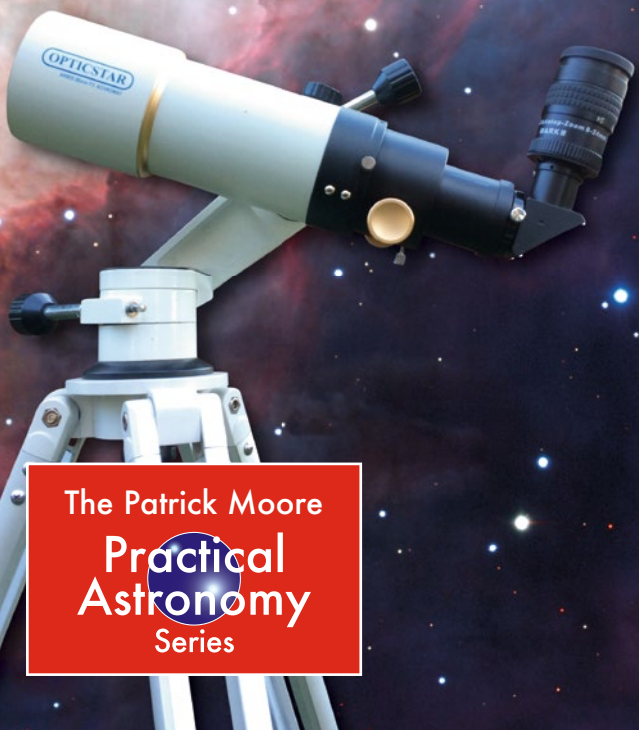
Neil T. English

The ShortTube 80 Telescope

A User's Guide



The Patrick Moore Practical Astronomy Series

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Neil T. English

Springer

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Preface

We live in a time of unprecedented technological progress, where nearly every aspect of our lives has been transformed by scientific breakthroughs. This is no less so in amateur astronomy, where an enormous variety of good telescopes is now available to the consumer to suit nearly everyone's budget. And while amateur astronomers have never had it so good, it is also true that choosing a telescope has become a daunting task, where rivaling telescope companies jockey for power to get their products into the hands of users.

In this golden age for buying and using telescopes for astronomy and nature studies a few instruments stand out, having stood the test of time and which continue to be used with affection despite there being better models on the market. We speak of course of the venerable ShortTube 80, a simple 80-mm achromatic doublet with a focal length of 400 mm. Ever since it was first conceived of back in the early 1990s, its light weight, low cost, and ultra-portability have endeared it to a great many amateur astronomers over the years, where it has flourished as a visual telescope, an imaging system and as a hard-working guiding 'scope for many astrophotographers. When reports from owners of this telescope began to circulate, more and more ShortTube 80s found their way into amateur hands, where they quickly became some of the best-selling telescopes of all time.

Fig. P1. The author's ShortTube 80 ready for an evening of observing. (Image by the author.)

In this book, we'll be taking a long hard look at the ShortTube 80, as a visual and imaging telescope. Its great popularity was in part attributed to a gamble taken by the founding president of Orion Telescopes & Binoculars, Tom Geisler, who's keen business acumen spotted the potential of a small, inexpensive rich-field refractor that could be taken anywhere at a moment's notice. Soon the ads appeared on the pages of *Sky & Telescope* magazine, and the orders started to pour in. The iconic model, the white-tubed Orion ShortTube 80, quickly became a huge hit with birders and amateur astronomers, where it served as an excellent telescope for deep sky viewing. But soon, more curious reports began to surface in books or on online amateur astronomy forums, where amateur astronomers reported some interesting results on traditional high-resolution targets such as the Moon, Sun, planets, and double stars.

In this volume, I've distilled down my own experiences with the venerable ShortTube 80, and describe the many deep sky targets accessible to

most anyone using this telescope. Conventional wisdom says that the ShortTube 80 is not a good 'scope for looking at high magnification targets such as the Moon, planets and double stars. And while there is certainly some truth in these claims, my own findings are far better than what many have claimed in the past. The truth is that this ubiquitous 80-mm f/5 refractor can indeed provide decent images at high magnification by using good eyepieces, color filters, and the like. Indeed, I'll be discussing how amateurs can soup up their ShortTube 80s to push the envelope on these difficult targets. Indeed, my own field work shows that the same telescope will resolve binary stars down to near the limit of its theoretical resolving power of about 1.5". What is more, I have enjoyed some good images of Jupiter, Saturn, and Mars with the same telescope, and I show the reader how to maximize the telescope's potential on these targets.

