



NORTH ESSEX  
ASTRONOMICAL  
SOCIETY

# Choosing Your First Telescope



@northessexastro



[www.northessexastro.co.uk](http://www.northessexastro.co.uk)












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# Don't Panic!

Choosing your first telescope can seem a bit scary at first. There are so many to pick from and lots of confusing technical jargon. If your head is spinning, this short guide from North Essex Astronomical Society will help you make the right decision.

## A Few Questions About You First...

When looking for a telescope, there are a few simple questions that will help you narrow down the choices quickly. Tick any of the boxes that apply in each section below, and then use your answers along with our telescope guide on the last few pages.

Approximately how much do you want to spend?		
£40-£200    £	£200-£500    ££	£500+    £££
<input checked="" type="checkbox"/>		
<i>We suggest you don't spend too much on your first telescope unless you are absolutely sure this is the hobby for you. A good quality telescope can be sold second-hand when you upgrade</i>		
Who is the telescope for?		
Family 	Teenager 	Adult 
<input checked="" type="checkbox"/>		
<i>Up to the age of about 14, mum or dad will be setting up and working the telescope. Younger teenagers will soon want something sturdy that they can set up and use without help, whilst advanced or expensive kit is best left to adults.</i>		
How large a telescope can you manage?		
Small/Light 	Portable 	Big and/or Heavy 
<input checked="" type="checkbox"/>		
<i>Will you just use the telescope in your back garden or does it need to be portable enough to take it out in your car to darker locations? Also think about where you will store it and how much weight you are able to move around on your own.</i>		
How comfortable are you with technology?		
Tech-Savvy 	Technophobe 	
<input checked="" type="checkbox"/>		
<i>If you're a whizz with the latest gadgets and smartphones, a computerised "GOTO" telescope might be for you. If you struggle with the microwave, a manual telescope is a better choice.</i>		
What do you want to view most?		
Moon / Planets 	Galaxies / Nebulas 	Star Fields / Clusters 
<input checked="" type="checkbox"/>		
<i>Some telescopes are better for viewing certain types of objects, whereas others work as 'all rounders'. Don't worry too much as you can see a lot with any telescope.</i>		

# Types of Telescope

There are three main types of telescope available for purchase. Each has its advantages and disadvantages. As with anything in life, you get what you pay for and price is (usually) a fair guide to the capability and quality of a telescope.

## Refractors

The refractor is most people's idea of a 'real' telescope, especially children. It consists of a glass lens at one end of the telescope and the focuser and eyepiece at the other.



Advantages	Disadvantages
<i>Small aperture refractors are compact, lightweight, easy to store and transport.</i>	<i>Larger aperture refractors are heavy, and often long and unwieldy.</i>
<i>Maintenance free and will work straight out of the box.</i>	<i>High quality ("Doublet", "Triplet", "Apo") refractors are very expensive.</i>
<i>Come in a variety of focal lengths suited to either wide starfield viewing or Moon/planet viewing.</i>	<i>Cheaper ("Achromatic") refractors will show coloured 'rainbow' fringes around bright stars, planets and the moon.</i>

## Reflectors

The reflector consists of a large curved mirror at the bottom of the telescope and a small flat mirror at the top which reflects the light out of the side through the focuser and eyepiece.



Advantages	Disadvantages
<i>Best 'bang for your buck' as reflectors are cheaper than the other types at all apertures.</i>	<i>Large reflectors may be lighter than other big telescopes but quickly become unwieldy.</i>
<i>Much larger apertures available than for refractors, and lighter than catadioptrics.</i>	<i>Need to be "collimated" from time to time to align the mirrors by tweaking a few screws.</i>
<i>Reflectors don't suffer from 'rainbow' colour fringes</i>	<i>Larger size/weight needs a better mount to prevent the view wobbling about.</i>

# Catadioptric

The catadioptric is a special type of reflector. It consists of a large curved mirror at the bottom of the telescope and a glass ‘corrector’ at the top with a spherical mirror set in to it. The light leaves the bottom of telescope through a hole in the main mirror and in to the eyepiece. There are two types in common use, the Maksutov Cassegrain (‘Mak’, usually smaller, **left**) and the Schmidt Cassegrain (‘SCT’, usually larger, **right**).



