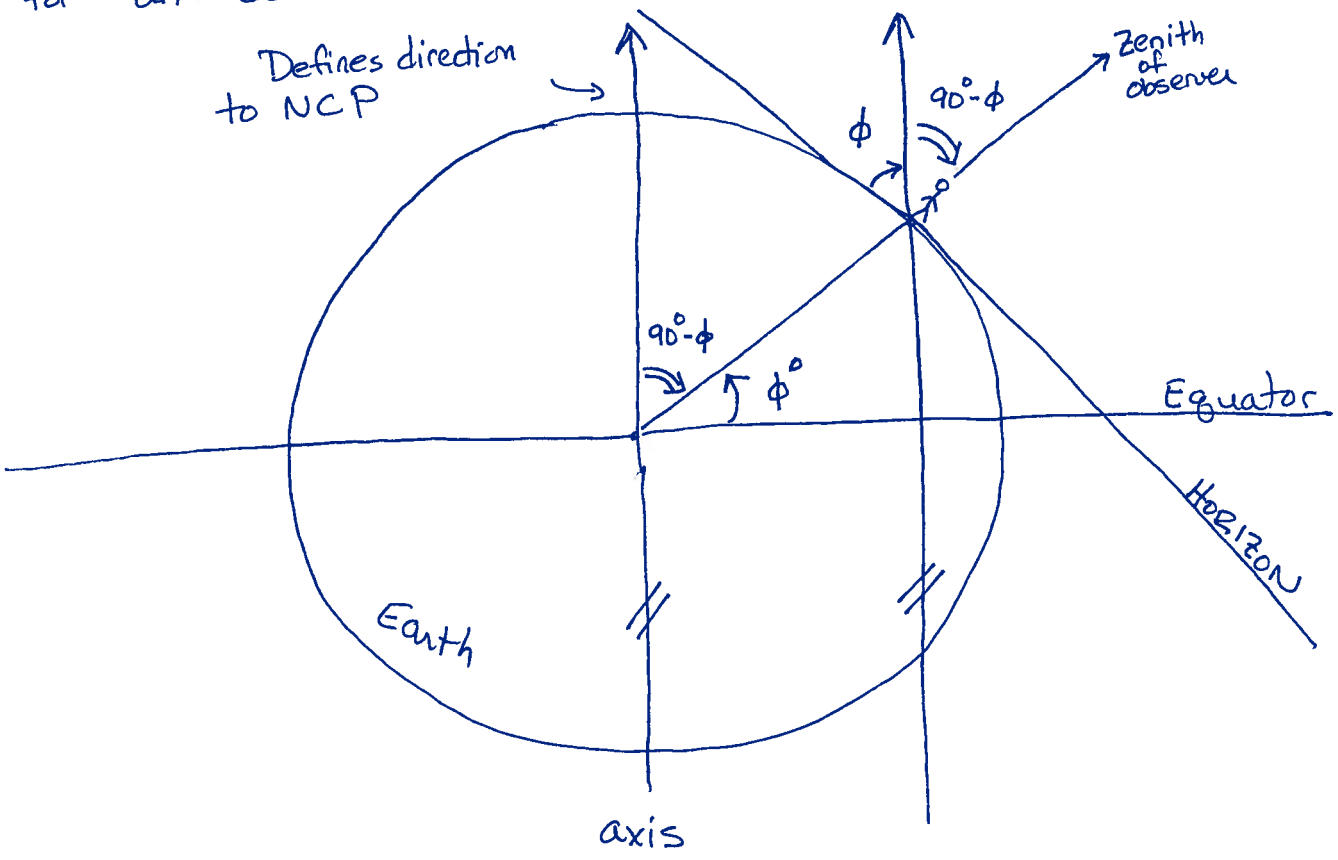
$\alpha = 0$ is defined by the point where the Sun crosses the celestial equator (The Vernal Equinox) γ