Astrophotographers even tried their hands at creating good quality astro-images with the ShortTube 80 with surprising results. When coupled to a narrow band etalon filter, the same telescope can yield magnificent images of the Sun, with its various filaments, prominences, and sunspots. In the hands of deep sky imagers, the ShortTube 80 has also proven to be a capable instrument. Bright stars do throw up prominent purple halos from the inherent chromatic aberration of this fast achromatic refractor, but with some clever image processing, you can create impressive images of familiar deep sky objects such as the Pleiades and the Orion Nebula. Others have successfully coupled narrow band filters to the ShortTube 80 to capture spectacular images of elusive nebula strewn across the sky.

So, if you've got an old ShortTube 80 handy, give it a dust down and feed it some light. It is my fondest hope that you will find this book useful and that you will gain a greater appreciation of the true versatility of this now classic telescope.

Fintry by Glasgow, UK Neil T. English
August 2019

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Chapter 1

Under a Dark Sky

It's mid-October in Scotland. The Sun is shining, but only feebly now, being long past the glory days of summer. A few white, fluffy clouds pepper an otherwise cobalt blue sky, and the wind has all but abated. The rain-soaked trees glisten in the sunshine, and the ground makes a crunching sound underfoot as boots wade through a thick deposit of fallen leaves to best position the telescope for a spot of daylight observing. The telescope, a small portable achromatic refractor, has a doublet lens composed of crown and flint glasses with an 80-mm aperture and 400-mm focal length. It sits on a sturdy but lightweight aluminum tripod equipped with good slow-motion controls. The metal dust cap is unscrewed, allowing the lens to taste the cool, ambient air. The retractable dew shield is extended to keep condensations at bay as well as acting as an effective tool against peripheral glare. Sighting along the top of the tube, I insert a low power eyepiece and aim the telescope at the topmost boughs of a beech tree about 50 yards in the distance, and looking though the ocular, I bring the image into sharp focus by slowly turning the single-speed focusing wheel.

The telescope reveals the intricate details of the natural world. The leaves remaining on the tree assault the eye with a riot of color; various shades of copper and gold set against a bright blue sky. Cranking up the power to 40× reveals their complex anatomy, with their well-defined mid-ribs, laminae, tips, and veins. Moving the telescope ever so slightly, I center on the brightly illuminated tree trunk, tweak the focus and marvel at the wealth of high-resolution details presented. The wrinkly gray bark is overlaid with a

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verdant armory of green mosses and lichens eking out a living in harmony with the tree. Reflected sunlight from tiny water droplets adds to the visual drama revealed by the telescope. Here and there a series of small holes are observed in the tree bark, a sure sign that foraging birds had been there searching for insect larvae.

On a nearby tree, a curious magpie perches on a long branch, chattering nervously as it surveys the landscape below it. Its black wing and tail feathers are overlaid with a kind of iridescent blue-green sheen that catches the weak sunlight. The telescope shows the magpie's intricately designed eye, which can resolve details far finer than any human can do. Soon another magpie appears, as if out of nowhere, and the chattering is amplified.

It's time to begin some solar observing. I saunter into the house, get a white light solar filter, and carefully affix it to the end of the dew shield of the ShortTube 80. Inserting a Celestron 25-mm X-Cel LX, I aim it at that great yellow ball in the sky, re-focus and sit back as the solar disk comes sharply into view. The edges of the disk broil in the turbulent atmosphere at low altitude, but some details on the disk can still be discerned. A small group of black spots are observed near the center of the disk – regions of

Fig. 1.1. The ShortTube 80 secure in its hard case. (Image by the author.)

intense magnetic activity on the surface of our nearest star. Increasing the power to 65×, I take a closer look at those spots, discovering much more complicated structure in and around them. The centers of the spots are very dark, black as charcoal to the eye, but immediately surrounding this intense blackness, I can make out the brighter, tan colored, granular structure of the penumbra. I note the new positions of the spots as well as making a note of their number, which are registered in my observing logbook.

Soon, the light begins to fade from the landscape as dusk approaches. As the blue color of the sky gradually transforms to blackness, more and more stars begin to make their presence felt. I reach down to the carry case and select a low power eyepiece to couple with the telescope to begin a relaxing evening of star gazing. I begin with a low power eyepiece delivering a power of 16× in a field of view nearly 4 angular degrees wide, more than enough to capture all but the largest deep sky objects. No need for a finder telescope; at such a low starting power the main telescope serves as its own finder telescope.

