By Nicole Mortillaro

SCOPES FOR STARTERS

(Danil Nevsky/Stocksy)

THE HOLIDAYS ARE OVER. Perhaps you were lucky enough to get a gift card that you plan to spend on a new telescope, or you got one and you need essential accessories. Here are a few pointers.

What telescope should I buy?

In order to know what kind of telescope you'd like to buy, it's important to consider a few questions: What do you want to observe with it — just the Moon and planets, or do you want to see fainter deep-sky objects? Do you need something light that you can take with you to the cottage? And do you want to photograph celestial objects with it?

Let's look at the important things you need to know about telescopes.

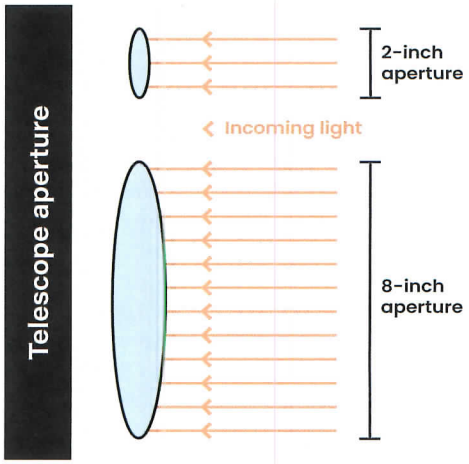
First is the aperture. This is the diameter of its main lens or mirror. Typically, aperture is expressed in millimeters or, for larger telescopes, in inches. Basically, the bigger the aperture, the more light-gathering potential, letting you see fainter objects.

Comparing the light-gathering power of two telescopes is done by calculating by the ratio of their diameters squared. Let's work through an example.

For a six-inch telescope, the diameter squared is $6 \times 6 = 36$. For an 11-inch (279.4-mm) telescope, the diameter squared is $11 \times 11 = 121$.

The ratio of the two diameters is $121 \div 36 = 3.36$, so an 11-inch telescope gathers more than three times more light than six-inch telescope. A six-inch telescope performs 2.25 times better than a four-inch telescope.

The downside is that a larger aperture means a bigger telescope. If you're an urban dweller, it is more cumbersome to drag a large telescope outside the city — and if it's more cumbersome, chances are you're less likely to set it up.



Eyepieces are very important. Each eyepiece delivers a particular amount of magnification, so most people buy a range of focal lengths (that's the little number labelled on the eyepiece). Don't get hung up about extreme magnifying powers, like 500x. Due to the turbulence of Earth's atmosphere all telescopes have a limiting useful magnification that is 50 times its aperture in inches, or twice its aperture in millimetres.

