Starting Out – Great Expectations

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Your brand-new telescope arrived today, and you put all the pieces together. What are you going to look at tonight?

Most new-telescope owners have a set of expectations in mind as they prepare for their first night under the stars, but often those expectations are quite wrong. Frequently, the expectations are too high, based on pictures they have seen in books — even the pictures on the box in which the telescope arrived — but they can also be way too low, based on what others have told them about light pollution.

Low Expectations

I sometimes hear people say that there is no point in buying a telescope, since it won't show you anything in your typical city sky because the light pollution is so severe. Nothing could be further from the truth. Though light pollution hampers certain areas of observation that depend on dark skies, there are many things to see from under even the most blighted urban sky. First and foremost, the Sun, Moon, and planets are just as beautiful in the city as anywhere else. In winter, nearby chimneys may cause unstable or blurred images, known as "poor seeing," but those affect only a few spots within the whole sky, and cease to be a problem in milder weather when furnaces are turned off.

What can you see of our Solar System in a typical amateur telescope? Lots! With the help of a solar filter that fits over the front of the telescope, you can safely view the surface of our local star. Most noticeable are sunspots: ink-black cool regions (called umbra) on the Sun's surface that typically are surrounded by medium-grey halos (called penumbra). Sunspots are often found in groups, and over daily intervals, change their shapes and orientations as they drift across the solar surface with the Sun's slow rotation. With good resolution, you can also see granulation — the actual convective cells on the surface of the Sun, bringing up heat and energy from the depths. Granulation is in constant motion, like water bubbling in a pot, except that it takes place over a period of several minutes.

The Moon is a spectacular object in *every* telescope. Where else can you study the details of an alien, airless world, watching the changing pattern of bright light and dark shadows across a fantastic landscape of mountains, valleys, and craters? Craters, a topographic form only rarely seen on Earth, come in a multitude of sizes and shapes. Watching the sunrise shadows as they cross a 200-kilometre-diameter crater is an awesome spectacle, yet one available almost any night to a telescope owner. Use as high a magnification as your telescope can handle; the Moon can usually reveal detail at any level. High magnifications also dilute the Moon's bright light, making the view easier on the eye and more satisfying than the view through a greenish "Moon filter."

All of the planets are visible in any telescope. Mercury and Mars will usually disappoint in a small telescope, as they only reveal fine detail in larger amateur instruments. Even so, when Mars is close, you should be able to make out a tiny polar cap and some darker markings on its peach-coloured surface. You may not see this at first, but take your time, relax your eye, and let the detail come to you. Making a simple sketch often helps bring out the detail; no artwork needed here: just draw a circle and try to add shading where you see it.

Saturn is the opposite of Mars: a spectacle in just about any telescope. Don't even think about trying to make a drawing of it — it's a challenge for even the most accomplished astronomical artist. Again, spend some time, relax your eye, and see if you can tease out the subtle interplay of light and shadow between the globe and the rings. Can you spot Cassini's Division, a thin black line about two-thirds of the way out? Currently Saturn's rings are getting narrower as they tilt in line with our view from Earth, so they, and Cassini's Division, are getting harder to see. Look for Saturn's moons surrounding the planet. Titan is easy in even the smallest scope; Rhea requires a bit more aperture. With an 8-inch aperture, you should be able to see at least five moons: Titan, Rhea, Tethys, Dione, and Iapetus. Use a planetarium program to plot the current positions of the moons. Iapetus is particularly interesting: its orbit is large and at an odd angle to those of the other Moons; it also has one black side and one white, so it visibly changes brightness from one side of its orbit to the other. Our *Observer's Handbook* (page 190) will tell you when it is brightest and dimmest.

I have saved the best planet for last: mighty Jupiter. Even the smallest telescope will show its four bright moons, in constant motion. Their positions change from night to night and from hour to hour. Here is a simple "research project": make a drawing of their position every night for a week. That is exactly what Galileo did when he first observed them in 1609. Some nights, one or two will be missing because they're either behind or in front of the planet. Your *Handbook* will tell you where they are and when they'll reappear (pages 183 to 189). The times are in Universal Time, so you'll have to subtract some hours, depending on where you're located (pages 39 to 40). If you are very lucky, one of the moons may be casting its ink-spot shadow on Jupiter's cloud tops. Most

scopes will show two or more dusky bands on Jupiter. A good scope and a well-trained eye will show lots of detail: see my article in the last issue of this *Journal*.

Some other excellent targets for light-polluted skies are double and variable stars. Many stars come in pairs, and amateur astronomers a century ago used to devote a lot of observing time to them, but this fell off because of rising interest in planetary and deep-sky observations. Doubles are becoming popular again, both because of their inherent beauty, and because they are unaffected by light pollution. I started observing variables a few years ago with Rick Huziak's encouragement, and found that I could have fun and make a scientific contribution even from my back yard in downtown Toronto. Thanks, Rick!

High Expectations

You've seen all those gorgeous colour images made with the *Hubble Telescope* or those backgrounds in Star Trek, and you can't wait to view them through your new telescope? Well, be prepared to adjust your expectations.

The human eye loses its sensitivity to colour at low levels of illumination. Your colour sensors stop functioning, and you start to perceive the world in shades of grey or, more accurately, pale green. That is just how the human eye works. It doesn't matter whether you're looking at a nebula through a telescope or from the command deck of the Starship Enterprise: all nebulae are faint, and, with a few exceptions, your eye won't see any colour in them.

When I first started into astronomy, all astrophotographs were made in black and white, so there was not as big a disconnect between pictures and what could be seen through a telescope. I still remember when the first colour pictures from Palomar were released and the excitement they caused. Nowadays, you hardly ever see anything else, so beginners often expect their telescopes to show the Universe in living colour.

So, forget about colour. Also, forget about deep-sky objects being bright through the telescope: most are faint, and the rest are even fainter. However, there *are* compensations. I've yet to see a photograph of a star cluster, either galactic or globular, that comes close to the view through a medium-sized telescope. No imaging technique can capture the full brightness range of the human eye. In long-exposure images, stars that are sparkling points of light of varying brightness to the eye become boring blobs of varying size on film or CCD.

Nebulae and galaxies are far less impressive at first glance, yet their faint inward glow is really quite magical. Most magical of all is what your brain adds to the image: the knowledge that the photons that are falling on your retina have been travelling for thousands or millions of years, just to hit the light receptors in *your* eye. No one else will ever see those same photons: they are yours alone. Anybody can look at a photograph, but with a telescope, you are actually *participating* in the Universe. That *always* takes my breath away!

Geoff Gaherty is currently celebrating his 50th anniversary as an amateur astronomer. Despite cold in the winter and mosquitoes in the summer, he still manages to pursue a variety of observations, particularly of Jupiter and variable stars. Though technically retired as a computer consultant, he's now getting paid to do astronomy, providing content and technical support for Starry Night Software.