

Resource: <https://calgary.rasc.ca/radec1.htm>

1 | Zenith:

- the point directly above you in the sky

2 | Local standard time:

- the solar time it is in your location
- be careful to account for daylight savings if you are using an modern day device to get your time

3 | Location:

- Described in longitude and latitude

3.1 | Longitude:

- Describes where you are in the east west direction
- it is a number between 0 and 180
- negative is western hemisphere
- positive is eastern hemisphere
- 0 is in Greenwich

3.2 | Latitude:

- describes where you are in the north south direction
- it is a number between 0 and 90
- negative is the southern hemisphere
- positive is the northern hemisphere
- 0 is the equator

4 | Meridian:

- the imaginary line that curves from the south point on the horizon to the zenith
- everything in the sky to the left of the meridian is rising (in your perspective)
- everything in the sky to the right of the meridian is setting (in your perspective)
- When a star, or some other celestial body is in line with the meridian it is at it's highest point, also know as the **Upper Culmination**

5 | Celestial Sphere:

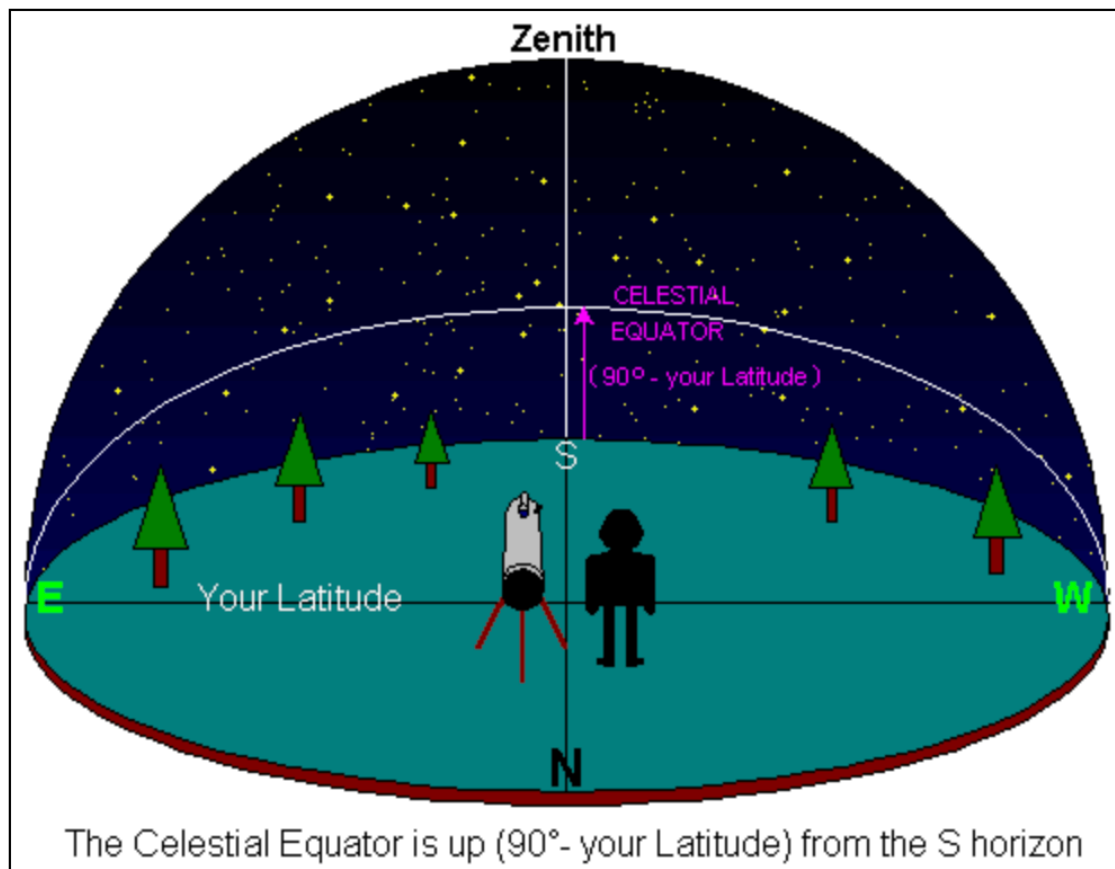
- can be thought of as the bubble around the earth with all of the stars

