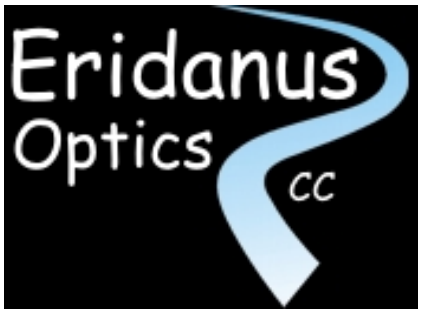
How do I choose a telescope?



This guide has been prepared by amateur astronomer Andrie van der Linde and owner of Eridanus Optics CC to aid prospective telescope buyers in making an informed decision.

So, you are new to astronomy and you want to buy your first telescope. You are now bewildered by a large selection of telescopes to choose from. What's more, every salesperson you speak to recommends something different, sometimes suspiciously close to the product available from the particular store. You don't know knowledgeable people to help you, and you don't want to spend good money on a bad product. Below you will find the following:

- **What plays a role:** This section gives a short list of the most important factors that you should consider in selecting the right telescope.
- **Components of astronomy telescopes:** This part deals with the various parts that make up an astronomy telescope.
- **What to choose from:** This part deals with the various options available to the first time buyer.
- **The way to go:** This part gives practical advice to consider before you buy your telescope.
- **What not to do:** This part highlights various common mistakes made by aspirant telescope owners.
- **Conclusion:** This part rounds up this topic, including practical hints to improve your viewing experience.

What plays a role

Various factors play a role in selecting a telescope. The following is a list of the most common factors that a potential telescope buyer should consider:

- **Price:** The telescope that you eventually buy may largely be determined by what you can afford.
- **Purpose:** A telescope to view faint deep sky objects and one for viewing the bright solar system objects will look different. If the telescope is intended for hosting celestial events, including viewing by large groups, you may choose a different telescope as the person who plans to work on his own.
- **Imaging:** Some telescopes are more suited to take photographs than others.
- **Storage space:** The available storage space should be considered.
- **Travel requirements:** If you want to frequently take your telescope along when travelling, you should keep the space required for the telescope in mind.
- **Physical ability:** The physical ability of the person who will normally operate the telescope may restrict the selection of telescopes to consider. A young schoolgirl or a frail elderly person may not appreciate a bulky telescope.

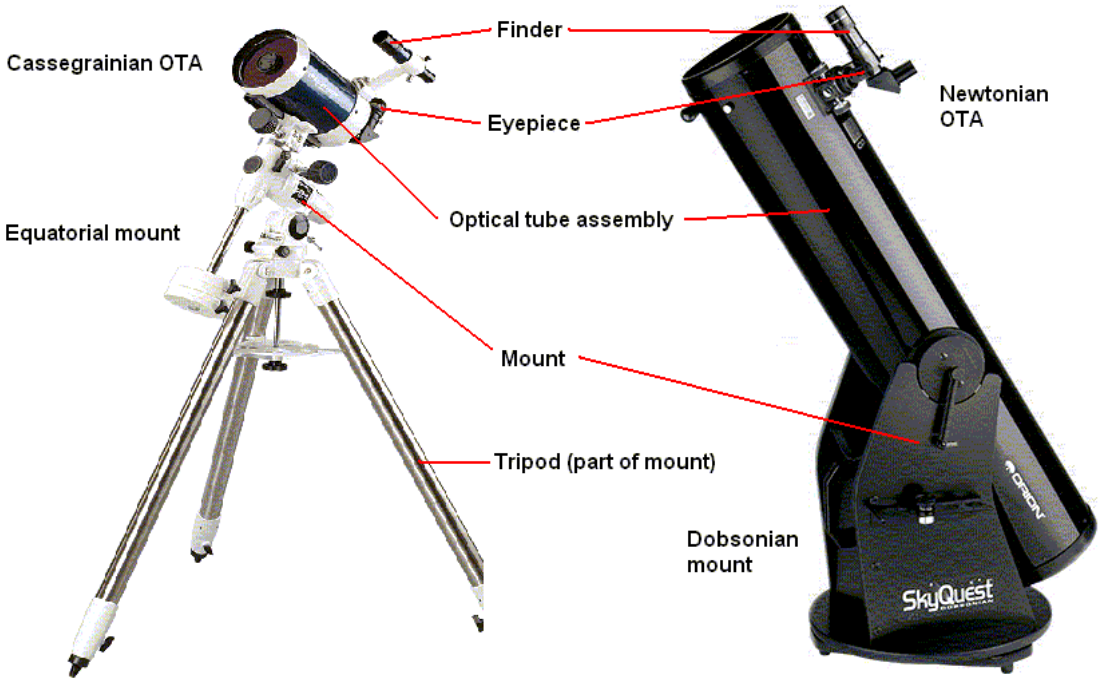
But first it is necessary to understand the various components that make up astronomy telescopes before I describe how the above factors and your own priorities will influence your choice of telescope.

