A guide to buying your first telescope By Nick Busby

What kind of telescope should I buy?

This must be the most common question asked by newcomers to astronomy and it is not the kind of question that has one simple answer, as everyone has different levels of experience, interests and financial means. This guide aims to explain the various options. I have also included some recommendations on brands and retailers; these are ones I know and trust and instruments that I have used and have experience of. I am sure there are others that are as good but these are the ones I know and are happy to recommend. I have no affiliations or associations to any of the companies or brands mentioned here.

What is a telescope used for?

This may seem to have an obvious answer – to magnify objects – but a telescope is used principally to collect light and make dim objects brighter; astronomers frequently use telescopes at very low magnifications. Many astronomical objects are quite large but also very dim. The challenge is often how to collect enough light and still have the lowest magnification and the widest field of view. The amount of light that a telescope can collect depends on the *aperture* or *diameter* of the telescope. Although it is true that having a larger aperture telescope will allow you to see more, aperture comes at a cost, both monetary and also in how easy it is to use. ***The most important consideration is what telescope will you be comfortable with***, for example it must be easy enough to carry, set-up and use – more on that later. I cannot stress it too much – if you buy a telescope that is too difficult or inconvenient to use, you will not use it.

What factors should be considered before buying a telescope?

There are many types and specifications of telescopes and buying one that suits your needs best will always be about finding a balance. Below I give an overview of the main types of telescope available. As you read this you should consider:

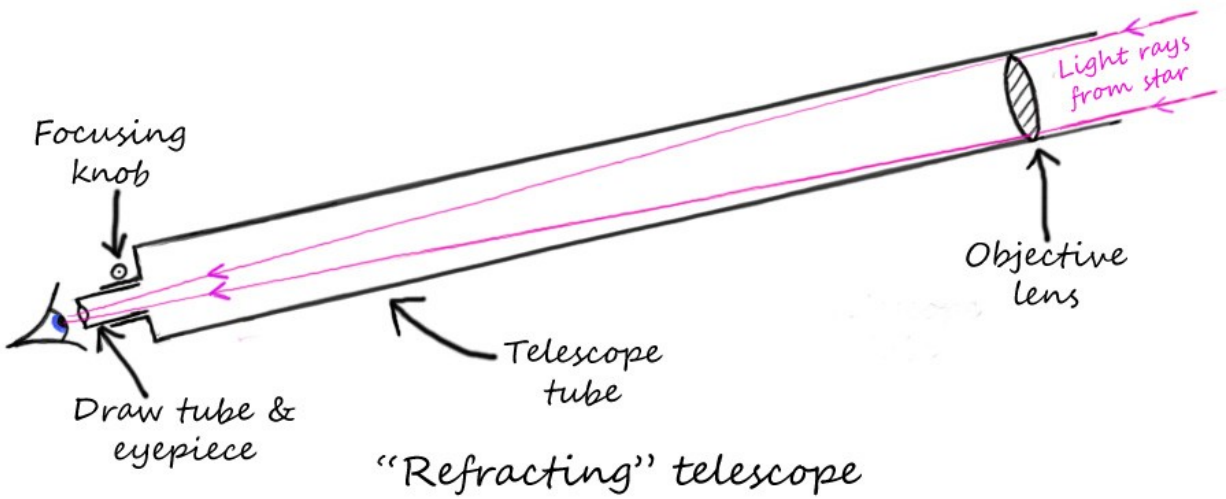
- **How easy it is to set up each evening?** - A heavy cumbersome telescope that takes a long time to assemble, align and cool may quickly become boring. The second hand market has many very expensive pieces of kit that someone has bought and hardly ever used because it was too complicated/ heavy/ difficult to set-up or a combination of these.
- **What do I want to look at?** - Most beginners do not know where their interest will develop so a multi-purpose telescope is usually a good idea, some telescopes can be very specialised. It is also important to temper your ambitions – for example you may see some of the fantastic photographs taken by amateurs and want to crack on and do the same yourself. The amateurs producing those pictures are nearly always very experienced and often using thousands of pounds worth of equipment, start with something simple. If the bug really gets you - progress to more advanced instruments as you gain experience. This guide is aimed at visual observing, not photographic.
- **What can I afford?** – Telescopes do get better the more you spend but there is a diminishing return eventually. There are many reasonably priced beginners telescopes between £100 and £500. Spending less than this on a new telescope is unlikely to give you reasonable quality and spending more for a first telescope is probably unnecessary.