6 | North Celestial pole:

- where polaris is on the celestial sphere

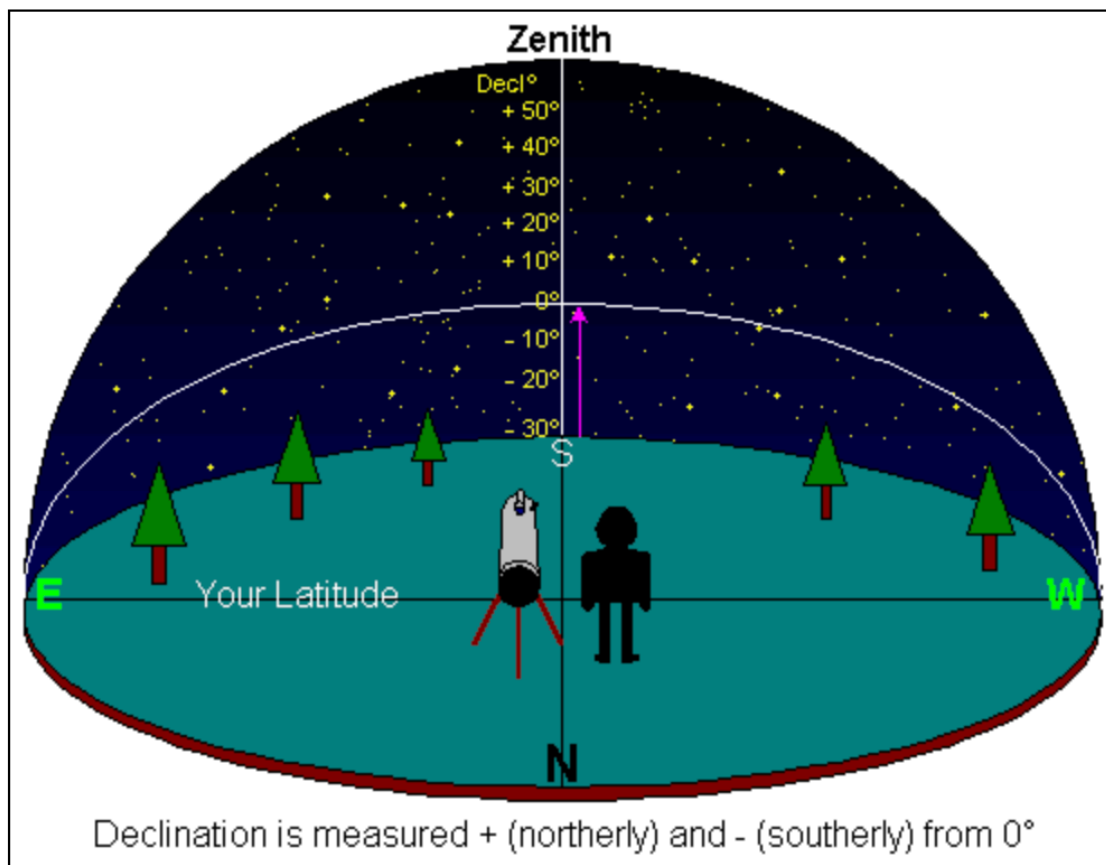
7 | Celestial Equator:

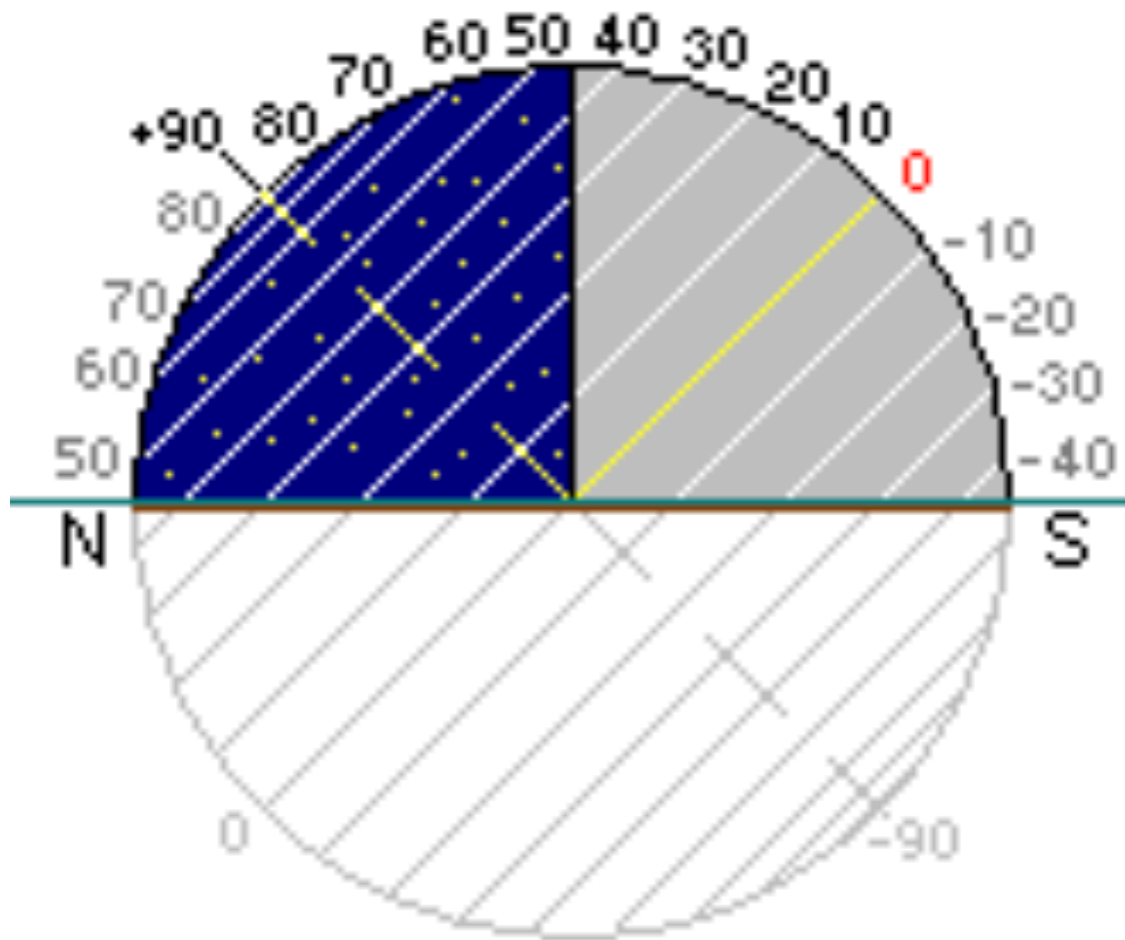
- if you extended the equator out into space "onto" the celestial sphere, then the circle that is made would be the celestial equator
- Everything north of the Celestial equator is called the **Northern Sky**
- Everything south of the celestial equator is called the **Southern Sky**
- the celestial equator is usually somewhere between the zenith and the horizon, this angle is defined by: $90^\circ - \text{your latitude}$



8 | Declination:

- the "y coordinate" or the "latitude" of the celestial coordinate system
- a number between 0 and 90
- 0° is where the celestial equator is in the sky
 - it is like the equator on earth, but for the stars
- Positive is northern sky
- negative is southern sky
- 90° is polaris