Prepared by Andrie van der Linde (andrie@eridanusoptics.com)
Website: http://www.eridanusoptics.com/store

Components of astronomy telescopes

When buying a telescope you'll normally expect to buy a complete set-up. Although it may be a basic set-up, it is usually possible to add suitable accessories to improve your viewing experience. A basic (complete) astronomy telescope consists of the following:

- Optical tube assembly (OTA)
- Mount
- Finder and
- Eyepiece



These components are discussed below:

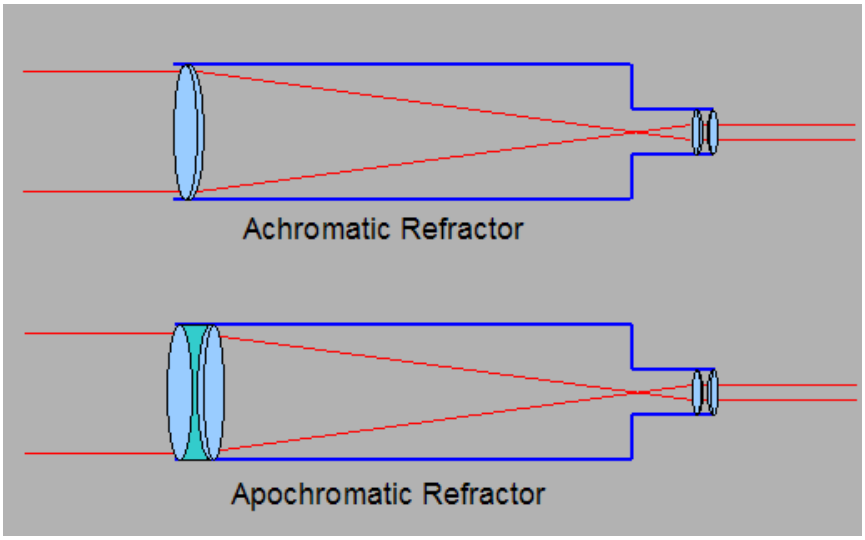
Optical tube assembly: This is the actual 'telescope'. It consists of the main (primary) lens, the supporting tube (or trusses in the case of very large telescopes) and a focuser. The optical quality of most telescopes (excluding 'supermarket specials') is generally acceptable (but not necessarily great). The different optical tube assembly (OTA) designs are:

- **Refractor:** This is the design generally associated with telescopes. Rifle scopes and spotter scopes (used for birding, surveying, etc) employ these designs. The main lens consists of a refractive element (like a magnifying glass). The most common lens design is the 'achromat' and consists of two matched glass lenses of different materials (eg. crown glass and flint glass) specially shaped to reduce colouring (chroma). 'Apo-chromatic' lenses are made with three glass components and virtually remove all chroma. Single lenses are not used in astronomy at all and are only found in cheap children's toys.

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

Small (<100mm aperture) achromatic refractors are the cheapest telescopes available and are typical entry level/economy telescopes. They are ideal for viewing solar system objects and bright celestial objects. Apochromatic refractors are serious telescopes and are ideal for photography and travel.

The Celestron Omni XLT 120 is a typical example of a refracting telescope (http://eridanusoptics.com/store/index.php?main_page=product_info&cPath=4_74&products_id=526)

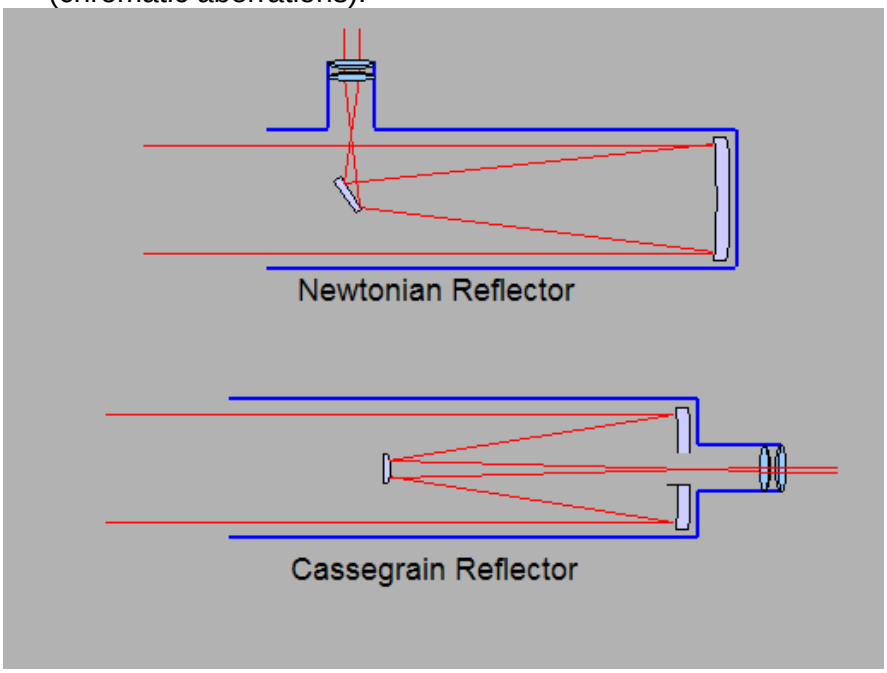


The basic refractor telescope design. (Source: http://www.budgetastronomer.ca)

- **Newtonian:** This is the cheapest large aperture (>100mm) telescope available. The main lens is a reflecting element (mirror) and a secondary flat mirror is positioned diagonally to project the image to the side of the telescope. Because

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

Newtonians have no refractive elements, there is no coloration of images (chromatic aberrations).

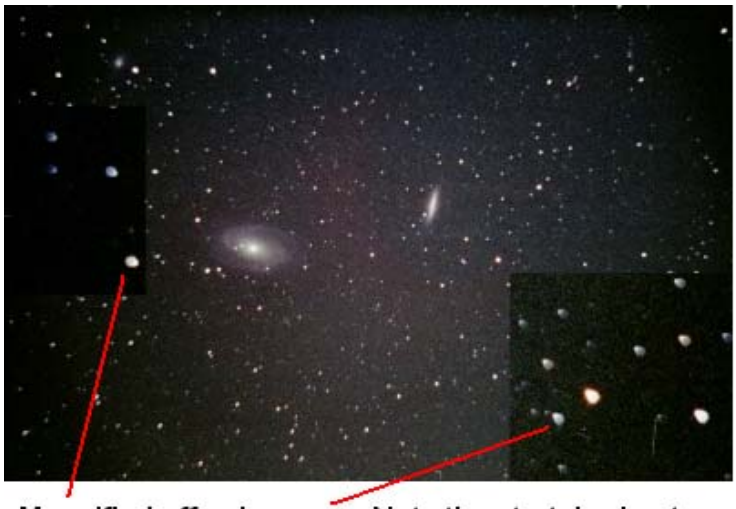


The basic Newtonian and Cassegrainian telescope designs
(Source: http://www.budgetastronomer.ca)

The collimation of a Newtonian telescope is more affected by travelling, bumping, handling, etc than other designs. Collimation tools such as Cheshire eyepieces end laser collimators are available on the market to correct suspect collimation.