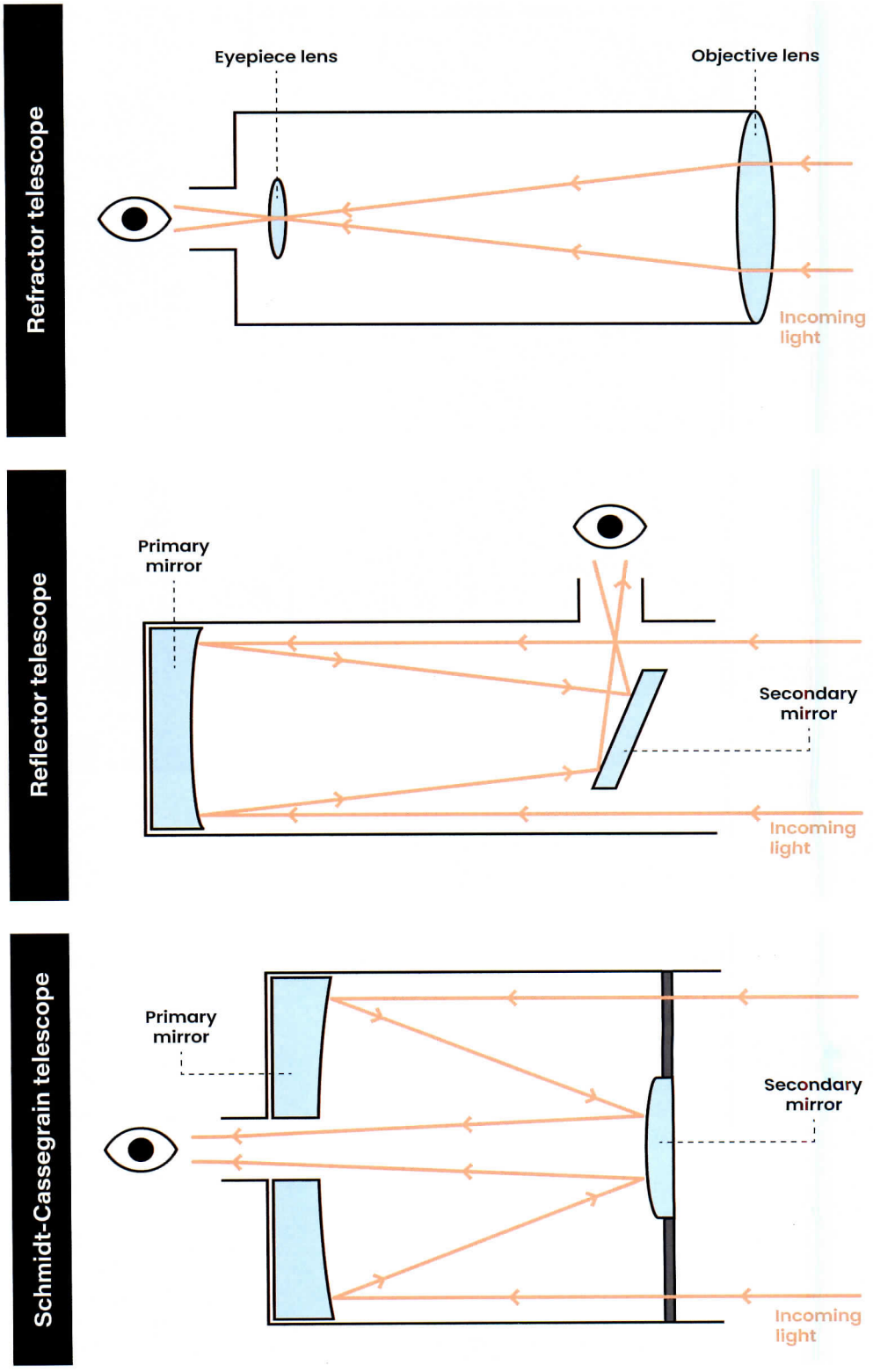
Different types of telescopes

The main types of telescopes each have their advantages.

Refractors have a lens at the front that forms an image at the back. These tend to be cheaper owing to their simple design. They are best for planetary and lunar observing because their smaller apertures work best on bright objects, and they are lighter and more portable than other types. The minimum aperture I recommend is 70 to 80 mm.