In late October darkness comes early upon the landscape. High overhead at my observing site in rural central Scotland, the prominent 'wonky W' shape traced out by the main stars of Cassiopeia looms large and right next door, the Celestial Hero, Perseus, is adorned with many bright and faint stars following the river of the Northern Milky Way. Eagerly, I aim the little telescope at a foggy patch roughly halfway between the two constellations, slowly turn the focus wheel to uncover a truly majestic sight; two open clusters, each the size of the full Moon and separated by a small sliver of dark sky. We have arrived at the famous Double Cluster, one of the showpiece objects of the northern sky.

Another eyepiece is selected, this time one that is powerful enough to allow both clusters to completely fill the field of view. An 11-mm wide angle eyepiece delivers a power of 36, which immeasurably improves the scene. Carefully focusing the telescope reveals hundreds of pinpoint stars filling the field of view. Looking more intently I notice that not all the stars are of the same color; many are white, some blue-white, still others are yellow or distinctly ruddy in complexion. The Double Cluster is located over 7,000 light years away – pretty close in the scheme of things and well inside our own galaxy, the Milky Way. Returning to the lower power field offered up by a 25-mm Celestron eyepiece and, following the curving chain of stars leading northwards from the twin clusters, allows me to see yet another fainter star cluster known as Stock 2. I take some quality time out to drink up the views. From a dark country site or even from the brighter skies of the suburbs, the whole vista is simply breathtaking!

Moving into Cassiopeia, I move the telescope to a spot roughly two-fifths of the distance from 3rd magnitude Ruchbah (Delta Cassiopeiae) and 2nd magnitude Shedar (Alpha Cassiopeiae). The low power eyepiece of the ShortTube 80 picks up the curious glow from about 80 faint stars comprising the open cluster designated NGC 457. The stars are arranged in chains, but its brightest members look for all the world like the eyes of an alien staring back at me from the depths of space. Perhaps that is why the same collection of stars has been given its more familiar nickname of the E.T. cluster. Not far away lies one of my favorite triple stars in the northern heavens, Iota Cassiopeiae. This magnitude +4.6 star is examined at high magnification, anything northwards of 150×, where it reveals a faint magnitude +8.2 companion. But close up to the primary star, a third (magnitude +6.9) member is resolved, making this an inspiring sight on a cool October night.

Looking to the constellation of Andromeda, now high in the eastern sky at mid-evening, the telescope is aimed at a distinctly foggy patch arrived at by following the curvy line of stars from Beta through Mu and finally to Nu Andromedae. The low power field is soon filled with a ghostly glow fully 3 degrees across. This is the great Andromeda Galaxy (M31), located some 2.5 million light years away. The ShortTube 80 at 16× shows that the galaxy is brightest at its center, which marks the lenticular shaped core of the galaxy. Off to either side, the galaxy's magnificent spiral arms can be traced to a couple of degrees beyond the core. M31 is about as large as our own galaxy, and that makes it one of the largest galaxies to be found within the Local Group, of which our Milky Way is also a prominent member, moving in unison with the rest through intergalactic space.

A more concentrated gaze reveals two fuzzy patches, one on either side of the core of M31. The easiest one to pick up is M110, owing to its greater distance from M31's core, but on the far side of the galaxy, tucked up close to the spiral arms, lies another tiny smudge (M32), disembodied from the main galaxy. These are the two bright satellite galaxies of Andromeda, both of which are gravitationally bound to it.

Next door, in the diminutive constellation of Triangulum, a low power sweep soon turns up a much fainter galaxy that is often missed in larger telescopes owing to its large size and very low surface brightness. This is the great face-on spiral galaxy M33. Unlike M31, M33 doesn't brighten all that much as you move from its edge to its center. Indeed, unlike the distinct, lenticular appearance of the Andromeda galaxy, M33 appears decidedly non-galactic in the low power field of the ShortTube 80, perhaps resembling a planetary nebula more than anything else.