- **Cassegrainian:** The optical components of these telescopes comprise a primary reflective lens (mirror) and a secondary curved mirror reflecting the light back through a hole in the primary lens. Most manufacturers fit the secondary lens onto a 'corrector' lens to improve the off-axis (away from the centre of the image) performance of the telescope. Many large aperture telescopes (8" up) are of this design due to the following:
    - **Compact:** These telescopes are much more compact than equivalent Newtonians due to the folded optics. It makes it easier to transport and to store.
    - **Off-axis performance** (image quality away from the centre)**:** These telescopes normally have longer focal lengths than similar aperture Newtonians, making it easier to achieve good off-axis performance. Where corrector lenses (eg. Schmidt or Maksutov) are used, off-axis performance is even further enhanced.

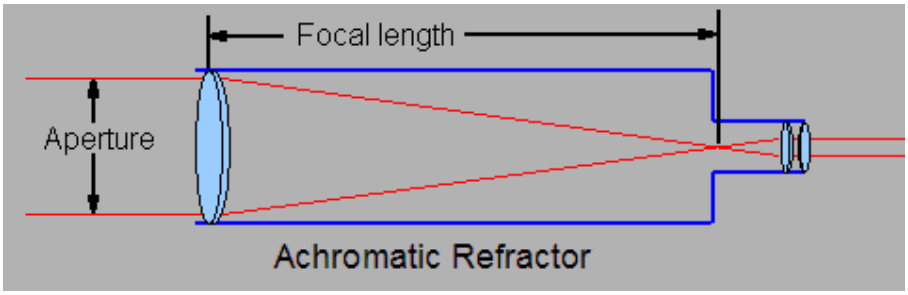
Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store



Magnified off-axis areas: Note the stretched out stars that look like comets. This problem is often encountered in fast Newtonian telescopes.

On the negative side, these telescopes are much more expensive than Newtonians of the same aperture.

The main properties of the OTA are:



- **Aperture:** This refers to the size of the primary lens. In small telescopes this is measured in mm (e.g. 60mm), but in larger telescopes this is measured in inches (e.g. 8"). This is the most important property of the telescope. Generally, larger is better as it will allow you to view duller objects. However, there are numerous bright objects suitable for viewing through small telescopes.
- **Focal length:** This property is used to calculate the magnification of the telescope in combination with an eyepiece. Long focal lengths are generally associated with high magnifications and narrow fields of view. Short focal lengths are normally associated with low magnifications and wide fields of view (also referred to as 'rich field'). The telescope's focal length can artificially be 'altered' with Barlow lenses, focal reducers, telecompressors, etc.
- **Focal ratio:** This is merely the focal length divided by the aperture. Therefore an 8" (200mm) telescope with a 1200mm focal length has a focal ratio of 1200/200 = 6 and is referred to as f/6. It gives an indication of the amount of light that enters the eyepiece (or a camera). The more light that enters, the faster you can take images with a camera. Telescopes with high f/numbers (e.g. f/10) are referred to as 'slow' telescopes (images are duller in the eyepiece or you need more time to take photo's) and those with low

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

f/numbers (e.g. f/4) are referred to as 'fast' telescopes (images are brighter in the eyepiece or you need less time to take photo's with a camera).

- **Field of view:** When looking into the eyepiece, you will see a circle within which the images of celestial objects appear. This is the field of view and is expressed as an angle. This is much wider as the actual (true) field of view you are looking at and is referred to as the apparent field of view. The apparent field of view is a determined by the eyepiece design. However, the true field of view of the telescope is limited by the telescope's focal length and the focuser. For a technical discussion, see the text box below:

Technical discussion on field of view:

If your telescope is fitted with a 1¼" focuser, you can only fit 1¼" eyepieces. These have a 28mm clear aperture through which the light must pass. The maximum achievable field of view with the telescope is then determined as follows:

FOV_{Max} = arctan(28mm/(Telescope's focal length))

or it can be approximated by:

FOV_{Max} = (180/Pi) x (28mm/(Telescope's focal length)) or

FOV_{Max} = 1600mm/(Telescope's focal length))

E.g.: A telescope with a focal length of 1200mm and a 1¼" focuser will have a maximum field of view of 1600 / 1200 = 1.33°.

If your telescope has a 2" focuser and you use 1¼" eyepieces, the same limitations are in force. However, 2" eyepieces have clear apertures of 47mm. You can therefore substitute the 28mm in the formulae above with 47mm (or substiture the 1600 with 2700). A telescope with a 1200mm focal length and a 2" focuser will therefore have a maximum field of view of

57.3 x 47/1200 = 2.24° (or 2700/1200 = 2.25°)

This limits the size of objects (e.g. open clusters, nebulae and galaxies) that you can see fully in an eyepiece. To see how this may impact your choice of telescope, consider the following:

Omega Centauri is the brightest (magnitude 3.7) and largest globular cluster in the sky. It is located about 15 800 light-years away in the constellation Centaurus and consists of about 10 million stars. The cluster's diameter is slightly less than one degree. This means any telescope with a 1200mm focal length can see the full cluster. A telescope with a 1¼ focuser (1.4° FOV) focuser will have 0.33° spare field of view. For a telescope with 2000mm focal length you need a 2" focuser (2700/2000 = 1.35°). A telescope with a 1¼" focuser will be able to pass a maximum field of only 0.86°. A 12" f/10 telescope (focal length = 3000mm) will probably not fit the full image in a 2" eyepiece. Only 0.90° (2700/3000) field of view can pass, even through a 2" eyepiece.