What types of telescopes are available?

There are essentially three types of telescope, those using lenses, also called *refracting* telescopes, those based on mirrors, called *reflecting* telescopes and those that use a combination of mirrors and lenses. All are capable of producing excellent results. The largest aperture telescopes, for example more than about 150 mm (6 inches), are almost always based on reflecting designs. This is because it is much more cost effective to make a large mirror than a large lens. This may lead you to think that you should buy a large reflecting telescope, although this may be the right choice you need to weigh up the pros and cons.

Refracting telescopes

The diagram below represents a simple refracting telescope. It basically consists of a lens at the front, called the objective, and an eyepiece at the other end. In fact the objective lens always consists of two or more components. This is to ensure that the view is largely free from false colour and colour fringes.

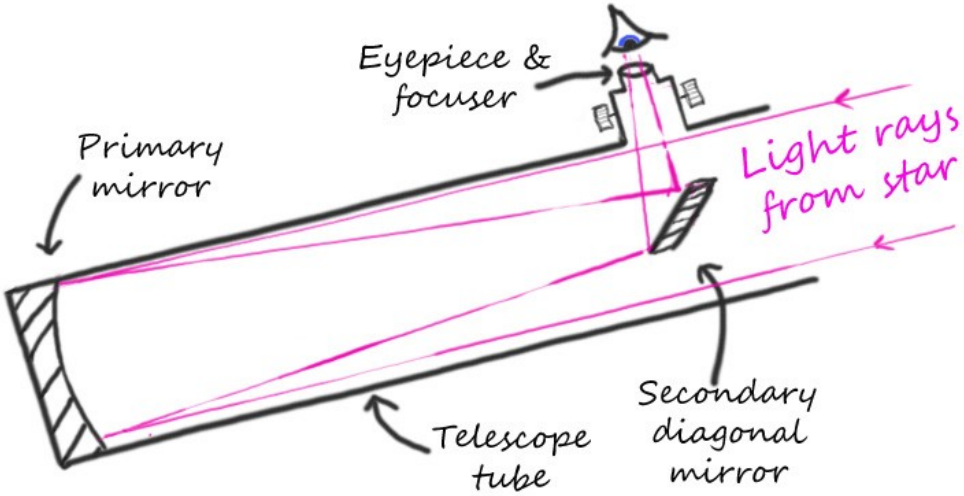


The advantages of refractors are that they are easy to set- up and essentially maintenance free. They can give wonderful, contrasty views and are often favoured by observers looking at planets for that reason. Bird watching and "spotter" scopes are usually refractors. Being relatively small, refractors can often use lighter, and therefore cheaper, mounts and of course they are the most portable. As they typically have relatively small apertures – a 150 mm (6 inch) aperture would be considered quite large, their use for dim deep sky objects can be limited.

There are a few types of refractors that vary greatly in quality and also price, you will see names such as "achromatic", "apochromatic" and "ED doublet" for example. Achromatic telescopes use two lenses in the objective made of different types of glass, this controls the false colour fringes that you would otherwise see around bright objects if only a single lens was used. Apochromatics use three lenses made with different glasses and give wonderfully clear, contrasty and defect free views, but they come with a big price tag. ED doublets are a compromise in that they use some exotic glasses in their lenses to achieve results approaching those of the apochromatic telescopes. There has been a trend in recent years to produce small short focal length refractors. They are light and convenient to use and capitalise on advances in glass technology to control optical defects. A basic "achromatic" refractor is the lowest cost type. In the 75 mm to 100 mm class there are a number of very good and reasonably price achromatic refractors available and they make excellent starter scopes. In contrast a high quality "apochromatic" refractor is probably the most expensive type of telescope one can buy – at the lower end of the market expect to pay at least £1000 for 100 mm of aperture, an "achromatic" will be around $\frac{1}{4}$ of this price and an ED doublet about $\frac{1}{2}$ the price of the apochromatic telescope.