Moving down the canopy of the sky into Pegasus, the ShortTube 80 is directed along a line from Theta Pegasi through Epsilon Pegasi and I extend

that imaginary line about half way again until the low power eyepiece reveals a somewhat misty snowball in an attractive field of fainter stars. This is the globular cluster, M15, located some 32,000 light years out in the halo of our galaxy. The view is considerably improved when the magnification is cranked up to 60× or so, when the globular reveals its true size better; about 12 arc minutes – that is, slightly less than half the diameter of the full Moon. The small telescope does not allow me to resolve M15 into distinct stars, however; that's a job for larger instruments. But astronomers inform us that M15 is home to several hundred thousand stellar members all bound up by gravity.

Moving westward, the eye is centered on the bright white summer star, Vega, and below it, two lesser suns, Beta and gamma Lyra. The telescope is aimed at a spot almost exactly mid-way between the two using the 16× eyepiece, and the wide field is carefully examined for a tiny luminous spot that does not focus down to a pinpoint like other stars do. Inserting the

Fig. 1.2. The ShortTube 80 is a fine ultra-portable 'scope seen here mounted on a Vixen Porta II Altazimuth Mount. (Image by the author.)

11-mm eyepiece delivering a higher power of 36× begins to show the object in enough detail to unveil its non-stellar nature. This is the famous Ring Nebula (M57), a giant smoke ring in the sky. Inserting a higher power eyepiece improves the view still more; a 4.8-mm Nagler T1 is just about perfect for framing this object, delivering a power of 83× in a field roughly 1 degree wide.

M57 is one of the most famous planetary nebulae in the northern heavens. These objects represent the last days of a sun-like star, which has spent its nuclear fuel and expanded its outer atmosphere before finally shedding it proper to the cold dark of interstellar space. The Nagler eyepiece shows a bright doughnut-shaped ring with a notably darker center. Much larger telescopes observing from the best locations on Earth show that a faint star-like object is located at the center of the ring, the superhot and super-dense core of the original star. This is what astronomers call a white dwarf.

Not far away in the sky over in Cygnus, a few degrees to the east of the 2nd magnitude orange star, Epsilon Cygni, a low power eyepiece picks up the faint glow of a star that has long since exploded out of existence as a cataclysmic supernova explosion many thousands of years ago. Astronomers refer to this supernova remnant as the Veil Nebula. Seeing this well is quite a challenge, though, even to a very experienced observer. Only when the sky is very dark, clear, and transparent can it be well seen in such a small instrument. Inserting the 4.8-mm Nagler eyepiece allows one to zoom in on the brightest part of the structure, which snakes its way past the bright field star, 52 Cygni. The Veil is estimated to be located some 2,500 light years away.

One of the great virtues of the ShortTube 80 achromat is its ability to achieve very wide fields of view. You'll be lucky enough to get a 3 or 3.5 degree field from most small telescopes, but you can go a whole lot wider in this little telescope owing to its very short focal length. The author reaches for his giant 2-inch eyepiece with a focal length of 34 mm yielding 12× in a whopping 5.8 degree true field! That's almost as wide a field as you'd experience in good medium power binoculars! Turning the telescope equipped with such an eyepiece on the star Alpha Persei will knock your proverbial socks off! The telescope will reveal a blizzard of bright white stars centered on Alpha in a stunning field! This is the famous Alpha Persei Moving Cluster, more celebrated by binocular enthusiasts than by telescopists. Why is this called an "association"? Well, astronomers have discovered that many of the stars you can see in the expansive field of view offered by the ShortTube 80 actually have a common space velocity, as if they were moving under the guidance of some invisible force (which we now understand is gravity).

Fig. 1.3. The ShortTube fitted with a 34-mm wide angle eyepiece yielding an enormous 5.8 degree true field. (Image by the author.)

From Perseus the ShortTube 80 is panned eastward into Taurus, and using the 34-mm super-wide eyepiece, the bright orange giant star, Aldebaran, is centered in the telescope. We have arrived at another great asterism of the northern heavens, the Hyades star cluster. Filling the field are numerous bright stars, arranged in doubles and triples. Many of the stars of the Hyades are located about 150 light years away.

Ironically, brilliant Aldebaran is not a bona fide part of this famous autumnal cluster but is actually located only 65 light years away. Does it matter in the scheme of things? Not really! It's one of those delightful illusions thrown up by the telescope!