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

Mount: Bad mounts probably ruin more aspirant astronomers' enthusiasm than any other component of the telescope. Mostly you can still make out something, even with mediocre optics, but if the mount does not retain its position after you located an object, then you simply cannot do any constructive viewing or show the magnificent celestial object you just found to family and friends. There are two basic mount concepts:

- **Alt-Az:** Altitude-Azimuth (Up/Down-Left/Right) mounts are better suited for terrestrial viewing and are normally not suitable for astronomy. Stars follow circular paths through the sky, but these telescopes are designed for horisontal and vertical movement. An operator will have his work cut out if he wants to track celestial objects. There are a two exceptions to this statement:

A typical Alt-Az mount

  - **Dobsonian mount:** This is without doubt the most popular mount used in amateur astronomy, and for good reason. More about this later.

The Orion SkyQuest classic series of Dobsonian telescopes are excellent beginner telescopes. (http://eridanusoptics.com/store/index.php?main_page=index&cPath=4_5)

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

- **GOTO mounts:** There is a computer and electric motors available to do all the hard work of tracking the circular paths of the celestial objects – but you pay for it.

The Celestron NexStar SLT130 is an example of a computerised Alt-Az telescope suitable for beginners. (http://eridanusoptics.com/store/index.php?main_page=product_info&cPath=4_114&products_id=601)

- **Equatorial mounts:** The principle behind these mounts is to align the mount's main rotation axis with the rotation axis of the Earth. This way you only need to correct one axis to compensate for the Earth's rotation. A blessing if you get it right (or close enough), but curse if you are way off. The following tracking options are available:
  - **Manual:** Slow motion controls are provided to allow you to track the objects manually.

The Orion StarBlast 114 EQ has an excellent equatorial mount.
(http://eridanusoptics.com/store/index.php?main_page=product_info&cPath=4_74&products_id=333)

  - **Clock drive:** A motor is used to compensate for the Earth's rotation. You still have to locate the object yourself. Dual axis clock drives are also available where declination corrections can be done.

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

- **GOTO:** As with Alt-Az mounts, there are also 'GOTO' options available.

Serious amateur astronomers often spend more money on the mount than on the OTA. This is to eliminate free play and other defects that influence the mount's ability to accurately track celestial objects through the sky.

Finder: Because of the high magnifications of telescopes, the actual field of view is extremely small. The finder has a much wider field of view and is used to get the object in the field of view of the main telescope. To be useful, you need to align the optical axis of the finder with the telescopes optical axis. Use far-away terrestrial objects for this purpose as celestial objects are constantly on the move due to the Earth's rotation. There are two basic types of finders:

- **Finder scopes**: These are small low powered (eg 8x magnification) telescopes with crosshairs. It gives the operator optical assistance and is very useful when exploring areas of the sky with few bright objects. When viewing objects that are directly overhead, one needs to be some form of contortionist; unless you use a finder with a right angle (90°) bend. Images are upside down (you soon get used to it) except when using a right angle finder.

A right angle finder scope
(http://eridanusoptics.com/store/index.php?main_page=index&cPath=20_31_32)

- **Red dot finders:** Red dot finders project a red dot onto the night sky. This is a very intuitive way to find objects, but you get no optical assistance from the finder. There are also no escaping contorted twists when locating overhead objects. The cheapest finders in this class simply project a spot, while the ;deluxe' models can project various targets such as cross hairs and circles. The tube within which the reflective element is mounted prevents stray light (such as coming from nearby streetlights) from creating glare on the reflecting element.

A typical red dot finder
(http://eridanusoptics.com/store/index.php?main_page=index&cPath=20_31_33)

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

Eye piece: This is the final item normally supplied in a complete telescope kit. It determines the magnification of the telescope:

Magnification = (Focal length of telescope)/(Focal length of eyepiece)

E.g.: A 10mm eyepiece used on a telescope with 1200mm focal length will give a 120x magnification.

Eyepieces often make or break the performance of the telescope. Low quality eyepieces (and other accessories) may seriously compromise the performance of even top quality OTA's.

A selection of eyepieces available from Eridanus Optics CC.
(http://eridanusoptics.com/store/index.php?main_page=index&cPath=20_21)

What to choose from:

The options provided below is intended for 'beginners' who know nothing or very little about astronomy. Experienced amateurs with unique requirements will probably not find any value in the advice provided:

- **Dobsonian:** This is the first telescope that I will recommend to a beginner. It is the most popular telescope among amateur astronomers, and for good reason:
  (http://eridanusoptics.com/store/index.php?main_page=index&cPath=4_5)
  - **It gives the most bang for your buck:** The Dobsonian consists of a Newtonian OTA (cheapest large aperture OTA) fitted onto the cheapest mount available.
  - **It is a 'no nonsense' telescope:** This telescope just doesn't give you any trouble. It is easy to understand, and is almost impossible to break. You put it down on a flattish surface that is sort of level and you are ready to go! If

something is in the way, you simply move the telescope over to a suitable position and continue your viewing.

- **It stores in a small space:** With the tube in the vertical position, Dobsonians require only the space of the base. The typical storage footprint is less than $0.3m^2$.
- **It has no free play in the mount:** The most frustrating defect commonly found in other cheap mounts is ingeniously taken care of by gravity.