Reflecting telescopes

The diagram below shows the basic layout of a "Newtonian" reflecting telescope, the most common type. Reflecting telescopes typically have a large curved mirror (the primary) at the bottom of a tube that reflects the light back up the tube to a smaller flat diagonal mirror (the secondary) and on to the eyepiece. Notice that the eyepiece is on the side of the tube near the top, not at the end as in a refracting telescope.



The "Newtonian" reflecting telescope

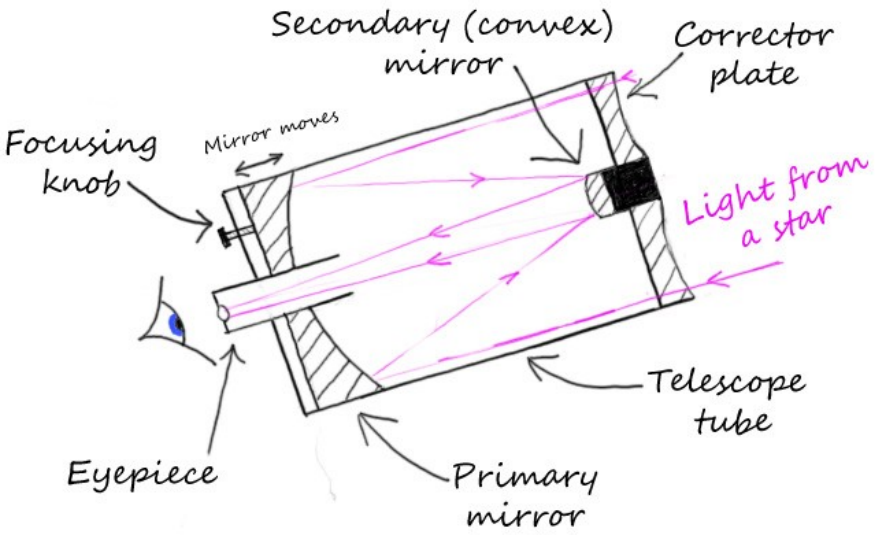
As, within reason, any glass of suitable dimensions can be used to make the mirrors and only one curved surface has to be prepared they are always much cheaper for a given aperture than a refracting telescope. They are usually larger in aperture and all modern professional instruments are a reflecting design. They do not suffer from the colour fringing effect of refractors although potentially have other optical defects that designers need to addressIt should be noted that reflecting telescopes may need some adjustment from time to time. This is to ensure that all the optical components are properly aligned. With practice this really is not a difficult task and it helps greatly to learn how to do it from someone that is experienced. Some people find this a bit daunting, but let me reassure you, it is not difficult. If you want a large aperture instrument (say more than 150 mm aperture) a reflector is the only realistic choice and most reflectors require some adjustment (technically called "collimation") at some point.

If you do decide to purchase a large aperture telescope remember they are physically big and quite heavy. Above an aperture of around 200 mm (8 inches) they can get very large and may need a large and expensive mount (although there are exceptions – see "Dobsonian" mounts later in this article)

A very common and excellent choice for a beginner's scope is a 150 mm or 200 mm Newtonian (the simplest reflector design). A nice quality 200 mm telescope without mount can be purchased for as little as £180. As reflectors may have relatively large apertures they are well suited to observing deep sky objects and they are also suitable for the moon and planets as well. This versatility along with the low cost and good quality images have made reflectors a very popular choice with amateurs for many years.

Combination type telescopes (catadioptric)

A catadioptric telescope is illustrated below. These are essentially reflecting telescopes but with some important modifications. They are designed to have many of the advantages of reflecting telescopes but are much more compact. They pass the light down, then up, then back down the tube, in effect folding the light path. In this way a telescope with a focal length of say 2 metres may have a tube only 1/3 of this length. To control image quality they usually have a clear glass element at the opposite end of the tube to the mirror (called a corrector plate).



A "Schmidt Cassegrain" telescope

The most common design is the "Schmidt Cassegrain". This was first popularised by the Celestron company in the early 1970s in the USA and the present design is still very similar. Such a telescope is more expensive than a simple reflector of the same aperture, much more compact and generally heavier. However it will be much cheaper than a refracting telescope of the same aperture. As with all reflecting telescopes, this type requires periodic adjustment for best results.

There are some important other designs on offer in this category, for example the Maksutov. These can also provide compact instruments using various ways of minimising optical defects.