Advantages	Disadvantages
<i>Long focal length packed in to a short telescope tube. Great for Moon/planet viewing, double stars and small objects.</i>	<i>Small field of view can make it hard for the beginner to find things. Much more expensive than the equivalent aperture reflector.</i>
<i>Small Maks are very compact, portable and practical to use. They do not need collimation.</i>	<i>Large aperture SCTs are big and heavy, and must be collimated from time to time .</i>
<i>SCTs are much more practical to move and store than the equivalent aperture reflectors.</i>	<i>Larger SCTs need an hour or two to cool down outside to avoid blurry views.</i>

## What’s All This About ‘Aperture’?

The ‘aperture’ of a telescope is the diameter of its main mirror or lens, which may be given in inches, centimetres or millimetres.

You can trust any astronomer when they tell you that ‘bigger is better’! A larger aperture gathers more light, which allows the image to be magnified more, so enabling you to see dimmer and/or smaller objects. Doubling the aperture gathers four times more light, as shown in the table to the right. **We think 130mm to 150mm is a good starting point.**

## And ‘Focal Length’?

The ‘focal length’ of a telescope determines its magnifying power and is given in millimetres. A telescope with a longer focal length magnifies more than one with a shorter focal length when using an identical eyepiece.

Unlike aperture, bigger is not always better when it comes to focal length. As you magnify the image more it becomes dimmer, so you need a larger aperture to compensate. It’s also harder to find things as the telescope’s field of view will be much smaller, plus it will tend to wobble about more due to the wind and vibrations caused by you. **A focal length five or six times the aperture (in mm) is a good compromise, and will be described as ‘f/5’ or ‘f/6’ in the advertisement.**

Common Telescope Diameters		
Millimetres (mm)	Inches (In / “)	Light Grasp
60	2 ½	1 x
70 or 71	2 ¾	1 ½ x
80	3	2 x
102	4	3 x
127 or 130	5	4 ½ x
152	6	6 ½ x
200 or 203	8	11 ½ x
254	10	18 x
279	11	21 ½ x
305	12	26 x
356	14	35 x



# Magnification and Eyepieces

Most telescopes aimed at beginners will be supplied with a couple of eyepieces. These will usually be fairly low quality but good enough to get you started. Each eyepiece will also have a focal length stated in millimetres. Lower numbered eyepieces (shorter focal lengths) magnify more than higher numbered ones. Confusing we know, but that's physics for you!

You can work out the magnification by dividing the telescope's focal length by the eyepiece's focal length. So if your telescope has a 600mm focal length, a 26mm eyepiece will magnify  $600 \div 26 = 23$  times magnification compared to the naked eye. Switch to a 6mm eyepiece and you'll get  $600 \div 6 = 100$  times magnification.



Eyepieces come in two diameters, **1 ¼ inches being most common**, and 2 inches being used for larger, more expensive eyepieces. More expensive telescopes will accept both sizes. You may also get a '**Barlow Lens**' which can be used to double the magnification of any eyepiece.

## Types of Telescope Mount

The telescope mount is just as important as the telescope itself. A bad mount will make the best telescope hard to use. There are three types:

**TIP: When observing with small kids, use a short stepladder to help them reach the eyepiece!**

### Altitude-Azimuth Mounts

An 'Alt-Az' mount is simple to understand and operate. You point the telescope up, down, left and right to find the objects you wish to view.

**Surprisingly, the view through an astronomical telescope is reversed so pointing up moves the view down, and pointing left moves right. It's confusing at first, but you'll get used to it!**

Tracking objects as the Earth rotates requires you to move in both the up-down and left-right directions simultaneously. This can be a bit tricky at high magnifications even if the mount has 'slow motion' controls like the one shown to the right.