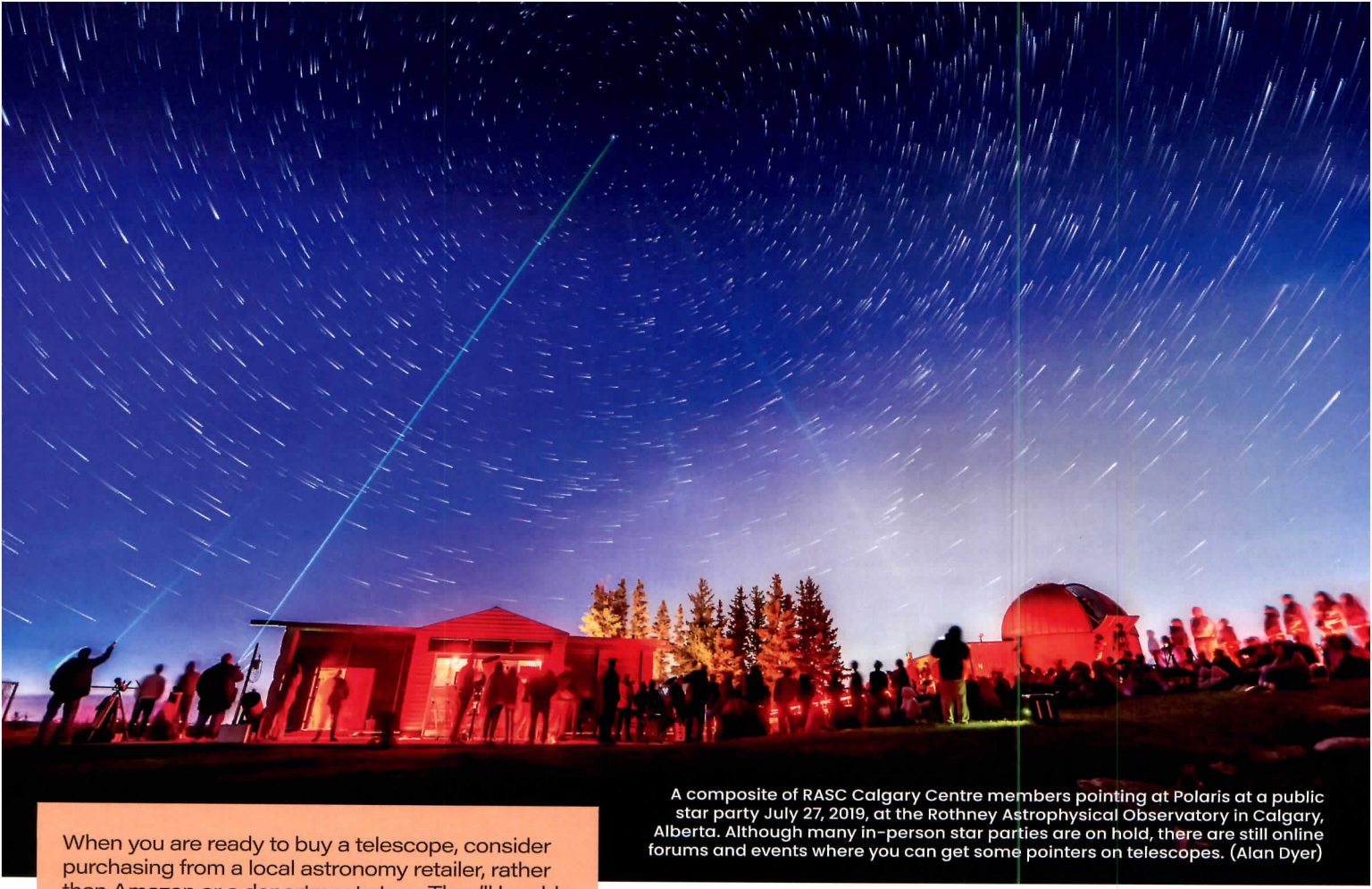
Reflector telescopes use mirrors to gather and focus the light from incoming objects and direct it out the side of the tube. This type tends to have larger apertures, making them good for viewing dimmer deep-sky objects like star clusters, nebulas and galaxies. The minimum aperture I recommend is six or eight inches. Although larger sizes are quite affordable, those ones can be very large and heavy. Dobsonian telescopes are reflectors that are mounted on a swiveling box instead of a tripod, making them especially sturdy and easy to use.

The **Schmidt-Cassegrain** telescope is the most compact type. Called a Schmidt-Cass or SCT for short, it uses both lenses and mirrors to form an image in a much shorter tube. This makes them easier to transport, but more expensive. Common apertures for SCTs are in the six-inch to eight-inch range, but smaller and larger sizes are available.



All three telescope types come in manual versions that you point by hand, or as motorized GoTo systems that are computerized, and you can pick targets from a database in the handset. You'll need to supply power to the latter. For either type, the sturdier the tripod the better, so the view doesn't shake too much when you focus the telescope. →

Diagrams by Isabelle Santiago



A composite of RASC Calgary Centre members pointing at Polaris at a public star party July 27, 2019, at the Rothney Astrophysical Observatory in Calgary, Alberta. Although many in-person star parties are on hold, there are still online forums and events where you can get some pointers on telescopes. (Alan Dyer)

When you are ready to buy a telescope, consider purchasing from a local astronomy retailer, rather than Amazon or a department store. They'll be able to help you select the best model for your budget and experience level, as well as suitable eyepieces and accessories.

Mounts

My first telescope was a simple refractor, and although it was wonderful (even more so after I upgraded it), the next one I moved to was a six-inch Celestron NexStar Schmidt-Cassegrain telescope. It was compact, easy to set up on my back deck or transport to a dark-sky site.

But then I wanted more. I wanted to take images of the night sky, be it the Moon, planets or deep-sky objects. But this takes a lot more work and a special kind of **mount** — the structure on which the telescope sits.

