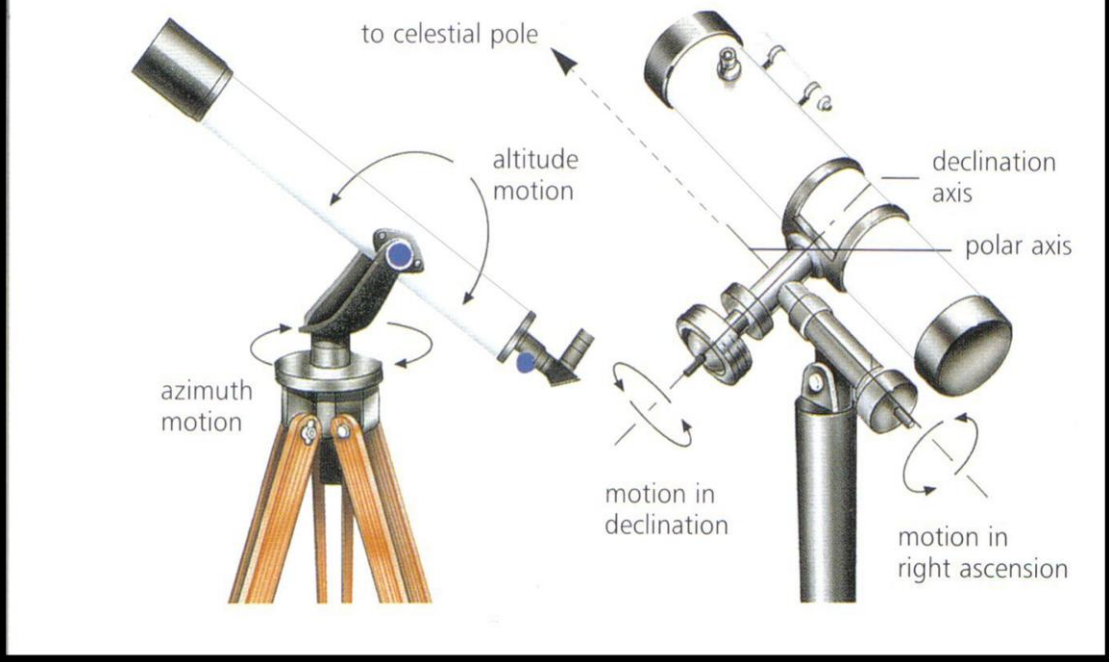

Setting Up - Latitude and Longitude
Newbury Beginners
18th May 2022
Steve Harris

There are two types of telescope mounting
Alt / Azimuth and Equatorial



The Equatorial makes it easier to track objects

The telescopes in the diagram above show the Alt / Az type mounting on the left and the Equatorial Mounting on the right.

We can see the Azimuth rotates east (left) and west (right). The Altitude moves the telescope up and down.

On the Equatorially mounted telescope, on the right, the Azimuth axis (now called Right Ascension or RA) is tilted to align with the axis of rotation of Earth.

Fortunately for us in the northern hemisphere the star Polaris is very close to where the Axis of Earth points to on the sky (North Celestial Pole).

This makes it easier to align the RA axis on the Equatorial Mounting to the North Celestial Pole.

By driving the RA axis at 1 rotation every 24 hours the telescope rotates at the same speed as Earth rotates on its axis.

This is very useful in that the telescope can follow any object by adjusting this one axis. The Altitude Axis is called Declination (Dec) on the Equatorial Mounting.

So we can point the telescope at an object and the mounting can then track that object.

Altitude / Azimuth (Alt-Az) or Equatorial

The Alt-Az type mount does not need to be aligned
Normally this type of mount is manually pointed
They can be rotated 360º to the right or left
Can normally be elevated from ~ -10º to ~ +100º
It is difficult to drive and track objects on two axis

The Equatorial type mount needs to be aligned
It needs to be levelled and orientated to North
It also needs to be set up for the users location
Once set up it can track by adjusting one axis
This makes it a lot easier to drive mechanically

The Alt – Az mounting can be set down on any flat and reasonably level surface and will be ready to use almost immediately. It is usually moved manually to find the object to be observed and then track the object as it moves across the sky.

An Equatorial mounted telescope needs a little preparation before it can be used for observation. Firstly it does need to be levelled using the adjustable legs on the tripod. It also needs to be aligned with the Celestial Pole (this is close to the star Polaris in the constellation of Ursa Minor – the Little Bear). This involves setting the Dec axis to the appropriate angle 51.4º for the Newbury area. Setting the Dec angle only needs to be done for the first set up at the usual observing site.

Mountings for a telescope tube assembly come in two basic types (1) an Alt / Azimuth Mounting and (2) an Equatorial Mounting.

The Alt / Azimuth Mounting has a simple horizontal rotating axis and a Altitude mount to allow the telescope tube to be pointed up and down.

The advantage is that it is simple but it requires simultaneous movement in both axes to track an object as it appears to move across the sky.

To overcome this problem the horizontal axis ‘Azimuth’ is tilted to the same angle as Earth so just this axis needs to be rotated. We call this an Equatorial Mounting.

In this Equatorial Mounting the Azimuth Axis is called ‘Right Ascension’ (RA) and the Altitude Axis is called ‘Declination’ (Dec).

Setting up my Equatorial Mounted Telescope

The telescope above is my 120mm aperture refracting type telescope.

