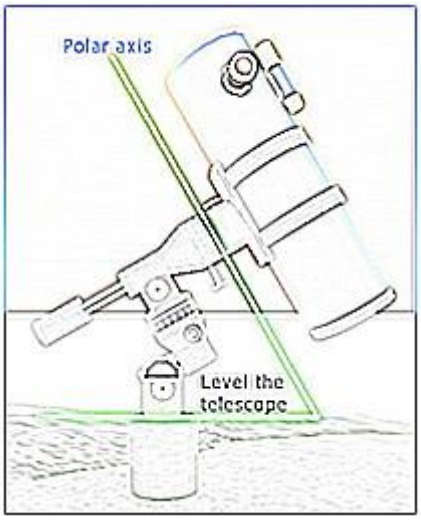
Aligning an equatorial mount worksheets

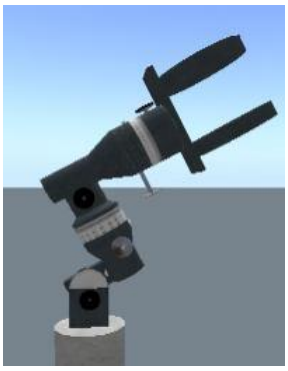


Setting the Declination Axis

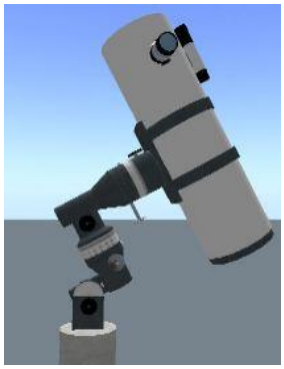
Here we are going to see how to mount the telescope and set-up the counterweights for smooth operation.

1. First of all secure the equatorial mount to its tripod or post.

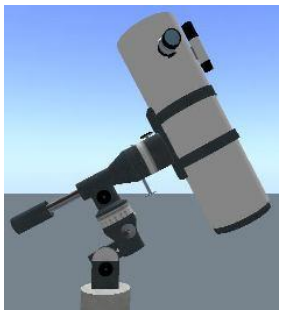
   To prevent rotation of the two axes during installation of the telescope and counter weights ensure the lock screws are tightened.



2. Now lower the telescope body into the cradle and secure the locking clamps.



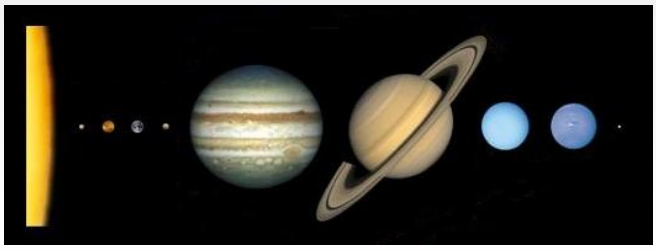
3. The counter weight shaft will either be a screw fit or secured by a locking nut into the equatorial mount. With the shaft in place, slide and set the counter weight onto the shaft.



4. As we are trying to achieve a smooth balance here, it's a good idea to attach any accessories that you are likely to have for normal operation, such as eyepiece and spotting scope. With everything in place adjust the counterweights on the shaft so that when the telescope of moved to any position it remains in place for each of the axis, by locking and releasing alternative axis

Polar Alignment

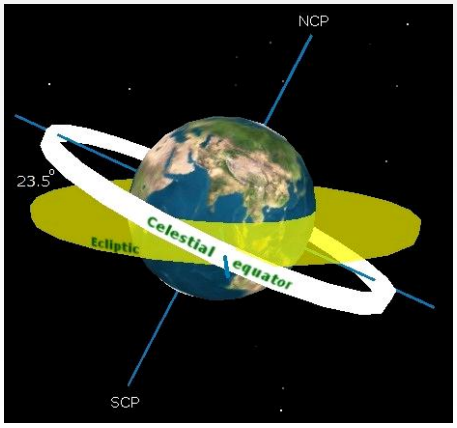
Lets begin by understanding the earths place in space. Like all the planets of the solar system the earth orbits the sun, and in the diagram below, where sizes are to scale but distances have been compressed, the earth is shown in its correct place, third in line from the sun. The planets are shown to be in line with the sun and can be imagined moving around on their orbital journeys as if resting on some vast invisible disk extending out from the suns equator, which we refer to as the **ecliptic**; in reality, you will come to appreciate that in fact not all planets are in fact sitting neatly on the imaginary ecliptic disk.



As well as moving around the sun, the earth and indeed all the other planets also have another rotation, about their polar axis. For the earth this polar axis is inclined at an of **23.4 degrees** to the ecliptic.

Where is the North Celestial Pole?

From the graphic here you can see how because the Earths poles are inclined at **23.5** to the ecliptic, the Earths equator extended into space, which we refer to as the **Celestial equator** marks that angle.



The **North Celestial Pole (NCP)** is the point in the sky directly above the Earth's North Pole, and so is that point in the sky around which all the stars in appear to rotate. Fortunately the NCP is very close to the star **Polaris** otherwise known as the **North Star** in the constellation of **Ursa Minor**, the **Small Bear**. For general polar alignment purposes, you may consider the NCP equates to the position of Polaris.

Lets take some time here to clarify some of these new facts

North Celestial Pole (NCP) and the South Celestial Pole (SCP) – are simply the North and South poles of the Earth extended into space.
Celestial Equator – This is the Earth's equator, again, extended into space.
The Ecliptic – This is the apparent path of the sun.

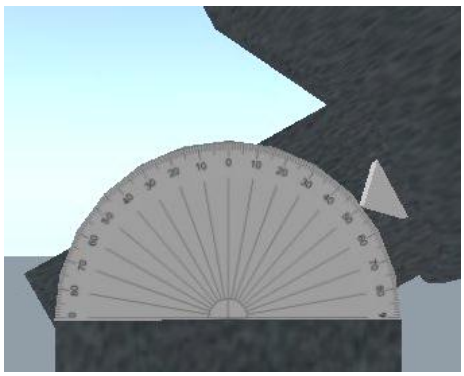
Finding the correct Latitude

Correct polar alignment is key to using an equatorial.

Before using the your telescope with an equatorial mount the telescope needs to be set-up in relation to the earths axis. It's important to appreciate the fact here that polar alignment is achieved by moving the polar axis of the telescope or the mount itself, and does not involve moving the telescope on the mount.

To begin using a spirit level, set-up your mount with the top as level as possible. If your telescope has tripods you can adjust the leg lengths until you get it quite level.

The next task will be to find your current latitude, if you are not sure, then the EarthTools web site at http://www.earthtools.org/ is as satisfactory way an any, simply zoon in to your location and read off the location details. Provided you do not change your location in relation to latitude this will be a one-off exercise.



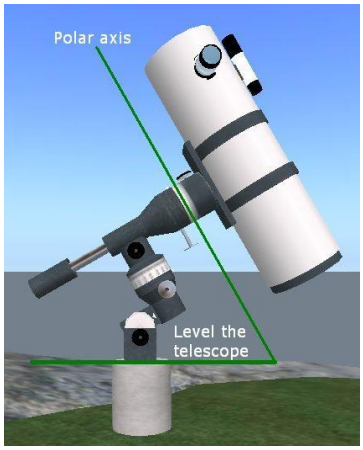
Having found your current latitude, adjust the telescopes Latitude scale and to the elevation equal to your latitude.

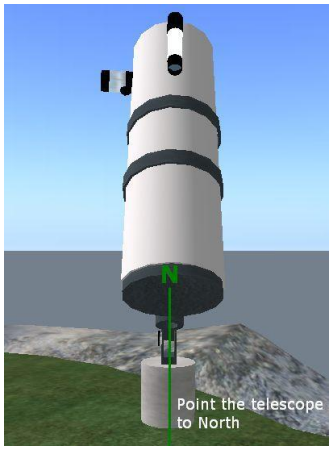
Here I have set my latitude to 50 degrees.

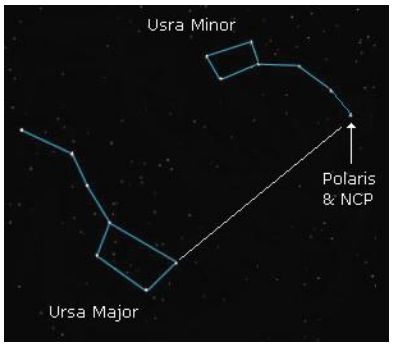
Polar alignment for a session

As you become experienced and so more demanding in your observing sessions, accurate polar alignment becomes increasingly important aspect, however for short period observing of say 1 to 2 hours, polar alignment can be achieved easily and in the space of a few minutes.

With the telescopes latitude set and the instrument level, now physically manoeuvre the instrument until its polar axis is pointing North; The polar axis can be visualised as an imaginary line drawn through the centre of the mount at an angle of 90-degrees to the counterweight shaft.



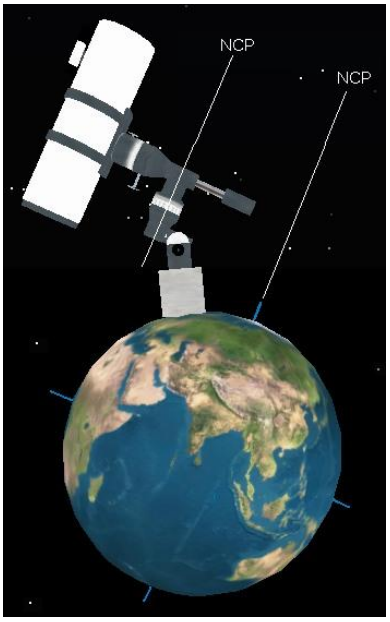




Unless you know where North is for your location, you will require a compass for the activity. Now set the declination axis to 90 degrees with the counterweight pointing down, and now with both axis locked make final adjustments to the telescope to position until the pole star is at the center of the eyepiece.
Some equatorial mounts feature a site hole in the mount to facilitate direct viewing to the celestial pole.

The diagram right shows our telescope on its equatorial mount, located on the earth at latitude 50 degrees, facing north. As you can readily see now both telescope and the earth's polar axis are pointing to the North Celestial Pole.

Now by rotating the right ascension slow motion the other stars and stellar objects should appear to rotate with your telescope.



Polar alignment summary

Your telescope should now to all intents and purposes be pointing to the NCP.
And now some very important operations considerations

- Do not move the base of the mount once it has been aligned
- Do not allow the counterweight to be positioned higher than the scope tube, as it can slide down and damage the scope or mount.
- If you feel the counterweight is going to become higher then the scope, then turn the scope around on the mount, and reposition rotate the telescope tube.
- The Polar Axis must always point to the North Star Polaris.
- Take care the eyepiece does not fall while rotating the telescope.