On the negative side:

- **Not easy to transport:** This is probably the worst travel-scope imaginable. There is simply no easy way to travel with the bulky mount. The tubes are also not really 'compact'.
- **Photography is not great:** This is not a motorised telescope – and imaging is always a challenge (I have personally done it and can assure you that there are easier ways). If you want to buy the telescope to go into astro-imaging, consider other options first. The 'Dobtorial' may be an option if you want to exploit the cheap large aperture and small storage space. More on this later.
- **No easy tracking:** Because it is a non-motorised mount, you'll constantly have to nudge the telescope along to compensate for the Earth's rotation. Don't worry, you'll quickly get used to it and it will soon come naturally. This limitation makes it an unlikely choice if you plan group viewing events.

The 'SkyQuest' classic range from Orion is one of the best options available to choose from. Telescopes from 4.5" to 12" are available.

The following are available to overcome some of the shortcomings of a standard Dobsonian:

- **Dobtorial:** Eridanus Optics can supply the 'Dobtorial' platform that allows for one hour's equatorial tracking with your Dobsonian. This is a low platform onto which you position your Dobsonian. This complicates setting up your Dobsonian, similar to setting up EQ mounted telescopes.

The Dobtorial platform provides one hour of equatorial tracking for Dobsonian telescopes.

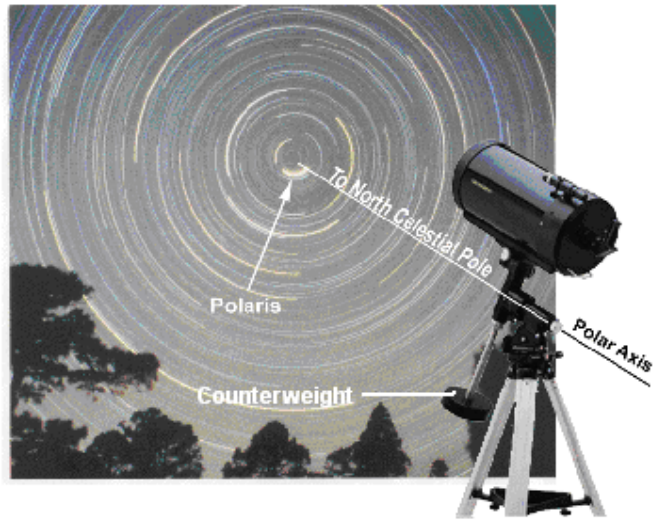
- **Intelliscope:** Orion manufactures the 'IntelliScope' range of Dobsonians. These feature computer assistance to help you locate those difficult

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

objects. These telescopes do not have motor drives (like GOTO telescopes) and you still have to move the tube around by hand based on instructions provided on the display unit.
(http://eridanusoptics.com/store/index.php?main_page=index&cPath=4_51)

The Orion SkyQuest IntelliScope series offers computer assistance

- **EQ Mounted:** If you are serious about astro-imaging, then this is the way to go. These telescopes are more difficult to set up, but if you can get it right, viewing is a pleasure. The main challenge with this mount is to align the right ascension (RA) axis with the (North/South) rotation axis of the Earth.
(http://eridanusoptics.com/store/index.php?main_page=index&cPath=4_74)



This image shows the principle behind Equatorially mounted telescopes. Telescopes in the Southern hemisphere should be aligned to the South Celestial Pole. (Note the counter weight) (Source: http://calgary.rasc.ca)

Electric motors (also called 'clock drives) are available to compensate for the rotation of the Earth automatically. When fitted with a computerised controller, these

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

telescopes are sold as 'GOTO' telescopes (see next heading). Clock drives and GOTO computers can be set to work in the Southern or Northern hemisphere. The reasons why you'll settle on this telescope will include:

- **Astro-imaging:** This telescope (when motorised) will keep celestial stabilised and rotate along with the objects during long exposures.
- **Easy tracking:** These telescopes normally have slow-motion controls. When properly aligned, you only have to turn the RA control to keep celestial objects in view. When motorised, you only need to press the occasional button on the motor control box to correct for drift due to small alignment errors.
- **Transportable:** This is surely not an elegant travel scope, but the mount is much more transportable than a Dobsonian. The tube is still bulky (less so if you buy a Cassegrainian OTA).
- **Observatory:** If you plan to build a dedicated observatory for your telescope, then this is the option to consider.

On the negative side:

- **Heavy:** Counter-weights are used to offset the weight of the tube and reduce strain on the drive train. This adds weight to your set-up.
- **Storage:** You have two choices, you either have to reassemble/disassemble the telescope every time you go out for a viewing session or you have to accept the large storage space required by the tripod. Larger telescopes (8" and larger) need to be at least partially disassembled to be moved around due to the sheer bulk and mass.
- **Planning:** It is not so easy to move the telescope around if the object you are looking for is behind some obstruction. The counter-weights and size of the telescope make it difficult to move around. If you have a Newtonian telescope, the eyepiece/focuser will be in an inconvenient position at some stage (this can be corrected, but will require that you rotate the OTA and possibly rebalance.
- **Set-up:** It is important to align the RA axis of the telescope with the Earth's rotation axis. You will also have to balance the telescope by moving the counter weights up and down the counter-weight shaft. These actions means that you will need more time to set-up your telescope and a person with a Dobsonian.

The Orion 8" SkyView Pro and StarBlast 4.5 are good value for money telescopes while the Celestron Omni range and AstroMaster range are also worth considering if you are interested in EQ mounted telescopes. All these telescopes (except the AstroMaster range) are compatible with clock drives.

- **GOTO:** This is often portrayed as the 'ultimate' telescope. The data base with thousands of objects promises unlimited viewing. Unfortunately most beginners view little more than the Moon, the naked eye planets (mostly Mars, Jupiter and Saturn) and a hand-full of deep sky objects (e.g. the Great Orion Nebula). It is no big challenge to locate these objects without the GOTO function and the additional cost cannot readily be justified. (http://eridanusoptics.com/store/index.php?main_page=index&cPath=4_114)

  The 'Alt-Az' mount is a very popular basis for GOTO telescopes. This is one of the exceptions where an Alt-Az mount is suitable for astronomy. This is however still not

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

a suitable mount for deep sky astro-photography. Although the object is tracked, the Alt-Az configuration cannot correct for the rotation of the object. (This can be corrected by an equatorial wedge that is used between the tripod and the mount.)

