

Hi this is Steve Nerlich from Cheap Astronomy [www.cheapastro.com](http://www.cheapastro.com) and this is *Your first cheap telescope*.

Broadly speaking there are two types of optical telescopes, refractors and reflectors. The first telescopes, including Galileo's, were refractors which have an objective lens at one end, which focuses light into a tube, and an eye piece at the other end of the tube that you look through.

Reflectors are also tubular, but the end you point at the sky is just an uncovered opening that light falls into, hits a parabolic mirror, gets focused up to a little diagonal mirror which directs it to an eyepiece attached to one side of the tube. There are many variations to this theme, but what I just described is your bog standard reflector.

Cheap Astronomy's own *Sky Station 1*, possibly the cheapest department store telescope in the southern hemisphere, is a reflector telescope. When you are operating at the cheap end of the market – hoping for an accurately made parabolic mirror may be a safer bet than hoping for an accurately made objective lens on a cheap refractor. But opinions vary on this point. If you can get a good deal on a cheap refractor – go for it.

Now, obviously magnification is the key purpose of your telescope, but there's a catch. You are probably familiar with the concept of low and high resolution photos – where you have two images of the same thing, but the low res image has a smaller file size because it doesn't carry digital code for every single pixel available and hence looks fuzzy compared to a high res image which is informed by much more digital code to give a much more detailed image.

There's a similar issue with telescopes – the more photons you can collect, the more detail you will gain about what you are observing. You never hear about the Hubble Space Telescope's magnification power – what matters is that it's a 2.4 metre telescope, meaning that its main mirror is 2.4 metres in diameter. Some Earth-based telescopes, like the Keck telescopes in Hawaii, have 10 metre mirrors. That's means an awful lot of photons are being collected.

For comparison, Cheap Astronomy's *Sky Station 1* has a 0.114 metre mirror. Applying lots of magnification to the amount of light it is capable of collecting, just turns little dots of light into big fuzzy blobs – there's just no detail there to magnify. But hey, just a low magnification 30mm eyepiece on *Sky Station 1* is quite enough to resolve Saturn as a little white disk with a ring around it. In my view, that's \$128 Australian dollars well spent. The Hubble Space Telescope is an awesome piece of equipment, but you're never going to fit it in your garage and it cost around \$2.5 billion dollars US.

Now, there is another trick to collecting more photons without a Hubble-sized mirror. It's possible to set your telescope on a motor drive so that it can stay locked on an object in the night sky for several hours, despite the Earth's rotation. During this time it delivers all the photons it collects to a fancy digital camera, called a Charge Coupled Device (or CCD) which over time builds a very detailed image of the object your telescope is locked onto.

Such an image often has colours you may not see if you just put your eye up to the eyepiece because there just aren't enough photons coming through in real time to fully stimulate your colour vision.

Although this kind of activity is not something to be contemplated by your average Cheap Astronomer, it does bring me to a puzzling aspect of the department store telescope market – at least in Australia. Without fail, all the telescopes on display have equatorial mounts – from the cheap bodgies up to those insanely expensive jobs with motor drives and 'Go To' computers.

If you don't know already, a Go To computer means you can tell your telescope to point at the third moon of Jaglan Beta and it will whir around and do just that. If you've made that last down payment on your second beach house and are wondering what to do next, this is definitely worth considering.

A Cheap Astronomer in a department store is more likely to be eyeing that recently discontinued four inch reflector that's been the display unit on the shop floor all this time and it's clear the store really just wants the floor space back now. So it's another great deal, but it's on an equatorial mount. Why?

Telescopes mounts are about as important to the operation of the telescope as the mirror, lenses and other stuff that sit upon it. Since telescopes are all about magnifying images, it's vital that the scope is mounted upon a stable platform as the slightest wobble will also be magnified and all you will see is a shaky blur.

A well made and expensive equatorial mount is a superb piece of engineering that gets the job done. Unfortunately, if you are in the business of building cheap telescopes, the mount is the first place you start cutting corners.

Back in the sixties, a certain John Dobson created the ultimate cheap telescope – incorporating a plywood construction, some PVC bearing surfaces and old carpet tiles. Fabulously cheap though the Dobsonian design is – at least in Australia – these telescopes occupy a niche end of the market and are only available in specialty stores or by mail order. Instead, the economies of scale department store chains are capable of generating are directed towards those bodgy, unreliable equatorial mounts.

And *Sky Station 1*? Yep equatorial mount, prone to wobble in a slight breeze and any viewed image shakes wildly with any adjustment of the focus control. So sometimes observing can be a challenge.

But hey, here's something to think about. The first documented confirmation that a telescope had been invented is recorded in 1608 when a spectacle maker Hans Lipperhey applied for a patent. He was unsuccessful, as before the end of 1608, telescope fever, as well as manufacture, had spread over half of Europe.

However, it was Galileo, in 1609, who began a systematic exploration of the night sky with a telescope, recording his observations and sharing them with others. This is why, four hundred years later, 2009 is the International Year of Astronomy. Galileo of course built his own telescope and ground his own lenses – briefly owning perhaps the most powerful telescope of his day and establishing himself as the world’s first astronomical gear freak.

Four hundred years later you can just stroll into a department store and pick up a telescope in a box. Whatever you get, it’s sure to be better than anything Galileo had to work with – and look what he accomplished.

Thanks for listening. This is Steve Nerlich from Cheap Astronomy, [www.cheapastro.com](http://www.cheapastro.com). Cheap Astronomy offers an educational website where the universe is the ultimate free lunch. No ads, no profit, just good science. Bye.