The mid-autumn sky is full of small open clusters well suited to the modest aperture of the ShortTube 80 refractor. One delightful place to start is the pretty communion of suns known as Messier 34 in Perseus, which is faintly visible to the naked eye, roughly mid-way between the Demon Star, Algol, and the pretty double star, Gamma Andromedae. Once it's centered in the low power field, a higher power ocular is selected to better frame the cluster. For this one, I remounted the 4.8-mm Nagler, which presents a field featuring at least five dozen stars at 83×. Though bound gravitationally to each other, there is no obvious center to the cluster. The eye and the brain it is

connected to seeks patterns in everything it sees, arranged into groups of stars into lines, curved arcs and even shapes of things that fill the workaday world, but all of this is illusory, too, a pleasant fiction that helps us make sense of things that are far grander than we can really understand.

Further east, the great pentagon of stars that delineate the constellation of Auriga the Charioteer are gaining altitude. Auriga is home to a trio of Messier objects ripe for study with the ShortTube 80 achromatic telescope. And still further east lies M37, which appears as a dim, foggy patch to the naked eye, but at medium powers in the telescope, the view is transformed into a scintillating sheath of faint stars about half the size of the full Moon, and which number over 100 in all, with its center marked with a bright red sun. M37 is the grandest of the Auriga Messier open clusters, but the other two are well worth a visit, too.

Sweeping westward into the heart of the constellation, the low power eyepiece picks up another cluster, M36, consisting of about 50 members, as seen in the 4.8-mm Nagler eyepiece at 83×. Finally, the westernmost Messier (M38) in Auriga is examined at moderate powers through the 80-mm refractor. This time, a distinct cross-shaped conglomeration of stars can be made out at medium power. Re-inserting the 34-mm wide angle eyepiece reveals an additional surprise however; M38 is accompanied by another open cluster, NGC 1907, a mere half an angular degree to the south, which is much fainter than M38 but nonetheless creates an interesting lesson in perspective. M38 lies 4,600 light years away, while the fainter NGC 1907 lies 1,300 light years further away still!

Auriga is home to some very challenging double stars. Arguably the most celebrated of these is Theta Aurigae, which appears like an ordinary white star of the 3rd magnitude in a low power eyepiece, but increase the power to 150× or above, and you will see that it has a much fainter, close-in companion shining at magnitude +7.2. Only on the steadiest nights will you be able to crack this system with the ShortTube 80. The separation is about 4”, which sounds a lot easier than it really is. The difficulty involves overcoming the glare of the much brighter primary, but that is easier said than done!

Of course, the mid-autumn skies are chock full of double and multiple stars, which are ripe for study with the ShortTube 80 achromat. Many are easy and beautiful; others are difficult and will challenge the visual skills of even the most seasoned observer.

Perhaps the most beautiful of all is the incomparable Albireo (Beta Cygni) at the head of the celestial Swan, now falling fast into the western sky. In binoculars or the lowest power telescope, Albireo shines with a soft golden hue, but increase the magnification just a little (say 16× or above)

and you will be delighted with a marvelous visual spectacle. The bright golden sun has a blue-green companion a short ways away. It pays to increase the magnification to better frame this gorgeous celestial apparition. I one again reach for the 4.8-mm Nagler yielding 83×, and just sit in silent contemplation as the beautiful color-contrast pair slowly drifts from east to west across the field of view of the telescope. You'll never tire of this iconic pairing of stars, one of the great showpieces of the northern sky.

Moving over to Andromeda again, the lovely golden sun, Gamma Andromedae (Almach), is centered, and the 4.8-mm Nagler eyepiece is used to zoom in on it. When carefully focused, the ShortTube 80 delivers another stunning view of one of the northern hemisphere's grandest double stars. Almach is seen to consist of a marmalade orange primary and emerald green secondary tucked up close by it.

After spending many years evaluating the high-resolution performance of the ShortTube 80 refractor, I can vouch for it being able to deliver extremely tight splits of tricky double stars. One perennial favorite is the famous Double Double in Lyra, characterized by Epsilon 1 & 2 Lyrae. An easy binocular double in its own right, the two stars, in turn, are revealed as duplicitous when higher powers are pressed into service. To do justice to this system, a good steady night is an advantage, as higher magnifications than usual are necessary. But during autumn which usually brings steady skies, it's a great time to get up-close-and-personal with these trickier binary stars. For this job, I select an old favorite eyepiece, a Parks Gold 7.5 mm and couple it to a 3× Meade achromatic Barlow delivering an amplification of 160×. Amazingly, once the stars are sharply focused, all four components are beautifully resolved in the same field of view.

