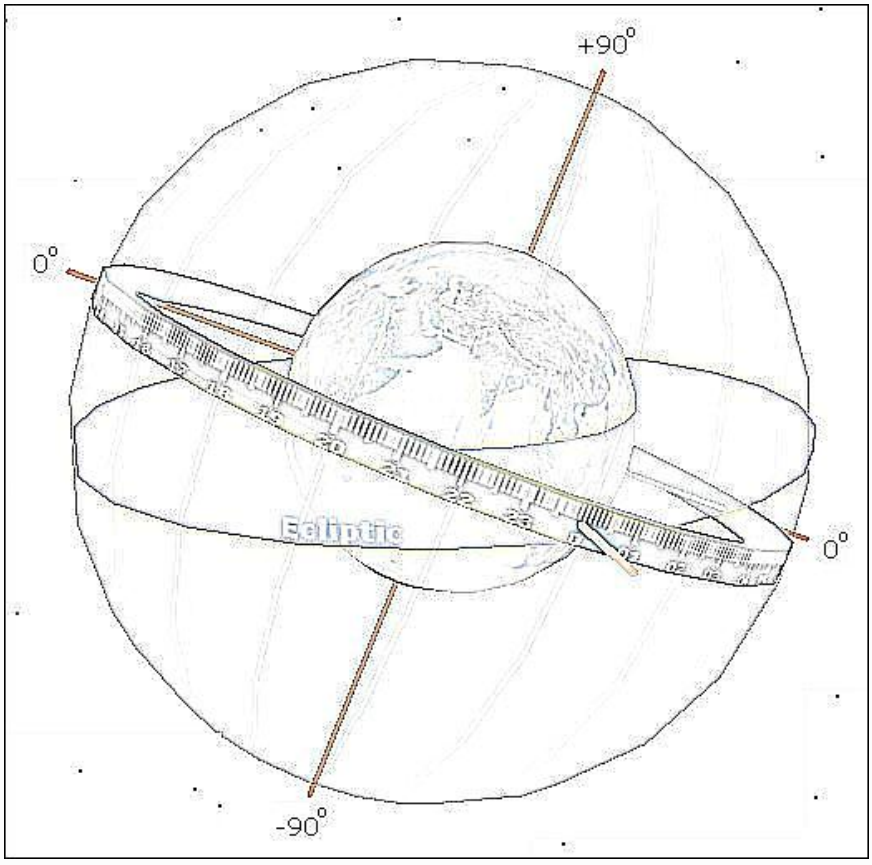
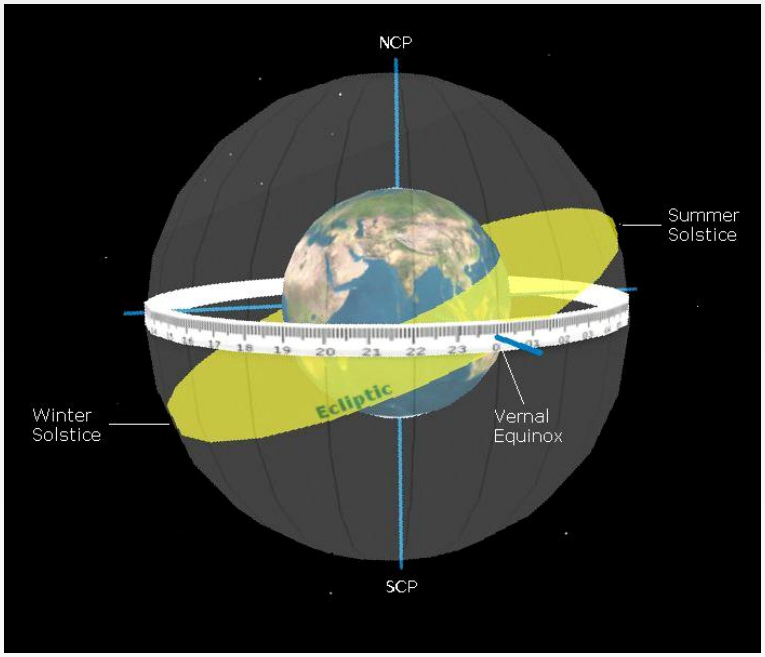
# Navigating the Night Sky





# Navigating the night sky

In the worksheets on Polar Alignment, you will have learnt how we achieve the equivalent of latitude for the night sky, and in these worksheets you will see how a system we call Right Ascension is used to effectively apply an equivalent of longitude. Looking at the diagram of the celestial sphere shown here you will now see that a scale has been introduced.



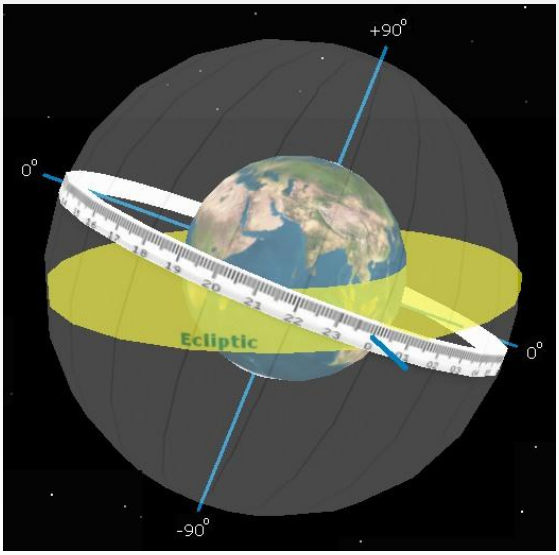

The zero point on this scale for celestial longitude, is known as a the Vernal Equinox. An equinox occurs when the axial tilt of the Earth lines up with the Suns equator, in other words the center of the Sun is in the same plane as the Earth's equator. From the diagram you can correctly deduce that an equinox occurs twice a year (around 21st March and 22nd September). The March Equinox marks the start of Spring, and is known as the Vernal Equinox, while the September Equinox marks the start of Autumn and this is referred to as the Autumnal Equinox; it is at these the points that both night and day have the "same length", or equal night, from which we derive the word equinox.