### Equatorial Mounts

An equatorial mount needs to be set up so that it is aligned to point at the North (pole) star. Tracking objects is then simply a matter of slowly turning one of the slow-motion knobs as the Earth rotates. Equatorial mounts can usually be fitted with an optional tracking motor, leaving you free to observe.

It is a bit trickier to set up an equatorial mount and to get your head around how you point it at things in the sky, but easy enough once you have seen one in action.

**Both cheaper Alt-Az and equatorial mounts tend to be quite wobbly and may come with flimsy tripods. You shouldn't underestimate this problem, as even at low magnifications a bad mount can make it impossible to get a good view.**



## Dobsonian Mounts

The solution to wobbly views is the Dobsonian mount. This is a type of Alt-Az mount but, instead of a flimsy metal mount and tripod, the telescope is attached to a sturdy wooden box. Don't be fooled by the apparently primitive looks and technology. **We think Dobs are the best type of mount for beginners, and indeed most of the largest amateur telescopes are Dobs too!**

There's a one time 'IKEA flat-pack' assembly job, and after that you can have your Dob up and running in the garden in moments. Dobs also split down easily into box and telescope for transport by car.

Another advantage is that most of the money goes on the telescope, which will invariably be a reflector, rather than on the mount. **You definitely get more telescope and a more sturdy mount for your cash than any other type of beginner telescope.**

## GOTO Mounts

**So far we've looked at manual mounts. These rely on you to learn your way around the sky in order to find things. You also have to track them as the Earth rotates unless you have a motorised equatorial mount. All three types of mount we have covered are also available in more expensive 'GOTO' versions.**

A GOTO mount has motors which move the telescope to any object in the sky automatically and then tracks it. The mount is usually controlled by a computerised handset or an Android/iOS app on a smartphone or tablet. All GOTO mounts need a battery or mains adaptor power supply which may not be included so please check when buying.

The advantage of GOTO mounts is that once set up and aligned, you can more easily find dim objects just by looking them up in the handset. The main disadvantage of GOTO is that each time out you have to start by aligning the mount to the sky. This is done by centring the telescope on particular bright stars, a skill requiring a bit of practice and some basic sky knowledge.



## Advanced Mounts

Some Dobsonians feature **"Push To"** that guides you to the desired object using directions on a small handset. You still move the telescope by hand, making it cheaper and lighter than GOTO!

There are a number of dual-mode mounts that allow you to change between Alt-Az and equatorial modes. Some mounts also have built-in or add-on GPS receivers and alignment cameras which will complete the whole set-up process automatically.

## Which Brand To Buy?

There are a number of brands aimed at beginner and intermediate astronomers. Whilst we do not endorse specific brands, there are three that offer a wider range of quality equipment:

<i>Celestron</i>	<i>Orion Telescopes &amp; Binoculars</i>	<i>Sky-Watcher</i>
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The same Chinese manufacturers build a lot of almost identical equipment for all three, so our guide suggests the versions that are cheapest! We've omitted a few brands which offer poor quality equipment at low prices, as well as those with high price tags aimed at more advanced astronomers.

## Where To Shop?

**Customer service is key in case of problems, so buy from an established retailer specialising in astronomy. Avoid 'bargain' telescopes sold by supermarkets, electronics and photographic retailers. Again, we do not endorse specific suppliers.** If you want to view before you buy the nearest specialist astronomy shops open to the public are:

**TIP: The best telescope is the one that actually gets used! Start with a model that is small and quick to set up.**

*The Widescreen Centre (Ely, Cambs): [www.widescreen-centre.co.uk](http://www.widescreen-centre.co.uk)*

*Tring Astronomy Centre (Tring, Herts): [www.tringastro.co.uk](http://www.tringastro.co.uk)*