From my experience I would hesitate to recommend the Schmidt Cassegrain to a complete beginner but some of the smaller aperture Maksutov Cassegrains make very good starter scopes. These smaller scopes do not need the somewhat complicated adjustments required of the larger Schmidt Cassegrains and are lighter and easier to handle. A 200 mm aperture Schmidt Cassegrain is a heavy instrument and weighs about 6kg. Schmidt Cassegrains are very versatile and popular with more experienced observers.

What about a mount?

All telescopes require a mount of some sort and these vary greatly in cost and quality, the mount may well cost significantly more than the telescope. Telescope mounts are much more substantial than even heavy camera mounts. They have to be as telescopes are much heavier than cameras and generally use higher magnifications than the longest telephoto lenses. The mount must be capable of holding the telescope quite rigidly. Many beginners telescopes come complete with a suitable mount and even a small range of eyepieces. Do check out the mount before you buy it; particularly at the very cheap end of the market the mounts provided with a telescope are often less than adequate

The main types of mount are equatorial and alt-azimuth. The equatorial mount can rotate about an axis that points to the pole star. This means

that it can follow the rotation of the earth by just turning about one axis. This type of mount takes a bit of practice to master and is the design most commonly used by astrophotographers. I personally prefer equatorial mounts as once you have learned how they work they can be very convenient to use. They only require one motor to follow the stars or can be driven by hand.

The alt-azimuth mount is so called because it can rotate about a horizontal axis (altitude) and also a vertical axis (azimuth). They are very intuitive to use but in order to follow the stars automatically they require two motors and some kind of computerised system (usually in the supplied handset) to control them. To run automatically they also require careful alignment on a number of stars.
There is a classic type of alt-azimuth mount named after the man that did most to develop and promote it – John Dobson. The Dobsonian is a very simple mount, usually made of wood, that can carry very large telescopes – always reflecting- at very low cost. They are very simple to set up and use, there are now even motorised computer driven versions available. They are ideal for beginners as they are so simple, the only downside is that the user has to find their way around the sky manually. There is no better way of learning the stars in my view.

To go-to or not go-to?

A "go-to" mount is one that uses a computerised handset to find objects in the sky. They are available in equatorial, alt-azimuth or Dobsonian types. They are extremely handy for beginners as they enable one to find objects very easily simply by selecting them on the handset. However they can be a bit of a chore to set-up and align with stars. Manufacturers go to great lengths to make this as simple as possible but it still can take some practice to get right. There are even mounts now available that can completely align themselves by checking the sky and identifying stars by themselves! Alt-azimuth mounts often can only be used with the computerised handset, typically equatorial mounts can be used with or without. There is a view that go-to scopes do not help beginners learn their way around the sky. There may be some truth in that but they do help one to find many of the most elusive objects and can reduce frustration. My personal favourite mounts are equatorial go-to – they give you the best of both worlds, manual or automatic; and the Dobsonian – because they are so convenient and allow the use of very large reflecting telescopes at very low cost.

Other accessories

The one type accessory that is essential of course is eyepieces. Quite often a few of these may be supplied with a new telescope. There is a truly bewildering range of these that you can buy. My advice again is to keep your purchases simple until you gain experience and know what kind of observing suits you best. The magnification that will be given by a given eyepiece is easy to determine. On the telescope, usually near the focuser, you should find a plate that will tell you the focal length of the telescope in millimetres (see "Explanation of terms" below). On the eyepiece you will also find a number, also the focal length. In the example below it is 9 mm.

The magnification is simply the focal length of the telescope divided by the focal length of the eyepiece. For example for a telescope with a focal length of 1000mm and a 10mm eyepiece the magnification will be 1000/10 = 100 times. You will need a low power eyepiece for locating objects and wide views; a 30 mm focal length is usually a good choice. A medium power of say 10 or 15 mm is useful for general purpose and a planetary eyepiece of around 6 mm is good for high powers. Eyepieces also have letters that describe the type, for example "K" for Kellner, "Pl" for Plössl , "Or" for orthoscopic etc. For general use Plössls