However, these are very useful telescopes. Get a GOTO telescope if:

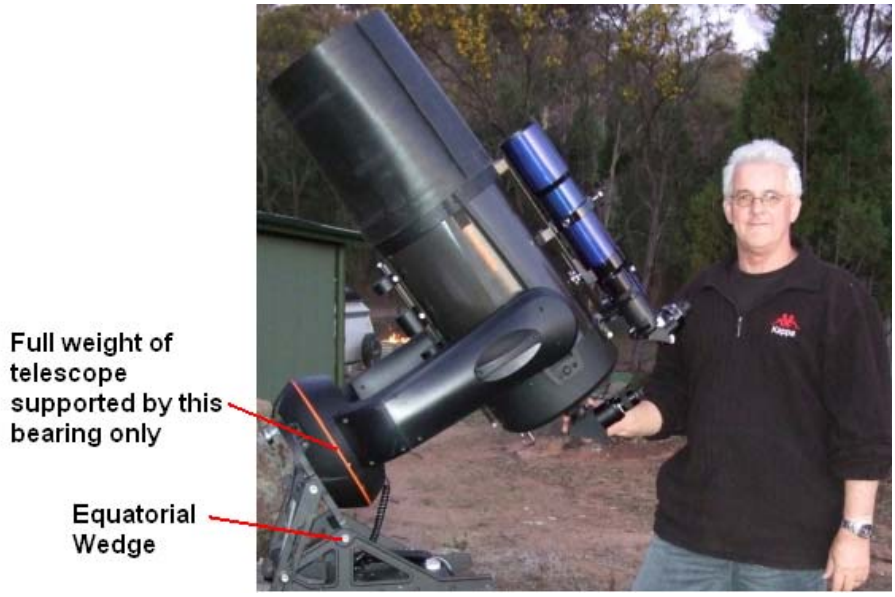
- **Imaging:** You are serious about astro-imaging of deep sky objects. Easy (easier) to find those elusive objects and easy to track them for time exposures.
- **Research:** If you want to use the telescope for tracking or observing unusual celestial phenomena on a regular basis. These will include:
  - The brightness of variable stars (periodic and cataclysmic variables).
  - Relative position of double/multiple stars.
  - Searches for supernovae, comets, etc.
- **Small telescope:** If you want to buy a small telescope this is the way to go. Typical small telescopes are at the 'cut-throat' end of the market where quality is often compromised. Buying a GOTO telescope immediately places it in a more expensive class, with better prospects of getting a good quality telescope. Both the optics and mechanical construction will be of better quality when compared to a similar sized non-computerised telescope because there is more incentive to build in quality.
- **Handicapped:** Some handicapped people may only be able to operate a GOTO telescope.
- **Technology:** If you are intrigued by technology, then these telescopes will provide you hours of enjoyment.
- **Group viewing:** If you plan to use the telescope primarily for group viewing events (e.g. you are a game ranger on a game farm or National Park), then this is the way to go. Ideally, you should team up with a colleague at these events (one to lead the discussion, and one to operate the telescope). Generally, you do not need a large telescope (e.g. 14") for the following reasons:
  - Setting up: The effort to set up a large telescope makes it unsuitable for this purpose, unless the telescope is housed in a permanent observatory.
  - Bright objects: There is little opportunity to view more than a handful of bright objects during group viewing events. These objects look spectacular, even through a 6" or 8" instrument. You may get a few 'wow's' though for your large telescope, so don't go too small.
- **Quality:** With more funds available, you can go in two directions:
  - **Larger aperture:** Very large aperture telescopes present their own challenges to store, transport, carry around and operate. I regard the 8" as the largest aperture telescope that can still be comfortably operated by the general public. This may depend on physical ability of the owner (young child, handicapped, body builder, etc) and should not be taken as an absolute rule.
  - **GOTO:** With spare money available, a GOTO telescope will buy you better quality. There are various different GOTO mounts available at increasing prices. For the same manufacturer's telescopes, the OTA and controller will be of comparable quality and price. Mount quality eventually dominates the price, and the best mounts come standard with GOTO functionality due to the small impact on the price.

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

On the negative side:

- **No running on flatteries:** These telescopes run on electrical power, and batteries are the most popular source. The batteries run flat, often at the most inconvenient time, especially when doing long exposure photography. Car batteries and power supplies operating from mains power can resolve this, but these power sources cannot always be guaranteed, especially when travelling or out in the field.
- **Setting up:** Although setting up GOTO telescopes gets progressively easier, it still requires time and knowledge.
- **Cost:** You undoubtedly pay a premium for the GOTO function. This money can buy you a larger not-GOTO telescope. Maintenance on these telescopes is also expensive and a small problem may make it impossible to repair.
- **Slow learning:** With the convenience of a computer to locate objects, it is natural to leave the night sky to the computer and be unaware of the location of even some obvious objects. You may also lack the ability to verify that your computer has indeed located the correct object.

Celestron has an extensive range of GOTO telescopes to choose from. These are available from entry level (60mm) to serious/professional astronomer (14").



Typical set-up for Cape Town (33° S). For latitudes closer to the equator, the wedge will be more upright and the fork arms more horizontal. (Source: http://www.sydneyobservatory.com.au)

Alt/Az GOTO mounts can be converted to equatorial mounts with the addition of an equatorial wedge. I believe a dedicated equatorial mount will work better in South Africa because of our low latitude. The main Azimuth bearing has to support the total weight of the telescope, accessories, etc. At 30° latitude, this means the load on this bearing is still 87% compared to one that is mounted horisontally.