*F1 Telescopes (Sittingbourne, Kent): [www.f1telescopes.co.uk](http://www.f1telescopes.co.uk)*

Increasingly, astronomy retailers are moving to online sales only, making membership of an astronomical society one of the few ways to get hands-on with equipment before buying. Some of the best known online retailers in the UK include:

*Altair Astro: [www.altairastro.com](http://www.altairastro.com)*

*David Hinds: [www.celestron.uk.com](http://www.celestron.uk.com)*

*First Light Optics: [www.firstlightoptics.com](http://www.firstlightoptics.com)*

*Harrison Telescopes: [www.harrisontelescopes.co.uk](http://www.harrisontelescopes.co.uk)*

*Pulsar Astro: [www.pulsarastro.com](http://www.pulsarastro.com)*

*Telescope House: [www.telescopehouse.com](http://www.telescopehouse.com)*

## Learning The Sky



**“Turn Left At Orion”** is essential reading for anyone beginning their journey through the night sky. With simple diagrams and advice, you'll soon be spotting all sorts of celestial wonders. Available from Amazon and many other retailers.

A good planetarium app is also invaluable for any astronomer. There are a number out there, but we like **“SkySafari 6”**, which is available for Android and Apple devices. The most basic version has everything the beginner needs and is often free.





# Telescope Guide



























The telescope guide lists examples of commonly used beginner and intermediate telescopes. It is organised by approximate price at the time of writing. Do shop around though as prices change! Use your answers at the beginning of this guide to find the models that fit your needs.

## Need More Help?















































We can't include every telescope available, so we cover complete packages as this is the easiest and most trouble-free way to start out. Look for our "Star Buys" which are the ones we'd purchase for at a given budget.

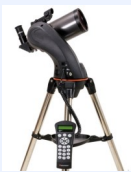


























































































If you would like to get 'hands-on' with different telescopes before committing to an expensive purchase, why not become a member of North Essex Astronomical Society? We welcome new members from **complete beginner** on. It's the best way to get one-on-one advice as you start your journey through the night sky. Membership details can be found at the back of this guide.

Model	Aperture : Focal Length	Description	Price?	Who?	Size?	Hi-Tech?	Best For?
<b>Celestron FirstScope 76mm</b> OR <b>Sky-Watcher Heritage 76</b> <b>Orion FunScope 76mm</b> 	76mm : 300mm (f/4)	<i>£48 Tiny Dobsonian reflector. Includes two eyepieces. Better than a toy scope. Stands on a high garden table.</i>	£				
<b>Sky-Watcher Heritage 100P</b> OR <b>Orion Sky Scanner 100mm</b> 	100mm : 400mm (f/4)	<i>£99 Small Dobsonian reflector. Includes two eyepieces, Barlow &amp; red-dot finder. Stands on a high garden table.</i>	£				
<b>Celestron AstroMaster 70AZ</b> 	70mm : 900mm (f/13)	<i>£110 Entry level Alt-Az refractor. Includes two eyepieces and smartphone adaptor for Moon pictures.</i>	£				
<b>Orion Observer 80ST</b> OR <b>Sky-Watcher Startravel 80 EQ1</b> 	80mm : 400mm (f/5)	<i>£138 Wide-field equatorial refractor. Includes two eyepieces, Barlow &amp; red-dot finder.</i>	£				
<b>Sky-Watcher Heritage 130P Flextube</b>  	130mm : 650mm (f/5)	<i>£142 Small Dobsonian reflector. Includes two eyepieces, Barlow &amp; red-dot finder. Portable and good optics for the price.</i>	£				