α has units of h, m, s

δ has units of $^{o}, ', ''$

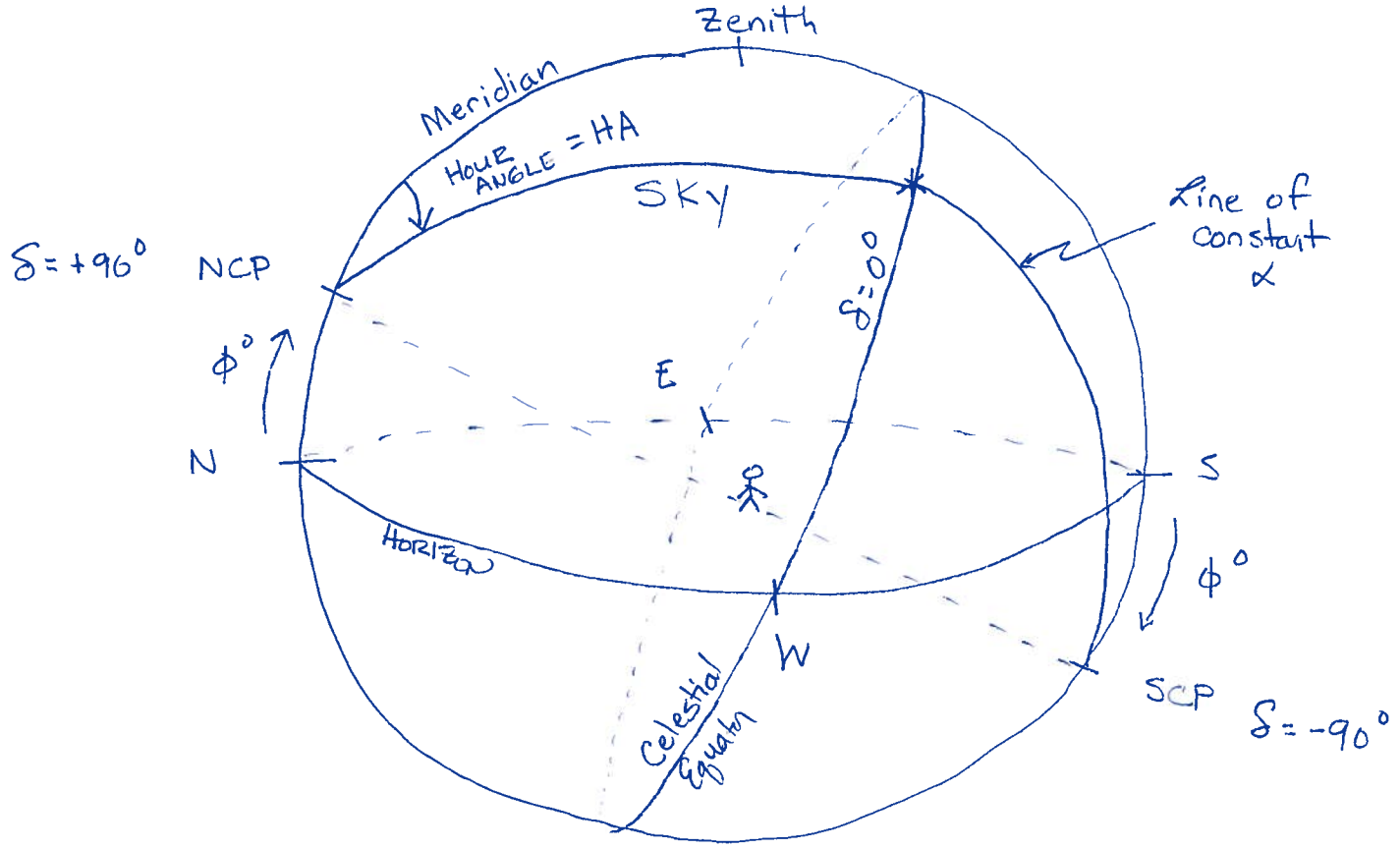
The Horizon and Equitorial systems are tipped with respect to each other.

How high is the NCP above the horizon for an observer on the Earth at (L_W, ϕ) ?



This diagram proves that the NCP is at an elevation of $\phi°$ above the observer's horizon in the direction of due north.

The Equitorial Coordinates are tipped by ϕ with respect to Horizon Coordinates:



Hour Angle ≡ HA ≡ the angle between the meridian and the line of constant α going through a source. HA is measured positive from ~~Zenith~~ the Meridian to the West.

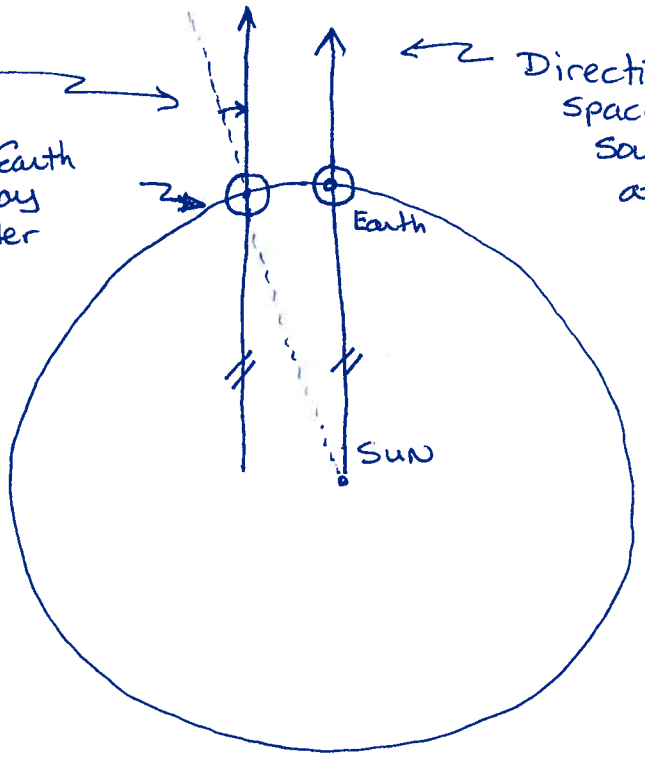
Because the celestial sphere appears to rotate with time due to Earth's rotation + revolution, we define

$$LST \equiv \begin{matrix}\text{LOCAL}\\ \text{SIDERIAL}\\ \text{TIME}\end{matrix} = HA + \alpha \quad \left(\begin{matrix}\text{units of}\\ h\ m\ s\end{matrix}\right)$$

So when $HA = 0$, $LST = \alpha$ LST tells you what α is currently transiting.

How fast does the sidereal clock run?

Since the Earth rotates around the sun, the ~~observer~~ source transits a little bit earlier than midnight the next day.



1 Tropical Year = 365.242190 days

But, with respect to the fixed direction in space, the Earth appears to have made 1 extra rotation.

So, $$\frac{1 \text{ sidereal sec}}{1 \text{ sec}} = \frac{1 \text{ day} + \text{TY days}}{1 \text{ TY days}}$$

$$= \frac{1 + 365.242190}{365.242190}$$

$$= 1.0027379093 \Rightarrow$$ The sidereal clock runs slightly <u>faster</u>.

If you add up this interval over 1 day (24^h), the difference is $3^m 56^s \Rightarrow$ Stars transit $3^m 56^s$ earlier each night!