The difference between “Astronomical Telescopes” and “spotting scopes” :

The name “ telescope “ actually means “to see far” and the term telescope can actually be applied to quite a wide range of optical, and other, instruments. In practice these days the expression telescope is usually used in describing two types of instrument – the astronomical telescope and the spotting scope.

An astronomical telescope is intended for use looking at the night sky, Moon, planets, stars etc , whereas a spotting scope is for down to earth things, birdwatching, ships, long range observation etc.

It’s not that one can’t do the job of the other, an astronomical scope can be used for normal observation and a spotting scope can be used to look at things in the night sky, but the instrument will be designed to perform best in the use it was intended. In practice it’s much easier to use a spotting scope for astronomical observation than it is to use an astronomical scope for normal observation. Here’s some of the considerations :-

Astronomical telescopes usually give inverted images, this doesn’t matter when you are viewing something in the night sky, but can be disconcerting when looking at a ship which appears upside-down. Eyepiece accessories can be obtained to erect the image though this can make the telescope a little clumsy to use. A spotting scope is designed to give erect, right way round images.

Astronomical telescopes are not usually designed with any degree of water resistance, after all you wouldn’t be using an astronomical telescope in the rain because the cloud means you wouldn’t see anything, but you might well be birdwatching in heavy rain.

One of the main differences is the ability to interchange eyepieces. Most astronomical telescopes conform to standard eyepiece fittings which means there are a vast number of different eyepieces available giving a wide range of magnification options.

(the magnification of a telescope is found by dividing the focal length of the telescope main tube by that of the selected eyepiece. For example, a 1000mm scope tube used with a 10mm eyepiece gives 1000/10 = 100x magnification. Used with a 5mm eyepiece, magnification would be 1000/5 = 200x)

Spotting scopes tend to be supplied with modest magnifications and if they have interchangeable eyepieces the range available is more limited than for an astronomical telescope. This is done for a good reason, for most observation purpose 20x – 30x is more than sufficient, and magnifications much more than 60x are not really practical. (see the important note later about magnification and brightness)

Another big difference between an astronomical scope and a spotter is the type of tripod mount usually supplied with them. :-

Spotting scopes usually have a standard tripod screw fitting allowing a normal (camera type) tripod to be used. The head movement here is side to side and up and down which is relatively quick and easy to use.

When viewing the night sky however the movement of the earth has to be taken into account as this causes objects in the night sky to appear to move in an arc. Astronomical telescopes are usually designed for “equatorial” tripod mounts which is a system of geared movement allowing the telescope to track the apparent movement of a body in the night sky. An equatorial mount can be used for normal observation too but it is less convenient and can take longer to find your subject.

Magnification and brightness.

Many first time buyers of telescopes make the mistake of thinking magnification is everything. It isn’t. The Aperture of the telescope, that is the size of the objective lens or primary mirror if it is a reflecting telescope, is important. Bigger objectives gather more light and so are able to give better resolution.

Higher magnification does make your subject appear bigger or closer but at a cost. Higher magnification makes the image less bright, less stable (because higher magnification means all movements are magnified) and gives a smaller angle of view. If you are using a camera to photograph through a scope , a highly magnified, and so darker image will require longer shutter or capture speeds, this means keeping the camera and subject still for longer. High magnification scopes will need very stable tripods and great care in ensuring that the subject doesn’t move, or that the tripod mount can track the movement.

In practice, for most general observation, a magnification of around 20x to 30x is ideal. Most spotting scopes these days are supplied with zoom magnification usually from around 20x, or just below, up to around 40x, 50x or 60x or sometimes a little higher. This makes them very versatile as they can be used in the lower magnification region for most observation with the option of increasing when necessary and if the object is particularly bright.

For observation of the moon, near planets and other bright night sky objects, magnification of around 60x is usually more than enough. This allows spotting scopes to be easily used for most basic astronomy. If using an astronomical scope, an eyepiece giving a magnification of around 60x would be a good choice.

Higher magnifications would only be required for viewing very distant dim objects, and then only if used in combination with a large objective scope so that it can gather sufficient light.

The moon, by the way, is a very bright object and even very small aperture scopes can generally be used to give clear viewing, you may even need to add a filter to reduce the brightness and glare to make viewing more comfortable. For photography the brightness of the moon allows for reasonably fast capture speeds and so is one of the easiest night sky objects to capture.

There’s more detail in our technical guide, click Technical Guide on the home page of the Optical Hardware website

Clear viewing of the night sky

Perhaps the most important consideration when viewing or photographing anything in the night sky is pollution in the air. We can't stress this enough. You can buy the largest objective telescope to gather lots of light and buy the best of the best of optics and none of this will make any difference if the sky isn't clear. Even on a totally clear night, light from astronomical objects pass through several miles of atmosphere and tiny amounts of pollution in the air can reduce the quality of the image you can see through your telescope.

There are two types of pollution to consider – dirt and light. Dirt (dust and smoke etc) will often be worse nearer to industrial areas. Light refracts in the air causing reduced visibility and can be a problem wherever there is ambient light from street lights etc. For the best observation you need to be as high as possible and well away from towns and cities.

Choosing a scope

In practice, unless your interest is very serious astronomy, a spotting scope will be a good choice. Spotting scopes are easy to set up and use and with magnifications of up to around 60x or 70x can be used for all general observation and most basic astronomy – moon, near planets and other bright night sky objects. These days spotting scopes are available with objective lenses from around 50mm up to 90mm or 100mm. The bigger the better, as bigger objectives gather more light, but if you are buying on a budget, it may be better to buy a higher quality scope with a smaller objective lens than a cheap big one.

If night sky is important 80mm or bigger would be ideal, and this will also satisfy most general observation requirements too.

For normal observation in daylight and even quite low light conditions a 70mm spotting scope is more than suitable, and for general daylight observations 50mm – 60mm will serve very well.

If your only interest is astronomy, then a good astronomical telescope is a worthy purchase. Please do bear in mind though that if you buy an astronomical telescope with an objective (lens or mirror size) less than 4 inches (100mm) the light gathering is very limited. Even though you can add eyepieces to astronomical telescopes to produce high magnifications, the limited light gathering will render this nearly useless.

Night sky digiscoping.

Both astronomical telescopes and spotting scopes can be used for photography through a digital camera.

With most astronomical scopes, the eyepiece can be replaced with a camera mount. This allows a digital or film SLR to be attached via a T2 mount. Some astronomical scopes will also allow a bracket or clamp to couple a standard compact digital camera.

Most good spotting scopes will now accept a variety of digital cameras through quick and easy to use adaptors.

Stability is a big problem. Most objects in the night sky are quite dim and so the shutter speed / capture speed of the camera has to be quite slow. This means you must reduce vibration and movement to obtain a clear picture. A solid tripod is essential and for very long exposures it may be necessary to track the object you are photographing using an equatorial mount.

Focussing is always a problem when you are digiscoping. The quite small viewing screen on many digital cameras combined with a dim object makes it difficult to see when an object is in focus. For astronomy most objects are effectively at infinity so once the correct focus position is found, perhaps with a little bit of trial and error, then this can be used for all others.

Vignetting (the blacking out of the corners of the picture) is an issue with most digital cameras when used with scopes. If the camera has a zoom lens then usually increasing the magnification slightly will reduce or eliminate the problem. Bear in mind though that increased magnification means a little less light and stability.