Model	Aperture : Focal Length	Description	Price?	Who?	Size?	Hi-Tech?	Best For?
<b>Celestron AstroMaster 90EQ</b> 	<b>90mm : 1,000mm (f/11)</b>	<b>£176</b> Small equatorial refractor. Includes two eyepieces. Optional tracking motor upgrade. Terrestrial viewing too.	£				
<b>Sky-Watcher Heritage-114P Virtuoso</b> 	<b>114mm : 500mm (f/4)</b>	<b>£183</b> Table-top Alt-Az reflector with directional / tracking motors. Optional GOTO upgrade available.	£				 
<b>Sky-Watcher Skyhawk-1145PS AZ-EQ AVANT</b> 	<b>114mm : 500mm (f/4)</b>	<b>£189</b> Dual mode Alt-Az / Equatorial reflector on tripod. Includes two eyepieces & red-dot finder.	£				 
<b>Sky-Watcher 150P Dobsonian</b> OR <b>Orion SkyQuest XT6</b> 	<b>153mm : 1,200mm (f/8)</b>	<b>£219</b> Mid-sized Dobsonian reflector. Includes two eyepieces & finder scope. Smallest freestanding Dob.	££				
<b>Sky-Watcher Explorer-130PS AZ-EQ AVANT</b> 	<b>130mm : 650mm (f/5)</b>	<b>£219</b> Dual mode Alt-Az / Equatorial reflector on tripod. Includes two eyepieces & red-dot finder.	££				 
<b>Sky-Watcher Evostar-90 AZ Pronto</b> 	<b>90mm : 900mm (f/10)</b>	<b>£229</b> Simple Alt-Az reflector. Includes two eyepieces & finder scope. Sturdy and stable mount. Terrestrial viewing too.	££				
<b>Sky-Watcher Skyliner 200P Dobsonian</b> OR <b>Orion SkyQuest XT8</b>  	<b>200mm : 1,200mm (f/6)</b>	<b>£289</b> Mid-sized Dobsonian reflector. Includes two eyepieces & finder scope. <b>Our favourite telescope!</b>	££				 
<b>Sky-Watcher SkyHawk-1145PS AZ-GTe</b> 	<b>114mm : 500mm (f/4)</b>	<b>£295</b> Small GOTO Alt-Az reflector. Includes two eyepieces, Barlow, finder scope. Controlled by free Android/iOS App.	££				 

Model	Aperture : Focal Length	Description	Price?	Who?	Size?	Hi-Tech?	Best For?
<b>Celestron NexStar 90 SLT</b> 	<b>90mm : 1,250mm (f/14)</b>	<i>£295 Compact GOTO Alt-Az Maksutov. Includes two eyepieces. Good for Moon &amp; planets.</i>	££				
<b>Sky-Watcher Skymax 102 SynScan AZ GOTO</b> <i>OR similar Orion StarSeeker IV 102mm GOTO</i> 	<b>102mm : 1,300mm (f/13)</b>	<i>£325 Compact GOTO Alt-Az Maksutov. Includes two eyepieces, Barlow &amp; finder scope. Good for Moon &amp; planets.</i>	££				
<b>Sky-Watcher StarTravel-102 AZ GTe</b> 	<b>102mm : 500mm (f/5)</b>	<i>£339 Portable GOTO Alt-Az refractor controlled by free Android/iOS app, Two eyepieces &amp; red-dot finder.</i>	££				
<b>Sky-Watcher Explorer 130PS AZ GTi</b> 	<b>130mm : 650mm (f/5)</b>	<i>£360 Small Smartphone controlled GOTO Alt-Az reflector. Includes two eyepieces, Barlow &amp; red-dot finder.</i>	££				
<b>Sky-Watcher Star Discovery 150i WiFi</b> 	<b>150mm : 750mm (f/5)</b>	<i>£389 Small GOTO Alt-Az reflector. Includes two eyepieces &amp; red-dot finder. Control via iOS/Android App.</i>	££				
<b>Sky-Watcher Skymax 127 Synscan AZ GOTO</b> 	<b>127mm: 1,500mm (f/12)</b>	<i>£399 Larger GOTO Alt-Az Maksutov. Includes two eyepieces, Barlow &amp; finder scope.</i>	££				
<b>Sky-Watcher Skyliner 250PX Dobsonian</b> 	<b>254mm : 1,200mm (f/5)</b>	<i>£439 Large manual Dobsonian reflector. Includes two eyepieces &amp; finder scope. Needs storage space!</i>	££				
<b>Sky-Watcher SkyMax-127 AZ GTi</b> 	<b>127mm: 1,500mm (f/12)</b>	<i>£445 Larger GOTO Alt-Az Maksutov controlled by free Android/iOS app, Two eyepieces &amp; red-dot finder.</i>	££				