Another favorite lies in the diminutive constellation of Delphinus. I aim at the diamond shaped asterism and center in on the golden star Gamma Delphini. A medium power eyepiece is sufficient to resolve this pretty double star, which consists of an orange primary and yellow secondary star. The pair form a true binary system, with an orbital period of 3,000 years. In the same field of view you can make out a much fainter pair, Struve 2725, consisting of magnitude +7.5 and + 8.3 stars; these are best seen at magnifications of 150× or thereabouts.

There are many more doubles accessible to this small, ultra-portable telescope, and we shall discuss these in more detail in a later chapter. For now, let us return to low power, wide field vistas.

It's getting late and Taurus is well above the eastern horizon. Atop the distinctive 'V' of the Hyades you're sure to spot a tiny asterism shining like tiny little fireflies against a sable sky. This is the famous Pleiades (M45) star cluster, one of the most magnificent and iconic deep sky objects in all the

heavens. Low powers and wide fields are the order of the day for this cluster, which is seen to consist of several dozen members of varying glory. Also known as the Seven Sisters, after a group of mythological nymphs, the daughters of Atlas and Pleione, keen-eyed observers can make out faint whips of luminous dust and gas around some of the brighter members of this cluster, particularly Merope, Maia, and Alcyone.

By now, mighty Orion is making a show in the east, with its bright stellar luminaries, fiery red Betelgeuse in the northeast, and Rigel, white and pure as the driven snow, marking the extreme southwest of the constellation. With the eye naturally drawn to a distinctly non-stellar patch below the middle star in the sword handle of the celestial Hunter, the 25-mm eyepiece reveals a stunning sight – a giant incandescent ball of gas lit up from the inside by neonatal stars.

We have now arrived at the Great Nebula in Orion (M42), arguably the most glorious deep sky object in all the heavens. Cranking up the power to 83× using the small 4.8-mm Nagler eyepiece greatly increases the contrast between the nebula, which is seen to glow in a soft, greenish light, and the background sky. At the nebula's epicenter lies the famous Sigma Orion complex of young, hot, spectral O-class stars, known more commonly as the Trapezium, which coruscate through the vast reaches of gas and dust enveloping it. These are new stars that have only just recently (on a cosmic timescale) begun to send forth their light into the universe. Only a few million years ago, they would have been conspicuously absent from the nebula that gave birth to them after millions of years of the gravitational collapse of the cold gas and dust out of which they were forged.

Re-inserting the 25-mm wide angle eyepiece, and turning on the belt stars of Orion, the generous 3.75-degree field allows one to frame all three stars in the same field of view. It's a mesmerizing sight to behold late on a dark autumnal night. Two of the belts stars – Alnitak, the easternmost member and Delta, the westernmost, are fine double stars in their own right, but in order to see them well, you'll need to crank up to power to between 80 and 150× to really do justice to these fascinating stars. Inserting the 34-mm wide angle eyepiece once again, I re-center the belt stars and admire the riot of fainter suns that surround it. This is Collinder 70, which consists of about a hundred stars in all, spread over an area at least 3 degrees wide.

The sky is now at its darkest, being after midnight. Most people are asleep, and the lights from the nearby towns and villages diminish. The Milky Way, like a vast luminous cloud spanning some 30 degrees in width, runs across the sky from east to west, carrying Orion, Gemini, Taurus, Perseus, Cassiopeia, Cepheus, Cygnus, and Aquila, as if in some majestic procession. Beginning in the east, I run the telescope through its brightest

Fig. 1.4. A little 4.8-mm T1 Nagler serves as a great higher power eyepiece for the ShortTube 80. (Image by the author.)

sections, drinking up the rich star fields that decorate each new field. I pause here and there to reflect on the sheer vastness of space before me and how fortunate I am to be living on a planet where I can safely observe its many glories at the bottom of a vast sea of protecting air. It's hard not to feel humbled by the experience.

It's almost time to pack up for the night, but already a waning crescent Moon, now past last quarter, has risen above the hills to the east, brightening the sky as it does. As it climbs ever higher in the sky, the view in the telescope becomes ever more crisp, as it becomes less affected by atmospheric turbulence closer to the horizon. Although not particularly designed to be a high-resolution lunar and planetary telescope, the ShortTube 80 delivers excellent results at moderate magnifications. The low power view is magnificent, revealing the strong earthshine on its dark side, with a southern hemisphere littered with crater fields testifying to its violent early history all those eons ago. Inserting the 4.8-mm Nagler (83×) reveals many fine lunar features that are less easily discerned at lower powers, including rilles, valleys, high mountain ranges, and vast lava fields that astronomers today still refer to as 'maria,' or seas.