This means it uses a 120mm (5 inch) lens to gather and focus light into the eye.

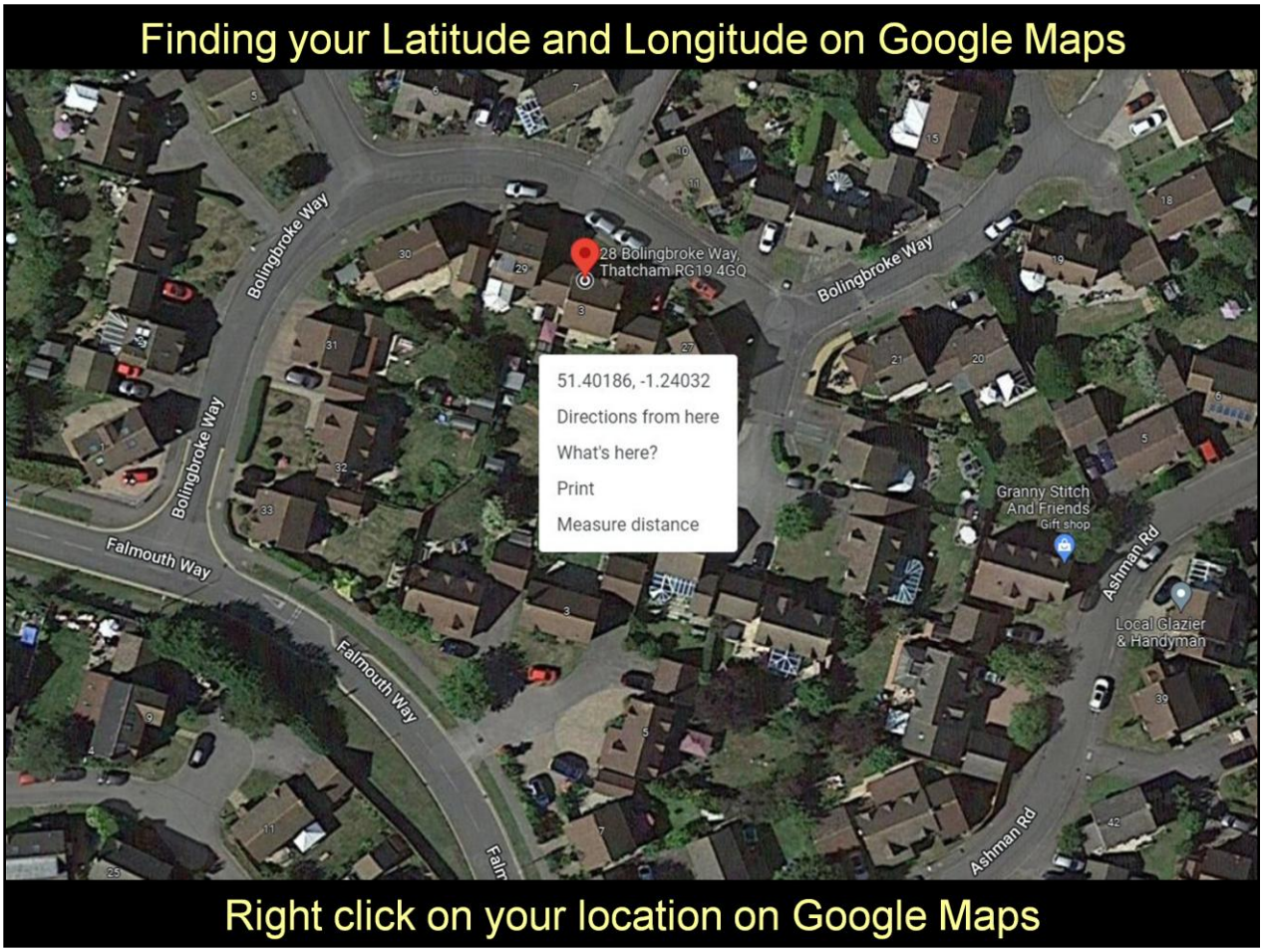
The telescope optical tube is mounted on an EQ5 Equatorial Mounting.

This design of Equatorial Mounting is called a ‘German Equatorial Mounting’.

It has a tilted axis that allows rotation east to west (known as Right Ascension or R.A.).

Mounted on this axis is another shaft that provides up and down movement (Declination or Dec).

This type of Equatorial Mounting requires a counter balance weight opposite the telescope tube.



Before setting up our Equatorially mounted telescope we must identify our location.

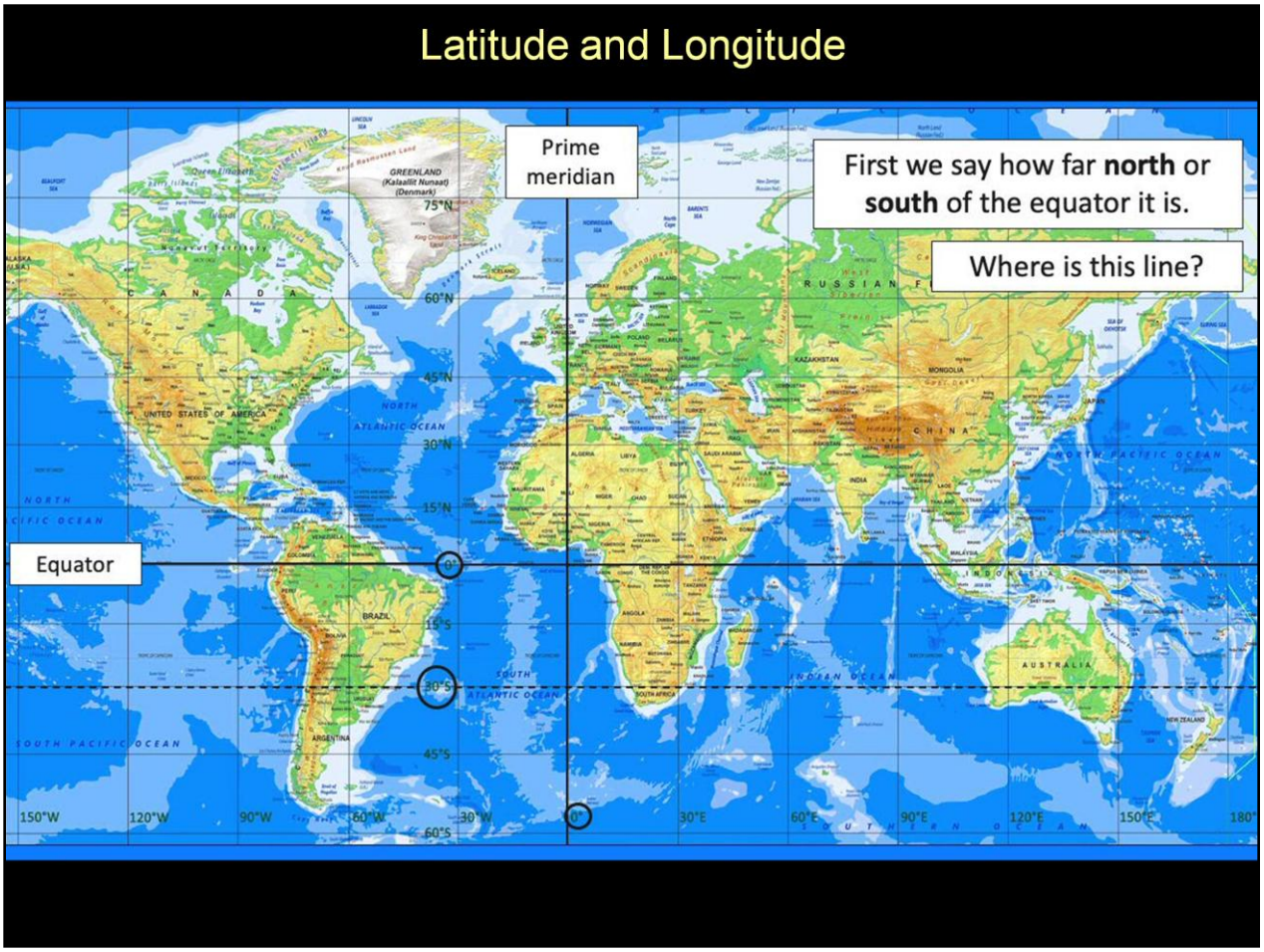
This is very easy to do using Google Maps.

First enter your observing location using the postcode or just find it on Google.

Right Click on the exact spot where you will be using your telescope.

Your Latitude and Longitude location coordinates will be displayed in a box as shown above.

Latitude (north – south) 51.40 and Longitude 1.24 west of Greenwich, London.



We need the Latitude location to enable us to set up our Equatorial Mounting.

The actual latitude from Google was 51.40186º but we just need 51.4º for the Newbury area or even just 51º for simple optical observing.

This Latitude location is our distance (Newbury) in degrees from Earth's Equator.

Therefore our Latitude location is 51.4º North of Earth Earth's Equator.

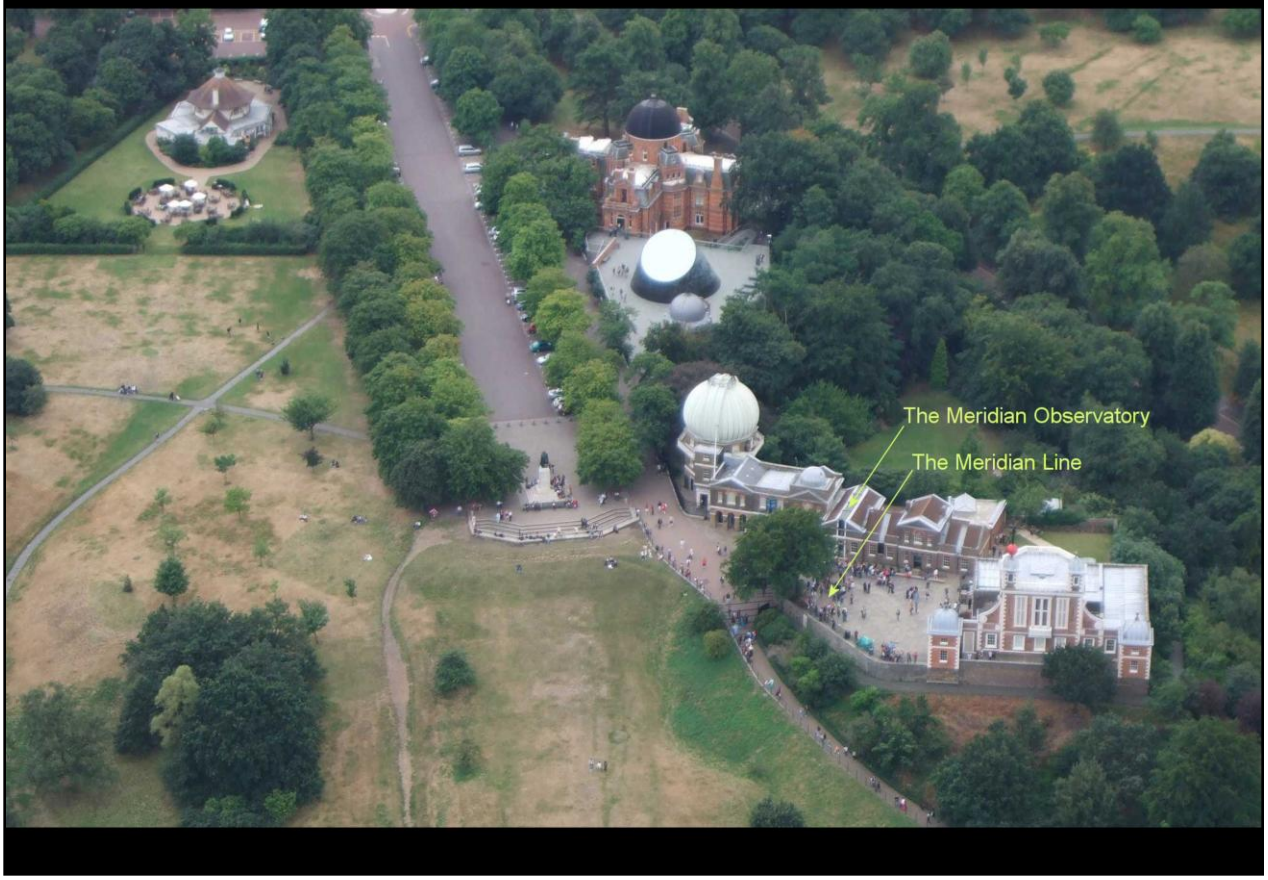
The zero for Longitude is measured from a line that passes through Greenwich, London.

Newbury is 1.24º west of Prime Meridian (0º) at the Royal Observatory Greenwich.

The map above shows the Greenwich Meridian marked in red, top to bottom.

The Meridian passes through the Royal Observatory in Greenwich Park.

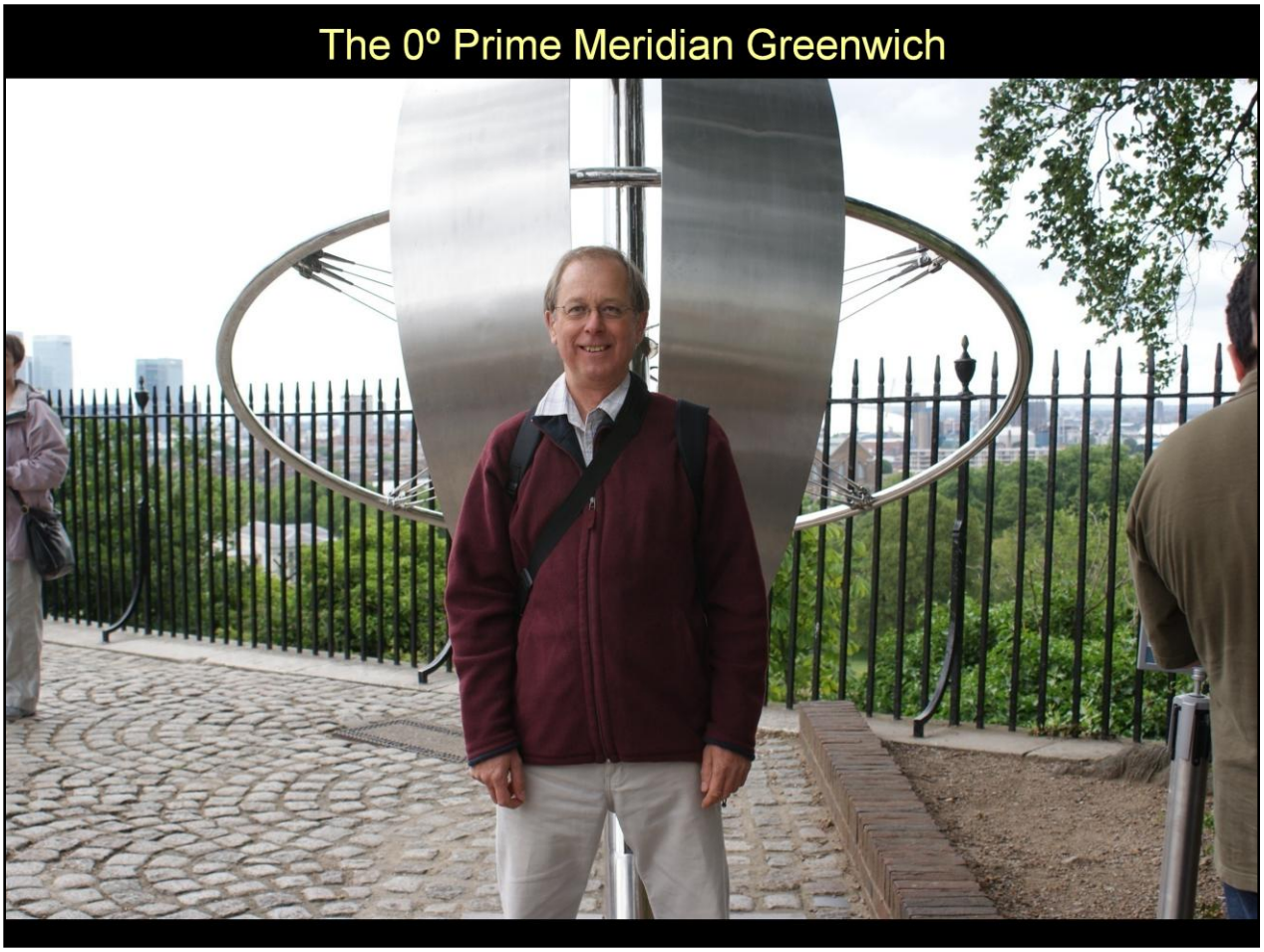
The Royal Observatory Greenwich



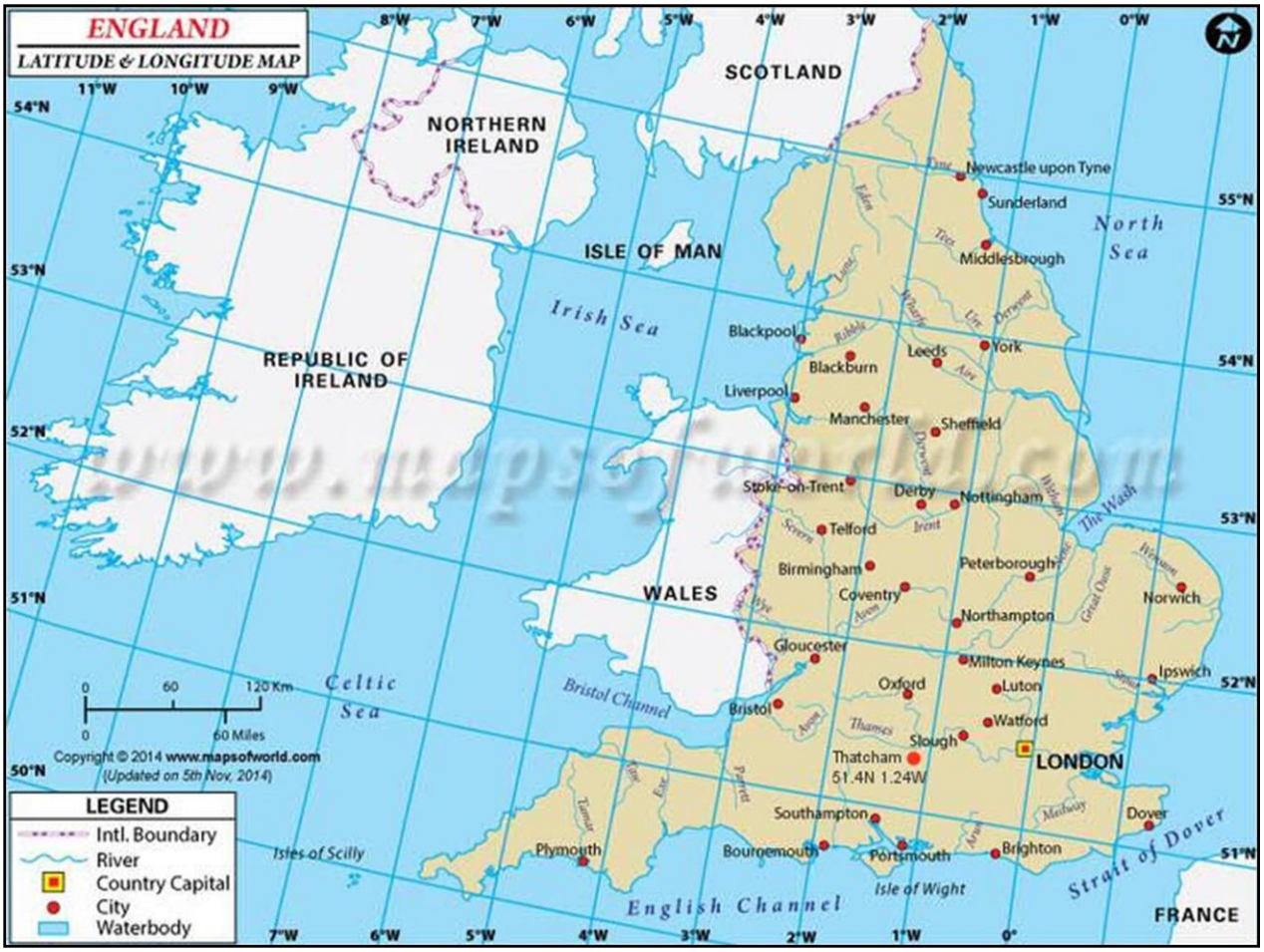
The Royal Observatory is shown in the aerial photo above.

The Meridian Transit Observing Telescope Observatory is arrowed.

There is a line representing the notional ‘Prime Meridian’ marked in the courtyard outside the Meridian Transit Observatory for the public to see.

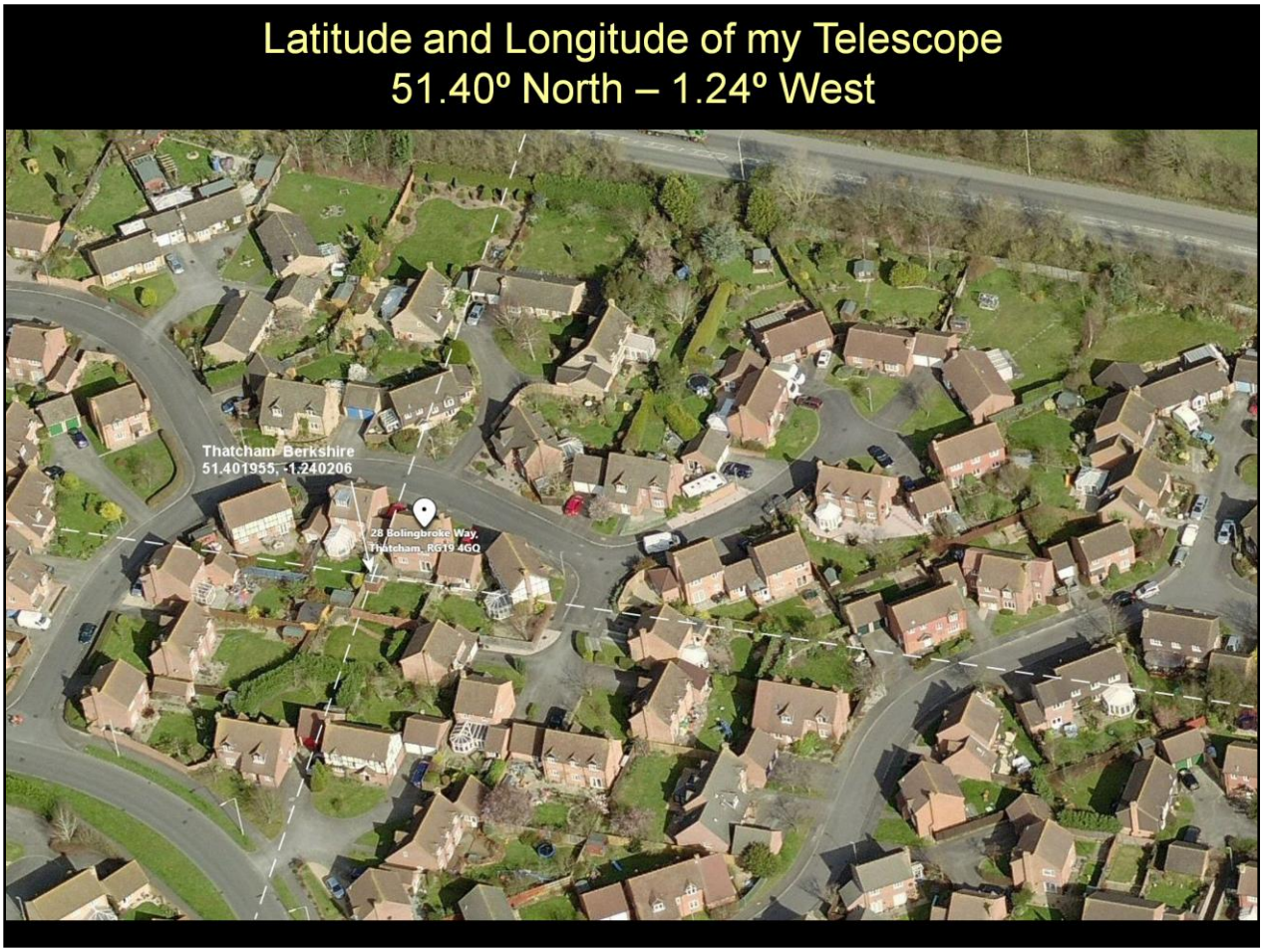


Members of the public can stand on the Meridian Line with one foot in the west and the other foot in the east.



The Latitude and Longitude grid is show on the map of England above.

Thatcham / Newbury is marked on the map at 51.4º North and 1.24º West of Greenwich.



My telescope is set up on my patio at grid coordinates shown above.

My Equatorial Mounted Telescope

My Skywatcher 120mm aperture refracting type telescope set up on the patio.

The telescope optical tube is mounted on an EQ5 Equatorial Mounting.

So let us have a look at the setting up process.

Equatorial Mount

This is a closer view of the Equatorial mounting.

This example is called EQ5 where the larger the EQ number the heavier and more robust the design of the mounting will. This ranges from EQ2 (the simplest) through to EQ6 (the heaviest).This example has electric motors on the RA and Dec axis.

The simple but flimsy EQ1 type are not supplied now.

Aligning the Equatorial Mount

First thing to do is set the tripod up in its approximate observing position.

Turn the tripod around until the ‘N’ mark is pointing to the North Pole.

This tripod has a location tooth for locating the Equatorial Mounting.

The mount will be located in the recess where the compass has be positioned.

Levelling the Equatorial Mount

A bubble gauge can be used to level the tripod as shown.

This may need to be done again if the adjustable tripod legs have to be raised or moved.

If we are to do visual observing the alignment and levelling does not need to be very accurate.

Fitting the Equatorial Mount to the Tripod

Equatorial Mounts have a location diameter that fits into the top recess on the tripod.

Generally there is a screw thread and hand nut to secure the mount to the tripod.

The tripod shown in this presentation has a location tooth at the North position.

The picture on the right shows the mounting securing hand nut at the top with the tripod leg spreader and its tightening hand nut at the bottom of the threaded rod.

Fine ‘RA’ adjustment of the Equatorial Mount

The EQ5 Mount used in this presentation has a very useful extra feature built in.

In the image above there is a fine adjustment for aligning the Mount more accurately.

It has just enough adjustment to allow the mount to be swivelled to create a useful alignment fine adjustment.

The two legs towards the south of the tripod can then be aligned with the east / west patio slabs.

Using the fine adjustment the Mount can be slewed enough to align the mounting north / south and locked.

This allows the telescope to be quickly and simply aligned by just aligning the tripod legs to the patio slabs.

Setting the Equatorial Mount Latitude (51.4º N)

After fitting the Equatorial Mounting to the tripod the Latitude set-up must be done.

This is required to ensure the Right Ascension (RA) axis is aligned to the Celestial North Pole.

The Celestial North Pole is located close to the star Polaris in the Constellation of Ursa Minor (the Little Bear).

A Lock Screw is used to release the latitude adjuster.

Then the screws can be used to set the dial to align with the 51.4º position.

The Latitude is then locked and will not need to be moved unless observing is to be from a different location.

More accurate adjustment can be carried out by aligning on the Pole Star if needed.

The telescope shown above has been set up with the RA axis pointed to the North Celestial Pole.

Tin the image the telescope tube is pointed towards the south.

This telescope has a limited right/left adjustment using the two knobs to rotate the EQ Mount position.

With this adjustment the two tripod legs can be simply aligned with the patio slabs.

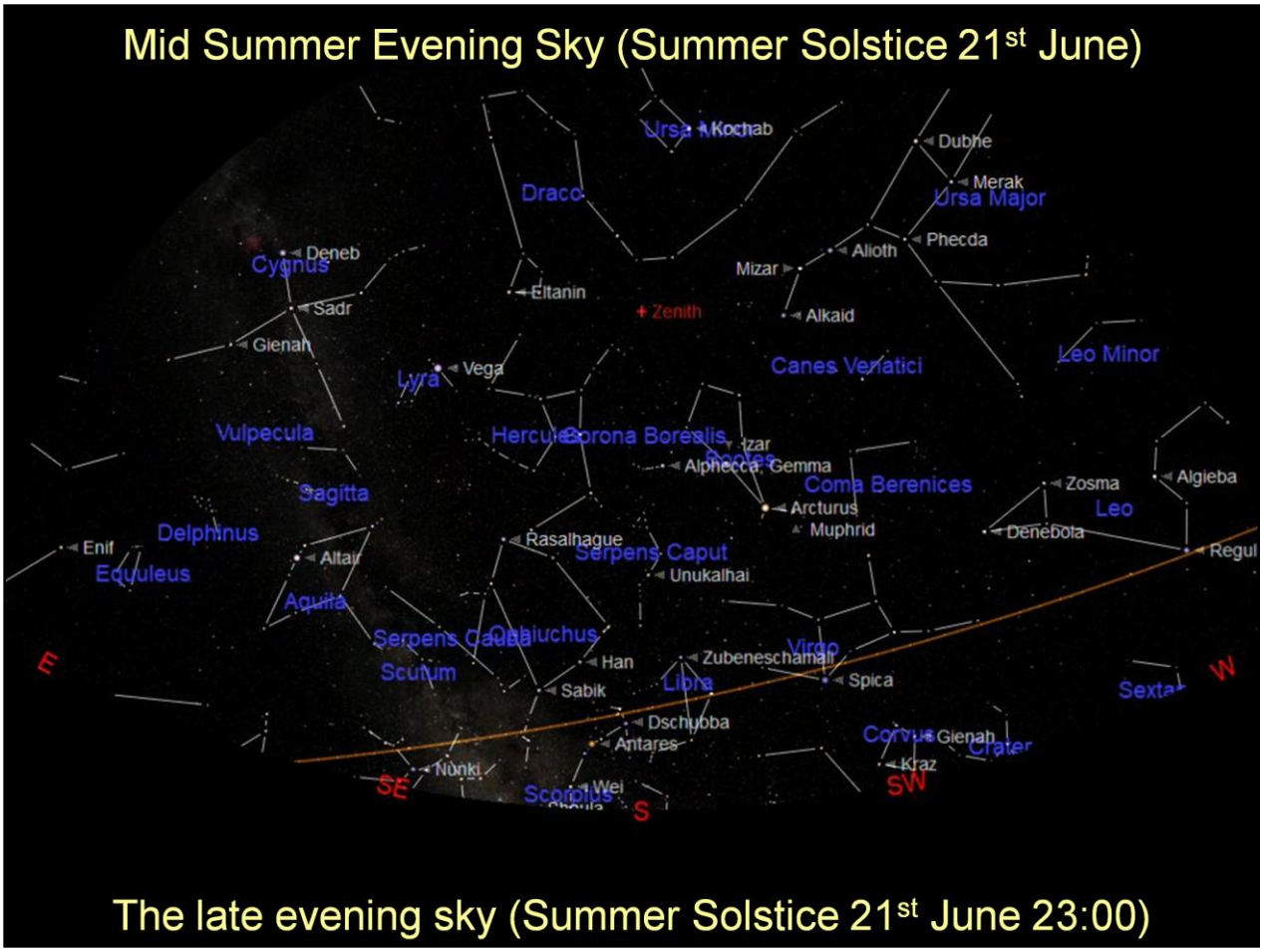
The telescope can then be set down in the same place without the need to realign every time.

It is essential to be comfortable and steady when using a telescope so sitting down is the best way to use a telescope.

If it is not possible to sit and observe it is useful to have the back of a chair or the handle on a set of steps to lean on and help stop us swaying around.

Also remember to start observing dressed in warm clothes it does get colder at night even during the summer.

Remember it is difficult to warm up after we have become very cold so it is best to start warm and stay warm.



The imaginary line along which the Sun, Moon and planets appear to move across the sky is called the ‘Ecliptic’.

During the summer nights the Ecliptic appears very low in the night sky as can be seen in the image above.

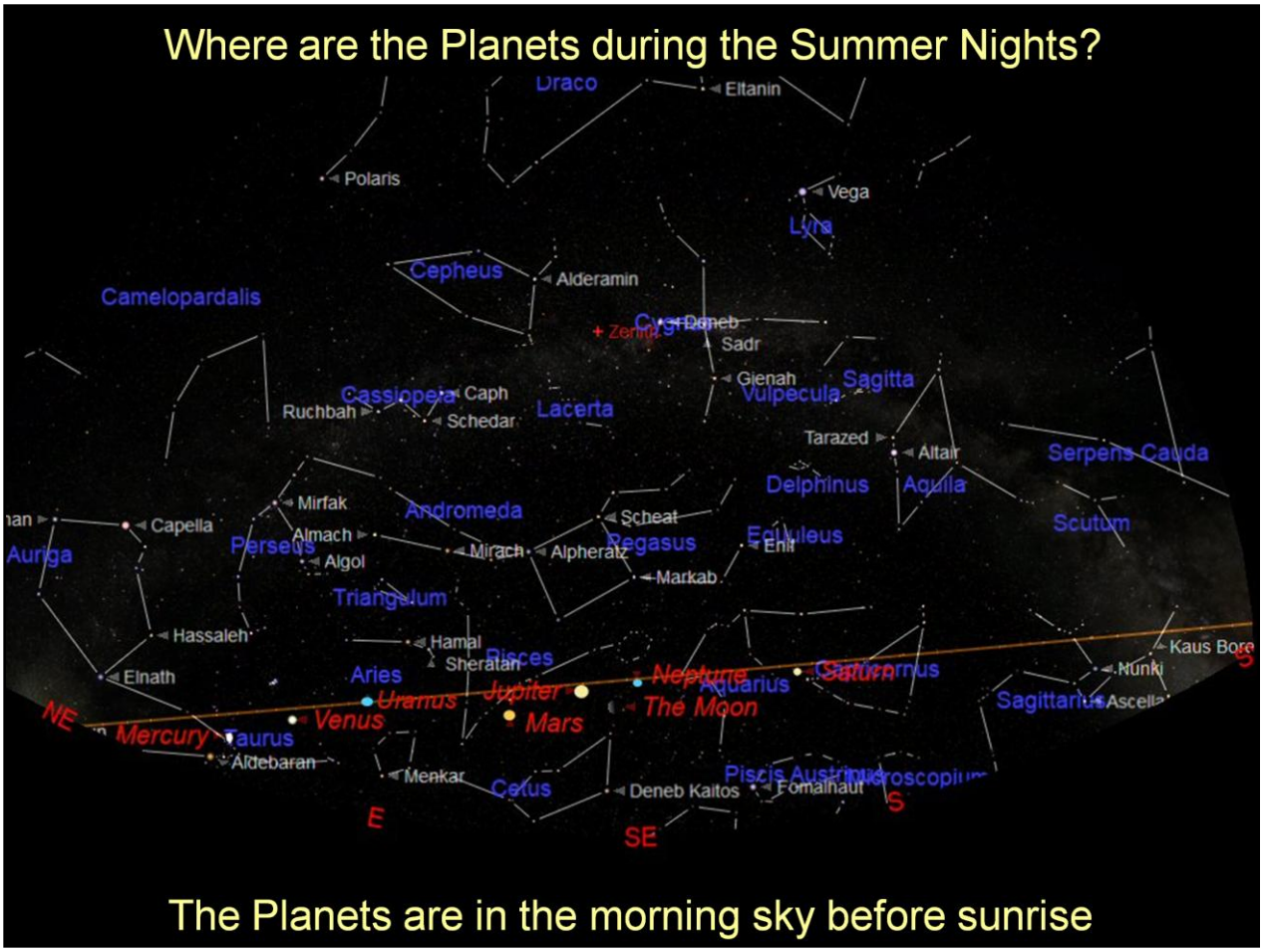
In the northern hemisphere the north pole of Earth’s axis is tilted towards the Sun during the summer season.

This gives the effect of a point on the surface (such as the UK) being closer to the equator of the Solar System (the Ecliptic).

At midday when the UK is facing the Sun it will be at its highest point and the Ecliptic and the Sun will appear higher in the sky.

However at midnight when the UK is looking away from the Sun the Ecliptic will appear lower in night in the sky.

Winter is the best time for astronomers because the nights are long and the planets and Moon are high in the sky and away from the thick and turbulent air close to the horizon.



The chart above shows the location of the planets along the Ecliptic in the morning sky.

The sky has been darkened to make the planets visible.

The planets are: (in order as they appear before sunrise) Saturn, Neptune, Jupiter, Mars, Uranus and Venus.

Mercury will be close to the Sun and difficult to see.

The planets appear low in the sky, in the bright morning or evening sky so are not well positioned for observing.

This presentation is available on the Beginner's Website at:

naasbeginners.co.uk