are excellent as are orthoscopics, both are reasonably priced. As your experience grows you may want to purchase some of the wonderful widefield eyepieces available. You should expect to spend at least £30 to £40 on a reasonable quality eyepiece that will give excellent views. You can of course spend much more – hundreds of pounds even, but it really is not at all necessary.
I should also mention that eyepieces essentially come in two sizes – $1\frac{1}{4}$ and 2 inch. Some telescopes can take either, all can take $1\frac{1}{4}$ inch. The larger sizes are very nice to use but $1\frac{1}{4}$ inch eyepieces are also fine.
One way of expanding your range is to purchase a Barlow lens. This lens in effect increases the apparent focal length of your telescope. So if you have a 1000 mm focal length telescope it will appear to be a 2000 mm focal length. So using our earlier example if we were using the same 10 mm eyepiece it would give a magnification of 20 times when used with the Barlow. Barlows come in 2x, 3x and 5x strengths. 2x is a good choice to start, 5x is used for planetary photography. A Barlow lens is often supplied with a new telescope and cost from £30 to buy. With a 2x Barlow lower cost examples are generally fine, with 5x it is better to pay more in my experience. Below are examples of two 2x Barlow lenses – a 2 inch diameter and a 1.25 inch diameter

Many telescopes are supplied with a finder scope. This is a low power small telescope that is used for locating objects. Red spot finders are optical devices similar to rifle sites and are very effective and easy to use, I personally prefer the red spot finder. Whichever you prefer you will need a finder of some sort.
Filters are an optional extra that can be very useful both in making observations easier and they are widely used in astrophotography. Various coloured filters are often used to help enhance the contrast of planets although the effect can be subtle. I would not suggest buying coloured filters until you become more familiar with observing however there is one type of filter that is very useful. Most of us live in areas with at least some light pollution and there are filters that can help cope with that. They work by selectively filtering out the light from certain types of street lights. I have found the low cost varieties of limited value but the more expensive filters work quite well. Of particular use if you want to observe nebulae is the UHC (ultra high contrast) and the OIII filters. These selectively allow the light of the glowing nebulae to pass but very little of the light pollution. The filters are simply screwed onto the threads on the bottom of the eyepiece.

If your interest takes you to looking at deep sky objects you should definitely consider one of these filters. If you are completely new to astronomy I would suggest you wait before purchasing any filters and you have a better idea of what you want.

Suggested set-ups

In this section I make some specific recommendations for equipment. I have selected certain brands mainly because I have first hand experience of them and trust them. I have also seen some low cost producers that sell equipment that frankly is not worth purchasing, so a bit of care, particularly at the bottom end of the market is needed. I should also mention second-hand equipment. For sure there are bargains to be had but a word of caution, be sure you know exactly what you are buying, if necessary ask someone with experience to help. I have seen beginners purchase equipment that has been messed about so much by the owner it required a complete re-build – a job beyond the purchaser's skills. On a positive note astronomical equipment has never been better, more widely available and cheaper than it is now.

I have tried to set-out my suggestions by level of experience, ability, ease of use and also price level. I have not presented much for the experienced user, I am guessing they know what they want and do not need my advice. The prices I suggest are indicative of what retailers are presently offering.

Complete beginner

This to me is someone who is new to the hobby and this is likely to be their first telescope. They do not know where their observing interest lies so a general purpose instrument is called for.

Celestron Astromaster 90 EQ - £149

This is a 90 mm refractor on a small but serviceable equatorial mount. A motor is available which I strongly suggest you purchase – it makes observing much easier. This instrument has a 90 mm aperture and will give good contrast and have few aberrations. It would be good for planets – showing the rings of Saturn, clouds and moons of Jupiter, great for the Moon and will spot most of the Messier objects (a catalogue of 110 relatively easy deep sky objects). It comes complete with a couple of eyepieces. As a refractor it will not require any adjustment. It is quite portable and does not need much cooling down if stored inside. As a most basic instrument it does have its limitations; it is not well suited to faint deep sky objects such galaxies and details on the planets will be limited but for the price it will be a good introduction.