- **Travel scope:** If you plan to take along your telescope on your regular travels, this is the way to go. Few of the telescopes described above are really easy to take along. If you have a special reason (solar eclipse, visiting a dark sky site, etc) then you will probably make an extraordinary plan anyway to take a large telescope.

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

Taking a large aperture telescope along every time you travel will become cumbersome and soon you'll start to leave it at home. My experience is that something like a cosmetic case or a box with fishing gear will take preference over a large telescope in the battle for boot space. The solution is to take a dedicated travel scope along. The following options are available:

- **Orion GoScope:** This telescope is a 70mm short focal length (350mm) refractor. It comes complete with tripod in a handy rucksack which makes it ideal for travelling and hiking. This is a very affordable telescope. (http://eridanusoptics.com/store/index.php?main_page=product_info&cPath=4_52&products_id=339)
- **APO-Chromatic telescopes:** If you don't want to compromise your viewing, this is the way to go. You get top quality optics, packed into a very compact telescope. TeleVue is among the best suppliers and William Optics provides value for money options on their range of quality telescopes. All telescopes from these manufacturers come in hard cases or rucksacks for easy travelling. You'll need to get additional accessories, including eyepieces, a tripod and finder scope to complete the package. When not travelling, these telescopes are also good for rich field astro-imaging and can be piggy-backed on your main telescope. (http://eridanusoptics.com/store/index.php?main_page=index&cPath=4_73)

While compact and fairly light, these telescopes don't offer large magnifications. They however make incredible rich (wide) field telescopes.

The way to go

Before you set off with your bag of money, it is advisable to know what you want. Each telescope has its own advantages and disadvantages, and only if you know what you want can you get the telescope best suited to your requirements. Your requirements should include aspects such as:

- **Viewing:** What would you like to view:
  - Solar system objects such as the Moon, Jupiter, Saturn, Mars, etc.
  - Deep sky objects such as Galaxies, Open and Globular clusters, nebulae and super novae.
- **Storage:** Where can you store the telescope? Would you need to disassemble it?
- **Location:** Where will you normally use the telescope? It may be at home, a nearby viewing location (suitable for a single evening's viewing) or a faraway dark sky location (worthwhile only if you can go for a weekend or longer).
- **Travel:** Would you like to take it along on holiday?
- **Imaging:** Do you want to take pictures with the telescope?

The best way to understand your own requirements is to do your homework first. Some options are:

- **Attend a 'star party':** This is unquestionably the best way to do your homework. You can look through a variety of telescopes, speak to telescope owners and get real practical advice. You will hear a variety of criteria on selecting your telescope, some of which may be applicable to your particular situation. You will see what works and what doesn't work and experience the quality for yourself. Various branches of the Astronomical Society of Southern Africa (ASSA) have frequent 'practical evenings' and arrange 'dark sky weekends' to pristine sites.

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

(Source: http://astroprofspage.com)

- **Surf the internet:** The information is out there. You hit this page, there are endless others out there. You do not have to trust this page only. More sources give you different perspectives. It is advisable to visit at least some of the relevant web pages from the mainline telescope manufacturers such as Celestron (http://www.celestron.com/ click on 'support/knowledge base') and Orion (http://www.telescope.com/control/learning-how-to-choose-a-telescope-for-astronomy--the-long-version) (NOTE: these links may change over time – contact us at andrie@eridanusoptics.com if you cannot find these support pages). Find reviews on the telescope you want to buy. If you can't find reviews, nobody is buying it anyway.
- **Start with binoculars:** This is probably not the glamorous way you expected to start your interest in astronomy, but is certainly very practical. Images through astronomy telescopes are upside down, and operating a telescope may not be very intuitive, whereas binoculars are very easy to operate. You'll familiarise yourself with the night sky and learn the position and shape of the constellations. There are several deep sky objects that can (and should) be seen with binoculars. Knowledge of the location of these objects will help you when you finally buy your telescope. **All** serious amateur astronomers use binoculars while using their telescopes, especially when looking for new or unfamiliar objects. Adaptors to mount astronomy (large aperture) binoculars to tripods are available. This is recommended if your binocular has a magnification of 10 or more. (http://eridanusoptics.com/store/index.php?main_page=index&cPath=8)
- **Contact a dealer who employs an active amateur astronomer:** To get good practical information, this is the way to go. Active amateur astronomers will be able to:

    - Understand the advantages and disadvantages of the various models in the market.
    - Understand your requirements and match you up with the best telescope.
    - Support you if you experience problems with your telescope.
    - Give you a realistic idea of what to expect to see and how easy it will be to locate objects.

- Give practical hints on how to set up your telescope and where to look for celestial objects.
- Help you in selecting accessories such as filters, imaging adaptors, etc.

At Eridanus Optics, this is exactly what you can expect. The staff members are amateur astronomers who frequently view on their own and attend group viewing events. We are also members of an astronomy society where we have interaction with other amateurs.

- **Price compare:** Surf the internet and compare the price with the international price. The USD price should be a fair gauge to compare the quality and value of different telescopes. If you convert the price to South African Rand, you should add around 40% to 70% for import cost.

What not to do!

There are some common mistakes made by new telescope buyers. Making these mistakes will in most cases ruin your whole telescope experience and it may be natural to conclude that 'astronomy is not for me'! These mistakes include:

- **Buying a 'supermarket special'**: Supermarkets and department stores occasionally stock telescopes. In most cases a single model will be available and no additional accessories are for sale. Floor personnel have little if any training on telescopes (because telescopes are not permanently stocked) and after-sales service (excluding a general return policy) may leave much to be desired.

A typical 'supermarket special'.