Rather than a simple **alt-azimuth mount**, which allows you to move the telescope left-right horizontally and up-down in elevation (altitude), imaging needs a sturdy motorized equatorial mount which you align with the North Celestial Pole, near Polaris (the North Star). This allows the telescope to follow the target as Earth rotates, keeping whatever you're observing perfectly still. Alignment can be tricky. Personally, it took me more than a year to learn this, but I'm fairly sure I just didn't grasp the concept. Equatorial mounts are also a lot heavier, and you need weights to balance the telescope and camera for smooth tracking.

Using your telescope

Next step: How do you use your new telescope?

I'm not big on reading manuals, but you should. It will help immensely; I know it helped me.

As well, you can always do a search on YouTube for the type of telescope you own to gain some pointers. I've found this incredibly helpful.

Another quick tip is, after COVID-19 is over and done with, try to attend a star party. Ask people about their telescopes. Most of them will be happy to share their experiences and a glimpse through their telescopes.

Once you have your telescope, master it and improve your knowledge by exploring on clear nights. I learned to navigate the night sky using my GoTo telescope by just slewing it around the sky. The first thing I found on my own was the Ring Nebula (Messier 57) using a good sky chart.

It might seem like a lot, but don't be intimidated when it comes to buying a telescope. Ask telescope owners, join a Facebook group or reach out to a telescope or astronomy community. Most people are happy to help and share their experiences. After all, we're all looking for the same thing: a wonderful view of the night sky and all the universe has to offer. ✶

In the eye of the beholder

Images by John Gillies

THE NIGHT SKY IS A BEAUTIFUL THING. But after seeing countless images of glorious, rainbow galaxies and nebulae, the first glimpse of a faint, grey astronomical body through a small telescope can be rather flat. While astronomers and astrophotographers often gather data to portray an object's chemical composition and light emissions, those images do not reflect what one can actually see through binoculars or a telescope.

Gathering the data from his home "Spring Hill School Observatory" near Princeton, Ontario, John Gillies under-processed these final stacked images in monochrome to a degree that matched his visual observations through telescopes, giving us a glimpse of what he actually sees when he puts his eye to the eyepiece.

MESSIER 11: WILD DUCK CLUSTER

With a moniker given for the roughly V-shaped arrangement of its brightest stars, the Wild Duck Cluster is an open cluster located about 6,200 light-years from Earth in the constellation Scutum. Loosely bound by gravity, it is one of the most densely populated open clusters known, containing over 2,900 stars.

MESSIER 17, MESSIER 18: OMEGA NEBULA AND NGC 6613

The Omega Nebula is one of the largest star-forming regions in the Milky Way galaxy. Located about 5,500 light-years from Earth in the constellation Sagittarius, it contains one of our galaxy's youngest star clusters, at only one million years old. Messier 18, also designated NGC 6613, is an open star cluster about 32 million years old, observable between the Omega Nebula and the Small Sagittarius Star Cloud.

MESSIER 27: DUMBBELL NEBULA

The Dumbbell Nebula, located more than 1,200 light-years away in the constellation Vulpecula, is the result of an old star that has shed its outer layers. It was the first planetary nebula ever discovered, spotted by Charles Messier in 1764.

MESSIER 31, MESSIER 32, MESSIER 110: ANDROMEDA GALAXY AND ITS SATELLITE GALAXIES

Located about 2.5 million light-years from Earth, the Andromeda Galaxy is our next-door neighbour and a member of the galactic Local Group. Visible with the naked eye, the 61,000-light-year-long galaxy has two dwarf elliptical satellite galaxies, M32 and M110, that are visible through binoculars and telescopes.

MESSIER 42: ORION NEBULA

The Orion Nebula is a stellar nursery located about 1,500 light-years away, making it the closest large star-forming region to Earth. Its brightness and prominent location just below Orion's belt means the nebula — a huge cloud of dust and gas where new stars are forming — can be spotted with the naked eye.

MESSIER 57: RING NEBULA

The Ring Nebula is a planetary nebula, the glowing remains of a Sun-like star. Sitting about 2,000 light-years away in the constellation Lyra, a white dwarf sits in its centre, lighting up the surrounding helium, hydrogen, oxygen, nitrogen and sulfur.

NGC 6960: VEIL NEBULA

The Veil Nebula is what remains of a massive star that exploded about 8,000 years ago. Once a star 20 times more massive than our Sun, the nebula is now about 110 light-years across, sitting about 2,100 light-years away from Earth in the constellation Cygnus. *

Textual sources: NASA and Students for the Exploration and Development of Space