Skywatcher Explorer 130P (EQ-2) - £165

This is a 130 mm Newtonian reflector on a basic equatorial mount. I can vouch for the optics, this was the first telescope I purchased and I still use it occasionally. Having double the light collecting power of the previous telescope it will show more deep sky objects and more details. I think these 'scopes represent super value for money. The downside is it will require adjustment from time to time and will also need cooling down time – at least

½ an hour if stored indoors – before use. This telescope is also available with a go to alt-azimuth mount (Skywatcher Explorer 130P + SynScan AZ GOTO £289). This is the version I originally purchased. The go-to works very well although does a bit of practice to master. A good choice for a beginner's go-to.

Skywatcher Skymax 127 (EQ3-2) - £395

This is a 127 mm Maksutov Cassegrain and comes with a couple of eyepieces. The mount is equatorial and more substantial than the previously described models. A go to version is available for £300 extra and this is a very capable mount. This Maksutov is a very good instrument and great for planets and deep sky objects. It will not require any adjustment although should be allowed to cool well before use. Having folded optics Maksutovs are very compact; this instrument has a focal length of 1100 mm. It will be superb for the Moon, very good with planets and reasonably capable for deep sky objects. The Maksutov is an excellent design, easy to use, very portable, versatile and has excellent optical qualities. The tube itself is also available in 90mm (£119), 150 mm (£499) and 180 mm (£749) versions – but you would then need to purchase a mount as well. Meade also have a good range of small Maksutovs such as the ETX90 (the go-to alt-azimuth is about £395). Maksutov Cassegrains are highly recommended instruments and suitable for beginners and those with experience.

Some experience, perhaps your second telescope

Skywatcher Explorer 200P EQ5 - £415

This is a 200 mm Newtonian on a substantial mount. This is also available on the HEQ5 PRO mount – an excellent go-to equatorial capable of astro-photography purposes (£969 for the mount and 'scope). This is a serious piece of kit, very versatile and you will not grow out of it quickly. It is an excellent choice for planetary and deep sky use. With a f ratio (see below) of 5 it will give bright widefield views. Like all Newtonians it will need to cool before use and will need some occasional adjustment but will amaze you with what it is capable of. In case you are tempted there are also 250 mm (£389 tube only) and 300 mm (£588) versions available. These are fantastic value and give stunning views, I have used both many times. However they are large and quite heavy and not very portable, they also require very substantial (i.e. expensive) mounts. If you do want to go down that route and have what enthusiast call "aperture fever" then you should consider a Dobsonian.

Skywatcher Skyliner Dobsonian range

250PX	£450
200P	£275
150P	£175

It may seem as though I have a personal interest in the Skywatcher brand as I have recommended a number of them! The truth is that the company that makes them (Suzhou Synta Optical Technology Co., Ltd.) have rather cornered the low cost market and supply excellent quality instruments. They also sell under the Celestron and Orion brands in this sector; the instruments are essentially the same although on the go-to models the software is a bit different.

The 250PX Dobsonian is a large instrument but in this form very convenient to use. Larger Dobsonians telescope are normally "truss tube" designs. Instead of a solid tube they have a collapsible structure that makes them more portable. This telescope is excellent with planets and the moon (you will need a moon filter) and superb with the "faint fuzzy" deep sky objects – a good all-rounder. It needs a good hour to cool if stored inside and again will need collimating from

time to time. I should say on this last point – I have a 250P myself and although I check it regularly – once set it does not move out of alignment despite taking it in and out of the car on many demonstrations. This is in fact my favourite demo instrument, big enough to show plenty of detail but not so big as to be cumbersome.

This instrument is also available as a go-to truss tube configuration (Skywatcher Skyliner 250PX FlexTube GOTO - £954). They have received good reviews but I have not used one myself.

While on the subject of Dobsonians I must mention the Skywatcher Skyliner 200P and 150P Dobsonians, which at £275 and £175 offer a real bang for your bucks. They are pretty insensitive to poor adjustment and will be super with planets and the Moon and ok for Messier deep sky objects as well. You even get a couple of eyepieces for that price! They are really easy to use and give unbelievably good results for the price, excellent as first scopes. If you can afford it the 200P is the better value. Highly recommended.

Other options

I have described a number of entry level instruments but of course there are many other more up-market options if you can afford them. They do not tend to be sold a packages but you can select separate items.

For compact portable but high performance instruments apochromatic and ED doublet refractors are the ones to beat optically but come along with a hefty price tag. Some Maksutov Newtonians come close but they are also expensive. An 80 mm apochromatic refractor from a maker such as William Optics will cost around £800 and an ED doublet just over half that amount. Such instruments will give superb high contrast, aberration free views and are also excellent for astrophotography.