In the Northern Hemisphere it is at the Summer Solstrice that we experience the logest day around 22nd June. And correspondingly the shortest day occurs at the Winter Solstice around 22nd December; the term solstice deriving from "stand still";

With a telescope suitably polar aligned, you will be able to observe objects in the night sky by simply rotating the Right Ascension axis, while this will be just fine for those objects that can be seen with the marked eye, many objects in the night sky shine with a magnitude that is below the threshold of the human eye to detect. We can of course simply look at star charts and find such objects by their proximity to those that are visible, a more desirable method however would be to make use of the declination and right ascension co-ordinates.

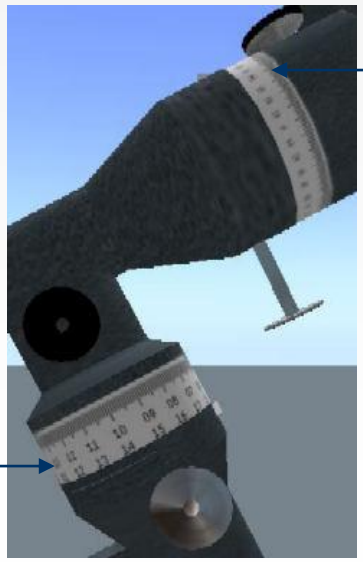
Imagine that we have now superimposed a sphere over the polar axis and celestial equator, now the position of any point on the surface of the sphere can be given with reference to the celestial equator measured through a 24 hour scale called right ascension and the angle between the celestial equator and the polar axis or declination. In the diagram below you can see that the polar axis has an angle value of +90° at the North Celestial Pole and –90° at the South Celestial Pole with the celestial equator set at 0°.

Looking at the Right Ascension axis represents a reference for stellar latitude co-ordinates, and you can see that it is measured in hours, minutes, and seconds starting at zero and extending through our 24 hour day, or 15 degree angles eastwards from the spring time intersection of the Sun's ecliptic path with the celestial equator known as the vernal (spring) equinox; you will find this is also referred to as the first point of Aries. The right ascension of a star is read from this starting point around the right ascension scale in an easterly direction. So a start wit ra of 3h 15 minutes would be this many divisions around the scale from zero.



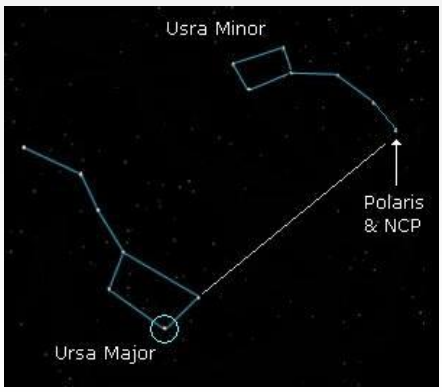

With the telescope balanced and Polar Aligned, you can start to use the equatorial mount in order to locate objects by their "Celestial Coordinates".

So let's take another look at those setting circles. To begin with notice that the Declination setting circle, that's the scale of 0 to 90 degrees is fixed to the mount, its set in place during manufacture. The Right Ascension setting circle however can be rotated; releasing any locks, you should be able to move it around by rotating it between your thumb and forefinger.




Select a circumpolar star; one does not set for your location. If you are living as I do at around latitude 50 degrees then an ideal candidate is β Ursa Major, or Merak as this is one of the two pointer stars to Polaris. The Celestial Coordinates for Merak can be reasonably rounded to: -

Ra:11 hours, 1 Minute and 50 seconds.
Declination: 56 degrees 23 minutes



In this exercise you will see how to select a target object then use its celestial co-ordinates to find other objects using the setting circles. The object that I will suggest for this exercise is Bodes nebula a magnitude 6.9 cluster very near to Ursa Major, which has the following celestial coordinates

Ra: 9 hours 55 minutes 33 seconds
Declination: 69 degrees, 3 minutes 55 seconds

1. Using the sufficiently loosened axis of the mount, adjust the telescope until Merak is cantered in the finder-scope or low power eyepiece.

2. Now quickly, because the star is moving (well, we know it's the earth turning really), rotate the RA setting circle to 11 Hours aligning it with the reference mark on the mount. Depending on the level of fine detail present on your scale you may be able to set slightly finer than this.

3. The declination of Merak is +56 degrees and 23 minutes, looking at your declination setting circle you should find that it does in fact read this value, assuming that is of course that the polar alignment procedure was correct.

4. First, to locate Bodes nebula Rotate in using ra, rotate the telescope about the ra axis until you reach 9 hours 56 minutes marker and lock the axis.

5. Now rotate the telescope about the declination axis until you reach 69 degrees marker and lock the axis.

6. You should now have the Bode nebula within the field of your finder-scope or low power eyepiece.

Is, if you have set up the mount properly. Now, moving quickly, because as the stars move across the sky, the R/A moves with them, find the coordinates of an object you wish to find, and move the scope on its two loosened axis' until both the R/A setting circle, (without touching the R/A circle) AND the Declination circle read the star's address. If you have done everything correctly, the object should be in or near the center of the eyepiece in the scope. You MAY need to move the scope around just a LITTLE to find the object, but it will be very near to where you are pointing the scope.