Model	Aperture : Focal Length	Description	Price?	Who?	Size?	Hi-Tech?	Best For?
<b>Orion StarBlast 6i Intelliscope</b> 	<b>150mm : 750mm (f/5)</b>	<b>£461</b> Table-top Push-To Dobsonian reflector. Includes two eyepieces & red-dot finder. Stand on a low garden table.	££				  
<b>Sky-Watcher 200P EQ5</b> 	<b>200mm : 1,000mm (f/5)</b>	<b>£479</b> Mid-sized manual equatorial reflector. Includes two eyepieces, Barlow & finder scope. GOTO upgrade available.	££				 
<b>Celestron Astro Fi 125mm SCT</b> 	<b>125mm : 1,200mm (f/10)</b>	<b>£549</b> Small GOTO Alt-Az SCT. Includes two eyepieces. Smartphone controlled via Wi-Fi.	£££				
<b>Orion SkyQuest XT8i Intelliscope</b> 	<b>203mm : 1,200mm (f/6)</b>	<b>£693</b> Mid-size Push-To Dobsonian reflector. Includes two eyepieces and finder-scope.	£££				 
<b>Sky-Watcher Skyliner 200P FlexTube GOTO</b> 	<b>200mm : 1,200mm (f/6)</b>	<b>£779</b> Mid-size GOTO Dobsonian reflector. Includes two eyepieces & finder scope. Stable, collapsible tube, heavy.	£££				 
<b>Celestron NexStar 6SE</b> 	<b>150mm : 1,500mm (f/10)</b>	<b>£879</b> Small Alt-Az GOTO SCT. Includes one eyepiece. Garish 1970s orange makes it easy to find in the dark.	£££				 
<b>Skywatcher Explorer 200P-DS HEQ5 PRO</b>  	<b>200mm : 1,000mm (f/5)</b>	<b>£1,059</b> Mid-sized equatorial reflector on heavyweight GOTO mount. Entry level for astrophotography.	£££				 
<b>Celestron NexStar 8SE</b> 	<b>203mm : 2,032mm (f/10)</b>	<b>£1,275</b> Large Alt-Az GOTO SCT. Includes one eyepiece. Low cost for a big SCT. Great for planets & other small objects.	£££				 



# Join North Essex Astronomical Society!

Membership is open to all. We cover a wide range of interests, knowledge, skills and abilities. We are a social and friendly group, catering for anybody with an interest in astronomy.

Don't be scared off if you consider yourself a beginner: *everyone is at some point!* Some members are more active than others, but all are welcome. We currently have around 100 members, from beginners to keen astrophotographers.

## Membership Fees & Benefits

Our annual subscription fees are £25 per person, £35 per couple/family, £10 for under 16s or full time students.

Membership entitles you to:

- Access to and full use of our observatory dark site and telescopes
- Our monthly Pulsar e-magazine, weekly updates, BAA and FAS newsletters
- Reduced door charge for public meetings
- Observing sessions and workshops
- Members-only events, meetings, activities and social outings
- Affiliate membership of the Society for the History of Astronomy

The £10 Junior Membership for under 16s also entitles the Junior member to free entry to all public meetings (although you must be accompanied by an adult).

Join today and pay online securely at:  
[www.northessexastro.co.uk/members](http://www.northessexastro.co.uk/members)



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