There are other outlets such as optometrists, camera dealers, hobby shops, etc that sell telescopes. Often a larger variety of telescopes and accessories are stocked. These include some of the better quality telescopes available on the market. Personnel at these outlets are generally more knowledgeable about optics. However, it is rare to find someone in these stores who actually is an amateur astronomer himself and who will be able to assist you properly.

My experience is that generally, the salesperson will provide you with the sales information provided on the packaging box anyway, and where that falls flat, give

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

you the assurance that 'the Moon and Saturn will look spectacular through the telescope' – or whatever assurance you may need.

- **Buying a cheap telescope 'to see if it works out'**: This strategy is designed to fail. Cheap telescopes (especially 'supermarket specials') suffer from defects such as bad optics and bad mechanical construction. Mounts intended for terrestrial viewing are often used for 'astronomy telescopes'. Cheap coatings are used to hide badly designed optics (by filtering out some colours). All these contribute to a bad telescope experience, including:
    - **Bad optical quality:** You cannot get a good focus and/or you see colored fringes on bright objects.
    - **Bad mechanical construction (focuser):** This is particularly true for the focuser. The main problem is radial movement (wobble) of the focuser. It will seem as if the object moves in the eyepiece while you focus. This causes the optics to be badly aligned (collimated), adding to the consequences of already bad optics. There may also be free play in the axial movement of the focuser and as soon as you release the knob, the object moves out of focus again. Axial free play is not very serious because you only need to set it once when doing celestial viewing.
    - **Bad mechanical construction (finder):** Because the field of view through a telescope is extremely small, finder telescopes or other finder devices (such as red dot finders) are standard accessories supplied with astronomy telescopes. The fittings of some telescopes are so bad that it is impossible to align the finder telescope/device to the main telescope, making it difficult to locate celestial objects. Free play in these fittings also contributes to your frustration levels.
    - **Loose mount:** With these telescopes, it is already difficult enough to get your object in view, but as soon as you release the telescope, the entire image moves out of view and you battle forever to let it settle in the correct position so that others can also see the selected object. Any free play in the mount **shall** cause this problem and frustrate you. This is a very serious problem because you'll often have to move the telescope due to the object moving out of the field of view as a result of the Earth's rotation. Mounts with slow motion controls are less affected by free play.
- **Expecting 'Hubble class' images:** Hubble and other professional observatories provide a constant stream of spectacular images of celestial objects, and it is a common expectation to see the same spectacular images through amateur class telescopes. Although it is true that objects such as Saturn, the Moon and a hand full of other objects leave people awed; this is almost where it stops. Most celestial objects that get hard core amateur astronomers excited, are little more than a dull and obscure suspicion that there may be something in view. In small entry level telescopes, these images will be even less impressive or mostly invisible. If you are at all interested in viewing deep sky objects such as nebulae, galaxies and star clusters, set your sights right from the beginning, and avoid disappointment.
- **Go for magnification:** Newcomers are often obsessed with magnification. Although it is true that magnification can bring out more detail in celestial objects, there are practical limits to this. Don't believe the packaging that claims 675x magnification for a 60mm telescope. Although it is possible, it is not practical. To determine the practical magnification limit for a telescope, simply multiply the aperture (eg. 60mm) with 2 (practical limit is 120) (multiply by 50 if the aperture is measured in inches – e.g. The practical limit for an 8" telescope is 8x50 = 400x).

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store

- **Buying an 'all singing and dancing' telescope set-up:** Keep in mind that the telescope ultimately will be the limiting factor on what you can see or image. When buying a telescope one is often tempted to buy additional accessories. Some accessories (such as a Moon filter) are recommended items anyway, but in a lot of cases, these will become 'white elephants' in your accessory box. Rather buy the minimum additional accessories and invest in a better telescope or save the 'spare money' for later. Think of buying additional accessories or better quality accessories after you experience limitations when viewing objects.
- **Buying a 'grey product':** Grey products (or parallel imports) are products imported by parties other than an approved dealer. Because these dealers do not need to maintain a support infrastructure, their prices may be lower than the official importer's prices. However, they cannot support you, and if you experience problems, you may easily be left in the cold as the official dealer may refuse to assist you.

Conclusion

Before buying your telescope you must understand what you want to get out of it. If you have conflicting requirements, (eg. looking for a cheap telescope suitable for deep sky imaging) you have to prioritise and/or compromise. Understanding the good and bad qualities of the various telescopes available will enable you to make the best choice.

After buying your telescope, test it. Contact the dealer where you bought it if you cannot get it right.

Search out the best available observing sites. These will be:

- **Dark:** Direct light from nearby street lights, your neighbor's security light, etc will compromise what you see. Light pollution in urban centres may also reduce the number of objects that you can see or the detail that will be visible. It is best, but not essential, to go to an area far away from light sources.
- **Open:** If your horisons are blocked from view, it reduces the number of objects that will be visible. The most important horison is to the North as objects close to the northern horison remain low. This is followed by the eastern and western horison. You may have to wait a few months, but eventually the object will be high above the horison. Southern objects may be above (or below) the horison within hours and with careful planning you may get your object within a few hours.
- **Clear and calm:** Areas that are often overcast or windy do not make great observing sites.
- **Stable:** Areas with large structures like parking areas where the sun heated up the surface do not support great viewing. Viewing from or over these areas reduces image quality due to the heat waves generated late into the night. Viewing in the direction of fires (like a nearby braai or veldfire) should also be avoided for the same reason.

I trust that the above will help you in selecting your telescope. If you are still unsure or have suggestions to improve this FAQ, contact me at andrie@eridanusoptics.com.

Above all, enjoy your telescope.

Andrie van der Linde

Contact Andrie: andrie@eridanusoptics.com
Website: http://www.eridanusoptics.com/store