The telescope is dismounted from the tripod, the dust cap threaded back on, and the dew shield retracted for convenient storage in its case. The eyepieces, too, are packed away, as is the tripod. It's been a great night out with the telescope. I retire from the starry field of glory with a head full of fond memories of all the places the ShortTube 80 has taken me. This is but one night with the telescope, and there will be many more like it.

Chapter 2

The Anatomy of a ShortTube 80

In the last chapter, the reader was given a flavor of just how well the little ShortTube 80 achromatic telescope could serve as a very satisfying, portable astronomical portal. However, this was but the tip of a proverbial iceberg of the impressive versatility the instrument is really capable of. Doubtless, the secret of the ShortTube 80's success is its simplicity and affordability. At its heart lies a doublet objective composed of traditional crown and flint elements. For optimal performance, the elements are not in contact but are separated by a tiny air space created by placing three small foil spacers between the crown and flint glasses. With an aperture of 80 mm (3.1 inches) and focal length of just 400 mm, the ShortTube 80 is capable of delivering very crisp, high-contrast views of a whole suite of deep sky objects. Its short focal length allows it to render very wide field views that are much more difficult to achieve in virtually any other instrument currently on the market.

The simplest models of the ShortTube 80, such as the units long marketed by SkyWatcher and Orion USA, come with basic rack and pinion focusers that can accommodate 1.25-inch eyepieces. Coupled to a generic 32-mm Plossl eyepiece, the telescope delivers a usable 13× in a very generous 4 degree field. To put that in perspective, the full Moon subtends an angle of just 0.5 angular degrees, so the ShortTube 80 serves up a field that can fit 8 full Moons from one end to the other; and with shorter focal length eyepieces even larger true fields can be squeezed out of it.

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The SkyWatcher objective lens system is generally housed in a plastic lens cell. That sounds cheap, but it's actually quite adequate for all conditions it is likely to be used in, from freezing winter weather to scorching summer nights. One can readily discern if the object glass is properly placed within its cell by doing the wiggle test. Take the telescope and shake it gently in your hands; if you can hear the lenses rattle a little, then it's safe to say it's probably good to go. One of the major problems encountered with the ShortTube 80 is an overly tightened lens cell, which can result in 'pinching' of the optics during large temperature swings that can sometimes be encountered in the field. Allowing some wiggle room in the lens cell largely prevents this pinching from taking place.

The basic ShortTube 80 units on the market have a single light baffle placed a few inches behind the objective cell, and the innards of the tube are painted a flat (unreflective) black color, which collectively serves to block off stray light that can cut down on contrast-robbing glare in the image. A small mirror diagonal usually comes with the ShortTube 80 package, which slides into the focuser drawtube and is usually secured by turning a single screw. The SkyWatcher units also come supplied with a couple of entry-level eyepieces, usually a low power, long focal length oculars with a focal length of 25 mm (16×) and a higher power unit (10 mm), which delivers a magnification of 40×.

Fig. 2.1. The air-spaced doublet objective of the ShortTube 80. (Image by the author.)

Fig. 2.2. The Standard ShortTube 80 usually comes equipped with a 90-degree 1.25" mirror diagonal much like the ones shown in the image. (Image by the author.)

The ShortTube 80 is an extremely versatile spotting 'scope. Its small size, low weight, and ability to use interchangeable eyepieces allow it to be used in a variety of settings, from low power, wide field scanning to higher power applications. And since most nature observers and birders rarely use powers in excess of 60×, the ShortTube's optical limitations (described in greater detail later) can be largely ignored. It is certainly able to observe birds decorated with their pretty plumage, or the radiant colors of autumn leaves. It can even be used as a long range microscope to observe scurrying insects running to and fro on a tree trunk some 15 yards or so in the distance.

If you divide the focal length of the ShortTube 80 (that is, 400 mm) by its aperture (80 mm), you arrive at a number called the focal ratio. In this case it is 5, or f/5 in the parlance of the telescopist. When coupled to an imaging system, such as a DSLR, the ShortTube 80 acts as a very cost effective 400-mm f/5 telephoto lens, offering clean, crisp images during daylight and by night.