Also compact but with larger apertures are the Schmidt Cassegrains from Celestron and Meade. As I have pointed out these are not really beginners 'scopes but are the kind of instrument that one might graduate to. A classic is the Celestron C8 SCT VX GOTO - £1363. The C8 started the Schmidt Cassegrain story in 1970 and is still going strong. If kept well adjusted these instruments are extremely capable and versatile. Keeping them well collimated is crucial and they are quite sensitive to misalignment (and can lose it surprisingly easily as well). My own preference is for Celestron's as they seem to be better built than Meade instruments, although I am sure Meade have many satisfied customers. The 150 mm Celestron VX GOTO is £1157, there is a large range right up to the C14 (£5831 for the tube assembly only). These larger instruments are used by some of the most experienced amateurs and astro-photographers – particularly for hi-resolution work. The refractors mentioned tend to be used more for wide field deep-sky photography.

Summary

- Don't get carried away – go for something that is convenient to use, you will use that far more.
- Refractors and smaller Maksutovs are a good choice if you are concerned about keeping your instrument adjusted and also want good portability.
- Newtonian reflectors give tremendous performance for the price but may require some minimal maintenance and cooling down before use, they are less portable than refractors
- Go-to mounts can make finding objects very easy but do take a while to set-up.
- Dobsonians give tremendous value for money and will help you learn the sky and can be a good starting point for a complete beginner.
- Schmidt Cassegrains are for the more experienced observer.
- If you are unsure as to what you should buy – do ask for advice from a good dealer or go along to your local astronomy society and ask for help. You will find that your local society will be able to give you invaluable tips to get you observing while avoiding some of the pitfalls.
- Be prepared to practise. It takes time to learn how to use a telescope and as with any acquired skill – the more you learn the more fun it will be.

Explanation of terms

Achromatic - A type of refracting telescope having an objective consisting of two lenses of differing composition. They are designed to have limited colour fringing. On bright objects they typically exhibit a slight blue fringe at the edge.
Aperture. This is the diameter of the objective lens of a refracting telescope or the large primary mirror of a reflecting telescope.
Apochromatic – A type of refracting telescope having an objective consisting of three lenses of differing composition. They are designed to have virtually no colour fringing.
Cassegrain – a type of reflecting telescope where the light is reflected from the large primary mirror onto a smaller curved secondary mirror then back down the tube and out through a hole in the primary mirror.
Catadioptric- a telescope with a primary mirror and some kind of transparent plate in front, used for correcting optical aberrations.
Collimation – the process of aligning optical components
Crayford focuser – a design of focuser that is very smooth and sensitive – often dual speed for precise adjustment.
Dobsonian – a basic type of alt-azimuth mount - used mainly with large reflecting telescopes.
ED – "extra low dispersion", it describes a type of glass used to minimise colour aberrations.
Focal length – The distance from the objective (in a refractor) or the primary mirror (in a reflector) to the point where the projected image of say a star will be in focus.
f ratio. This is the same as the f ratio that you will see on a camera lens and is simply the focal length of the lens (the distance from the lens to the point where the image is in focus – in a camera it would be the distance from the lens to the film or sensor) divided by the aperture. For example if the distance from a camera lens to the sensor was 50 mm (the focal length) and the aperture was 25 mm the lens would have an f ratio of 50 divided by 25 *i.e.* f2.
Maksutov – a type of catadioptric telescope that uses a transparent window called a "meniscus" in front of the primary mirror to control spherical aberration. Common in both Cassegrain and Newtonian configurations
Messier objects – Charles Messier was an 18th century astronomer that compiled a list of 110 objects to avoid confusing them with comets; the objects in the catalogue is an excellent starting point for beginners to look for.
Newtonian- a type of reflecting telescope where the light is reflected to the side of the tube near the top of the scope by a small flat secondary diagonal mirror.
Schmidt – a type of catadioptric telescope with a primary mirror and a thin "corrector" plate on the front to correct for spherical aberration, usually but not always in a Cassegrain configuration.

Technical notes

I have tried as far as I can to avoid technical discussions but there are some points you may want explaining and to bear in mind when making your choice.