9 | Right Ascension:

- the "x coordinate" or the "longitude" of the celestial coordinate system
- but because the earth is rotating, the stars always seem to be moving, so instead of degrees the Right ascension is given in time (0-24h, where 0 and 24 are the same)
- Also called the hour angle
- the more east you go the higher the hour angle

10 | Azimuth:

- the compass direction of the star observation.
- if you have to turn clockwise/counterclockwise from north to see the star, it is that angle

11 | Altitude:

- the angular height of the star in the sky

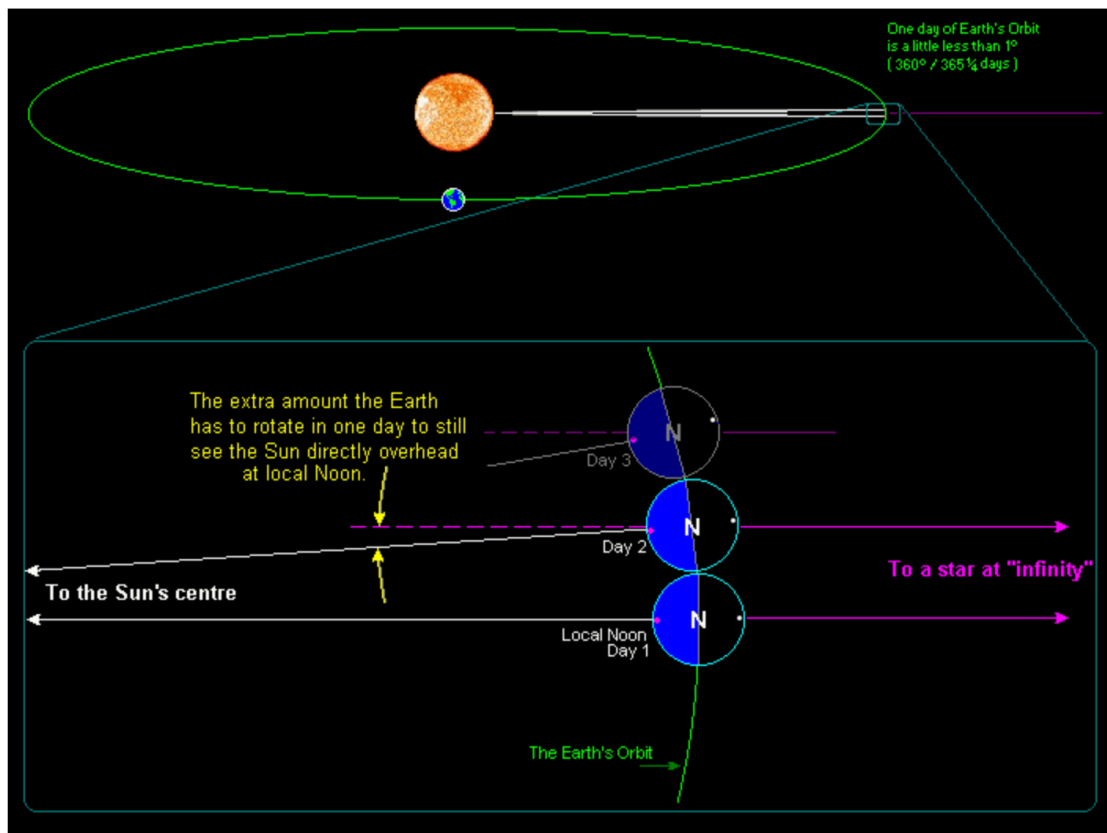
12 | Vernal Equinox:

- where 0 zero is for right ascension
- it also is also the point in the sky where the sun is at the spring equinox

13 | Local Mean Sidereal Time (LMST):

- the time that your meridian reads on the "right ascension axis"
- Can also be calculated with the Greenwich Mean Sidereal time (GMST) and your longitude

14 | Sidereal time:

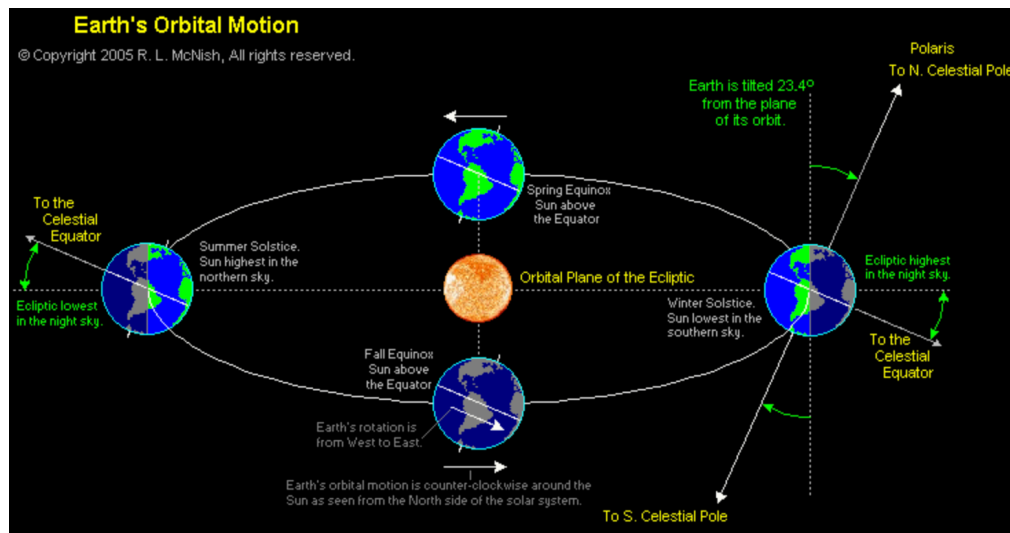


- The diagram above shows how the earth rotates a little more than 360 degrees each "day" (the sun getting to the same place it was the day before in the sky)

- because of this our 24h day is relative to the sun, not relative to the actual rotation of the earth
- in solar time the rotation of the earth takes about 23h 56 minutes, a **Sidereal Day**
 - this is also the time it takes the earth to rotate relative to a given star

15 | Ecliptic plane:

- the plane on which the earth orbits the sun on
- the rotation of the earth is tilted about 23 degrees relative to this plane
 - this tilt causes the seasons
 - In the summer the sun seems higher
 - In the winter the sun seem lower (see image below)



16 | Ecliptic:

- the great circle on the celestial sphere that the sun seems to follow over the course of the year.
- the ecliptic and the celestial equator intersect at two points: the **Spring equinox** and the **Fall equinox**
- Because the earth rotates at a tilt, the ecliptic seems to go up and down over the course of a day. See this link: https://calgary.rasc.ca/images/radec_ecliptic_anim.gif

17 | Polar View:

- all of the definitions above apply to when you are looking in the southward direction, if you are looking in the northward direction the rise and fall of stars is flipped (rise in the right, set in the left)
- it also means that some stars do not set
- because of this, some stars will pass your meridian two times a day.

- the time the star passes the meridian, at the lower point in the sky, is called the **lower culmination** of the star.
- see his animation for more info: https://calgary.rasc.ca/images/radec_polar_anim.gif

18 | East view:

- weird: https://calgary.rasc.ca/images/radec_rising_east_anim.gif

19 | West view:

- weird: https://calgary.rasc.ca/images/radec_setting_west_anim.gif

20 | Precession:

- the gravitational pull from the sun causes the earth's north south axis to "wobble"
- this means the celestial north pole will slowly pivot around a point called the **North Ecliptic Pole**



- note that at this moment, polaris happens to be the closest to the celestial north pole, but after thousands of years that will change and another star may be called the "pole star"
- completes one rotation every 25,700 years
- see this image for more info:

