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TIPS FOR NEW ASTRONOMERS



HORIZONS, THE MERIDIAN, AND THE ECLIPTIC

Near to the horizon star light has to pass through much more of the atmosphere than it does when the star is high in the sky. This means the light is significantly dimmed, looks redder and is subjected to all sorts of distortions, so astronomers avoid this part of the sky if they can.

Incidentally a line that passes through the point on the horizon exactly due south of where you are standing, up over your head to the pole where Polaris is found then back down to the northern horizon is called your meridian. It is important to know where your meridian is. It is simple enough to find, simply get a compass, stand at your usual observing spot and look at what is on the horizon exactly due south, for example a recognisable tree or house or whatever, and make a mental note of it. In the simulated picture below with Llangorse lake just to our south west, it is close to midday and the Sun is on our meridian (the green vertical line).

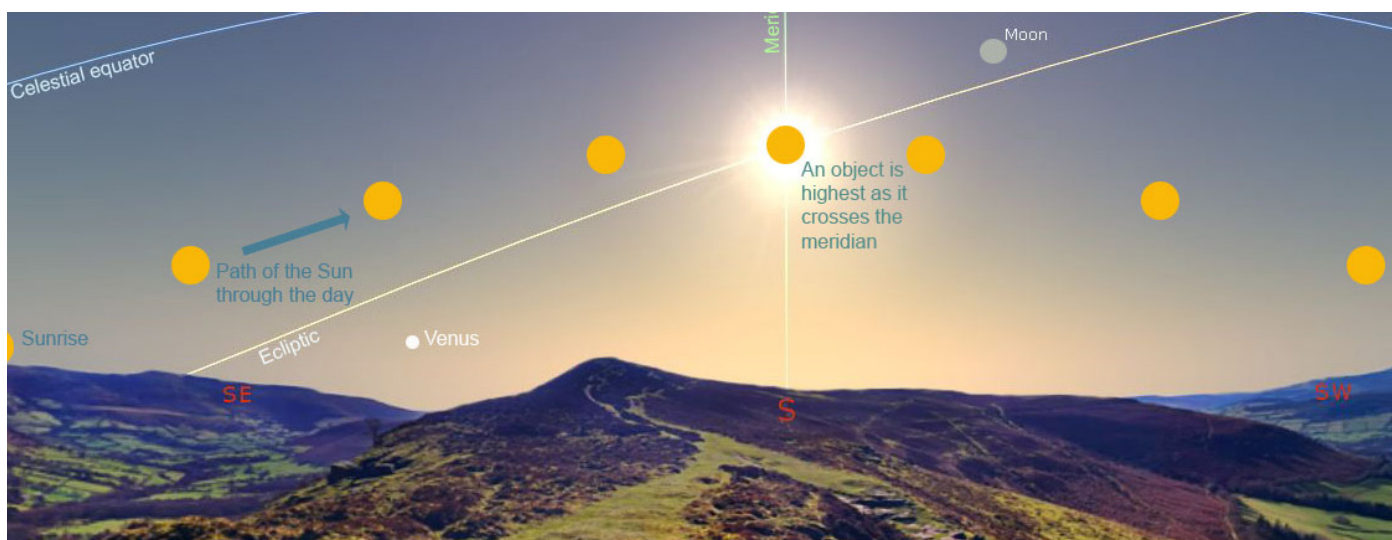


Figure 4 Diagram of the ecliptic and celestial equator over LLangorse

In the picture above the Sun is on another line called the ecliptic, the Moon to the west is close to this line as is Venus to the east on this day. The ecliptic is the line that the Sun, and Moon and all the planets, appear to slowly follow across the sky through the year, if you could see them during the daytime they would appear to be moving against the background stars. Of course the Sun is not really moving but the Earth is, in its orbit. In the picture above the ecliptic is shown below the blue line at the top which is the celestial equator. This is simply the Earth's equator projected into space.

In the summer months the ecliptic line during the day rises up above the equator and the Sun is high in the sky in the south, but the ecliptic would be low at night. In the winter, as shown in this picture, the ecliptic is below the equator during the day and above it at night. The consequence of this is that any planets in the night sky in the summer will be near to the horizon and hard to observe but in the winter months when the ecliptic is high at night they will be high in the sky and that is a good time to observe them away from the bad air near the horizon. Incidentally another name for the ecliptic is the Zodiac.

In conclusion try to find a position with a good clear southern view and don't worry much about the northern aspect, winter is the best time to observe the Moon and planets if they are available then and try to observe any objects when they cross your meridian.

SO YOU WANT TO BUY A TELESCOPE?

Two great adages - "Nothing is so easy to justify as the things we want" - astronomy equipment is no different and there is a thriving market in hardly used second-hand gear because of it. "The best telescope for you is the one you will use" - get something too big or heavy or complicated and it will gather dust or go on the second-hand market. It is essential to understand your skill level and get something that is appropriate and remember help is on hand. You are strongly advised to speak to your local astronomy society for advice or reputable specialist retailers.

You can do a considerable amount of observing using binoculars and even just your unaided eyes. There is insufficient space here to give a complete course on observing and instruments but only an overview.

The answer to the question "what telescope should I buy?" is "What do you want to look at?" General purpose instruments are always a compromise. Of course the beginner doesn't generally know the answer to that question either so we have to start somewhere. The best place to learn to swim is usually the shallow end and that is where we shall start. But don't think that is an option that is too easy, there are many observers who start with binoculars and get totally hooked. With binoculars there are loads of things to see that need the low magnification and wide field that only they offer.

TWO EYES ARE BETTER THAN ONE

Even hardened telescope devotees usually own at least one pair of binoculars, they are excellent for exploring the summer star scapes of the Milky Way, the lovely open clusters such as the Pleiades and Hyades on a crisp winter's night or the majestic Beehive cluster in the spring. There is a lifetime of things to see with binoculars and well as serious scientific work on variable stars and hunting for comets.

Binoculars come in all shapes and sizes and a price points to suit all pockets. The following tips are a quick guide to buying binoculars but again you are urged to consult your astronomy society or retailer.

- Don't start with giant binoculars however tempting, binocular observing is about wide bright fields not magnification. A magnification of x8 is perfect, x 10 is also ok if you have them but more than that is a different ball game
- An aperture of about 50 mm is perfect, with quality binoculars 40 mm is also good. With smaller apertures the view will be too dim to see many objects. When you look for binoculars they will quote number such as 10x42 or 8x50. The first number is the magnification and the second number is the aperture. As a rule of thumb the second number divided by the second should not exceed about 5. For the technically minded that is because that number is the size of the beam of light coming out of the eyepiece and it should match the size of your pupil (which is around 5 or 6 mm in the dark depending on your age). So 8x50, 8x40, 10x50 are all great.
- If your budget is limited i.e. under about £300 go for a "porro prism" design. The alternative is "roof prisms" the latter are more expensive to make well but in more upmarket models are just as good, more compact and arguably more rugged.
- In the specification look for BAK-4 prisms instead of the older and cheaper BK7. BAK-4 is a newer type of glass and will give a better performance.
- There are other extras such a fully coated multi-coated optics that are points to looks for. These coatings allow more light to pass through the lenses and less internal reflections. Also more expensive instruments may be waterproof and possibly nitrogen filled, desirable but not really necessary for astronomy.
- Do try to look through the binoculars before your buy them to ensure you are comfortable with them, which can be difficult if purchasing online.

- Binoculars larger than 50mm aperture will be too heavy to hold for anything but a short period of time. Even smaller ones can get tiring. Larger binoculars always have some way of being supported on a tripod, smaller binoculars often do as well. The cover over the nut on the front of the hinge can sometimes be unscrewed and a ¼" thread may be found there. A bracket can be purchased that screws into this threaded hole and onto a tripod, a very useful accessory.



Fig 5 Various binoculars, A) roof prism, B Porro prism, C) "giant" binoculars

USING BINOCULARS

Here are some top tips to use with binoculars.

- Make sure they are properly adjusted for the distance between the pupils of your eyes, when looking through you should comfortably see through both eyepieces.

- You will need to adjust to suit your individual eyes. If you look at the right eyepiece it can usually be rotated and has markings on it. The left eyepiece does not rotate. Hold the binoculars to your eyes and with your right eye closed focus using the central focusing knob on a distant object. Then close your left eye and using your right eye and rotate the eyepiece until the image is in focus again. Open your left eye and both fields should be in clearly in focus.
- Only use spectacles if your prescription is for astigmatism. If you are long-sighted, short-sighted or just a mature observer leave the spectacles off as the binoculars will easily compensate.
- If when you look through the binocular things feel strained and the two images do not very easily merge into one then they are probably out of collimation. If they are new send them back under warranty. Quality instruments are unlikely to lose collimation but if they do they can often be corrected by a service engineer with the correct equipment for less than the price of new binoculars.
- When using binoculars to find an object in the sky first just look at the object then raise the binoculars to your eyes without stopping looking. You should find that they are pointing at the correct spot. This manoeuvre is worth practising on distant aeroplanes for example. Be careful to not look at the Sun when doing this, it is best to practise it at night.
- It is helpful to hold the binoculars with two hands and rest your elbows on a rigid surface such as a wall in order to steady them. You will also get much better results with a tripod or monopod.
- All of the above advice applies to giant binoculars except that they are unusable without a tripod or monopod, they are simply much too heavy to hold.

I STILL WANT A TELESCOPE

Telescopes come in many shapes and sizes and cost from a hundred pounds or so to many thousands of pounds – so how do you decide what to buy? Here are a few top tips.

- Before you buy anything speak to someone in your local astronomical society or a specialist retailer. They will discuss with you what you hope to do with the instrument, your level of expertise and budget. They can also give you help in its use after your purchase.

- Don't be too ambitious, start with a smaller simpler instrument, there will be plenty to see. If you find you want a more sophisticated instrument when you are more experienced you will be in a much better position to judge what type. One of the most common reasons for a telescope gathering dust unused in the cupboard is because it is too unwieldy or too complicated for its owner.
- To goto or not to goto, that is the question. A "goto" telescope mount is one that is equipped with a small computer that once aligned can find objects for you in the sky. They have advantages and disadvantages, they certainly can make things easier but aligning them and using the computer can be a bit of a learning curve in itself. They also cost significantly more. There is an argument that starting with a completely manual mount helps you to learn your way around the sky. The decision on which to go for depends on your budget and if you are prepared to commit the time in learning how to use a goto. If you are content looking at the Moon, planets and brighter star clusters you will not need a goto facility.
- Set your expectations - do not expect to be able to see the wonderful coloured images than the Hubble Space Telescope dishes up. The eye is much less sensitive than a camera so objects such as nebulae and galaxies will appear as grey patches, although planets and stars are coloured. While on the subject, astrophotography is a very specialised activity that requires very expensive equipment. Do not expect to be able to use entry level instruments for this purpose other than shots of very bright objects such as the Moon.

TYPES OF TELESCOPES

The range of telescopes type will be bewildering to the novice. This section aims to explain the basic differences but is much less than a buyers guide, just an overview.

There are essentially two types of telescopes – refracting and reflecting and both these types have many variations, particularly reflecting telescopes.

A refracting telescope is what many people think of as a telescope. It is basically a tube with a wide lens at one end and a smaller eyepiece at the other end. Binoculars are a pair of refracting telescopes joined together. Variations other than physical size come down to the quality of the glass used to make them and how many lenses they have. There are some very good low cost refractors for beginners starting at about £150 with a basic mount and a couple of eyepieces. They are easy to set up and can give good views of the planets and the moon and some of the brighter deep

sky objects such as star clusters and nebulae. For absolute beginners, occasional users and particularly younger observers they can be a good choice. Refracting telescopes vary greatly in quality and high quality ones (known as apochromatic) can be very expensive indeed, many thousands of pounds, but the lower cost achromatic refractors can still be really good. The names “apo” and achromatic refer to the way the instrument corrects things such as colour fringing on bright objects.

Reflecting telescopes use a mirror to capture the starlight and reflect it into the eyepiece. There are many configurations of reflectors with complex names but the simplest was developed by Sir Isaac Newton in 1668 and has changed little in principle since. Aperture for aperture reflecting telescopes are much cheaper, for this reason virtually all telescopes with an aperture more than 150mm (6”) are reflectors and all professional telescopes are as well. The Hubble and James Webb Space telescopes are both reflecting designs.

There is a sort of hybrid reflector available that has a large mirror but also some lens like components for “correcting” the image i.e. minimising some of the inherent optical weaknesses. These instruments fold the light path to make the whole package more compact (although still relatively heavy). A common and popular example of this type is the Schmidt Cassegrain (aka SCT). Although SCTs are compact they are also more complicated than a simple Newtonian so significantly more expensive, although much less than a refractor of equal size.

A 150mm Newtonian reflecting telescope is an excellent instrument for a beginner and offers remarkable value for money. The majority of reflecting designs are liable to require adjustment and alignment of the mirrors from time to time. This can be daunting for the beginner but if you are in any doubt if this would be an issue have a chat with someone in your local astronomical society who will certainly be able to show you how it is done. With a little practice it becomes second nature.

Many telescopes come with a small range of accessories and eyepieces which are usually fine for the beginner and there is a huge after market for those wanting to spend their money on better quality items. Don't be too anxious to buy accessories though. Find out where your interests lie first.

THINGS YOU CAN EXPECT TO SEE IN THE SKY

- **By eye alone**
 - Constellations and asterisms
 - Closer open star clusters
 - The Milky Way
 - Noctilucent clouds
 - Planets as bright star-like objects and the Moon
 - Aurora
 - A few galaxies
- **With binoculars**
 - Open star clusters – they excel at this for the closer ones
 - Brighter globular clusters – generally as hazy blobs
 - Planets and the moons of Jupiter
 - The Moon and some of the larger craters and mountains
 - Some brighter galaxies
 - The brighter nebulae
- **With a telescope**
 - Distant star clusters in detail
 - Globular clusters resolving thousands of stars
 - Planets with surface detail and the moons of Jupiter and Saturn
 - Fine detail on the Moon, objects just a few kilometres in size
 - Hundreds of galaxies, but this does require experience
 - Nebulae of many types
 - Double stars