Focal length

As explained above this is the distance from the objective lens (refractor) or mirror (reflector) to the point where the image is in focus, usually about where the eyepiece is located. This number is always stated on the telescope tube – usually close to the focuser. In the example below 650 mm is the focal length and 130 mm is the aperture.

It is important to know because it affects the image you will see. The longer the focal length the higher the magnification will be with a given eyepiece and also the smaller the field of view you will see. Often low magnification is what you will want. For example - if you enjoy observing large deep sky objects, such as the Andromeda Galaxy or the Great Orion Nebula, a shorter focal length may be preferable (say 1200 mm or less). If you like looking at the planets or the moon a longer focal length could be a good choice (more than say 1200mm). The larger the aperture the longer the focal length tends to be.

Magnification

This is often misunderstood by beginners. While some objects such a planets do require higher magnifications, many objects require just the opposite. Also bear in mind the higher the magnification the dimmer the object will appear. You will learn with experience the best magnification to use for different types of observation. A telescope has limitations – a rule of thumb is that a telescope cannot be used with a magnification more than 50x its aperture in inches. In other words a 5 inch (130 mm) telescope should not be used to magnify more than 250x. In fact even this magnification would require near perfect weather conditions to be useful. So for the Skywatcher 130p mentioned above – that has a focal length of 650 mm you should avoid an eyepiece of less than about 3mm focal length but more realistically 5mm or 130 times (650/5=130). In life, astronomy and magnification, less often gives you more!

"f ratio". This is a little bit more complex but for those use to using a telephoto lens on a camera it is the same principle. The Skywatcher 130p example has an aperture of 130 mm and a focal length of 650 mm, its "f ratio" is therefore 650 divided by 130 which equals 5. This number is important, the lower the number the brighter the image – exactly the same as a camera lens. But with a telescope the lower the number the more susceptible the instrument is to optical defects. This is true for refractors and reflecting telescopes, those with larger f ratios – say more than f7 – are much less sensitive to optical defects or poor adjustment than those with shorter f ratios. In reflectors, in the past decade or so, the trend has been for shorter f ratio instruments, mostly driven by low cost but good quality Chinese exports. Telescopes around f4.7 are very common and a good compromise. When amateurs had to grind and polish their own mirrors they usually stayed above f7. It is now also possible to buy instruments less than f4, however these require very exacting maintenance and are intended for astrophotography. Modern expensive apochromatic refractors are often made with very low f ratios to give a wide field of view for astrophotography, they are made to exceptional quality so have a very high price tag. Achromatics are often built with an f ratio of around 10 – this helps to minimise imperfections in the image that comes with the lower cost design.

Viewing the Sun

Viewing the Sun must always be approached with extreme caution – ***under no circumstances should you attempt to do so with any of the instruments described here*** . Failing to heed this advice is likely to result in blindness. Your local astronomy society will be able to advise you how to do it safely using the correct equipment.

Some supplier details

It is often best to purchase this kind of equipment from specialist suppliers, who can advise you as well. I have listed below a number of suppliers that I have personal experience of, of course there will be many others that are equally capable.

365 Astronomy
http://www.365astronomy.com/

First Light Optics
http://www.firstlightoptics.com/

Green Witch
http://www.green-witch.com/

Harrison Telescopes
https://www.harrisontelescopes.co.uk/

Rother Valley Optics
http://www.rothervalleyoptics.co.uk/
SCS
http://www.scsastro.co.uk/

Scope'n'Skies
http://www.scopesnskies.com/

Telescope House
http://www.telescopehouse.com/

Tring Astronomy Centre
http://www.tringastro.co.uk/

Widescreen Centre
https://www.widescreen-centre.co.uk/

Astronomy Societies

I recommend contacting your local society as they will be able to give you plenty of very helpful advice. You will be able to find out where you nearest society is from the Federation of Astronomical Societies - http://fedastro.org.uk/fas/

Three close to the Brecon Beacon Dark Sky Reserve are:

Abergavenny Astronomy Society
http://abergavennyas.org.uk/

HOVAS (Ebbw Vale)
http://www.hovastronomy.org.uk/

Usk Astronomical Society
http://www.uskastronomicalsociety.org.uk/

