PHOTOGRAPHIC SOCIETY OF AMERICA WORLDWIDE

Journal

90 YEARS | OCTOBER 2024

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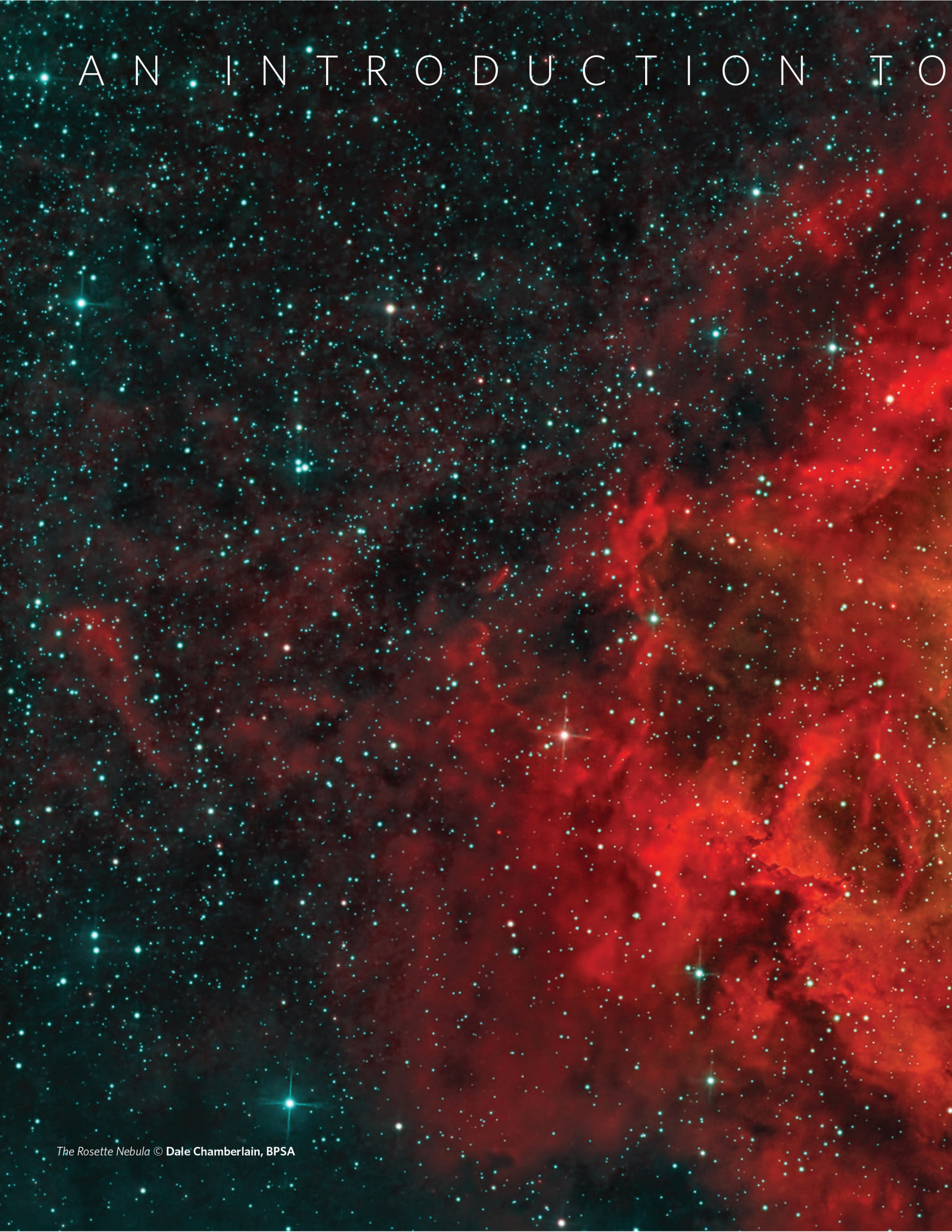
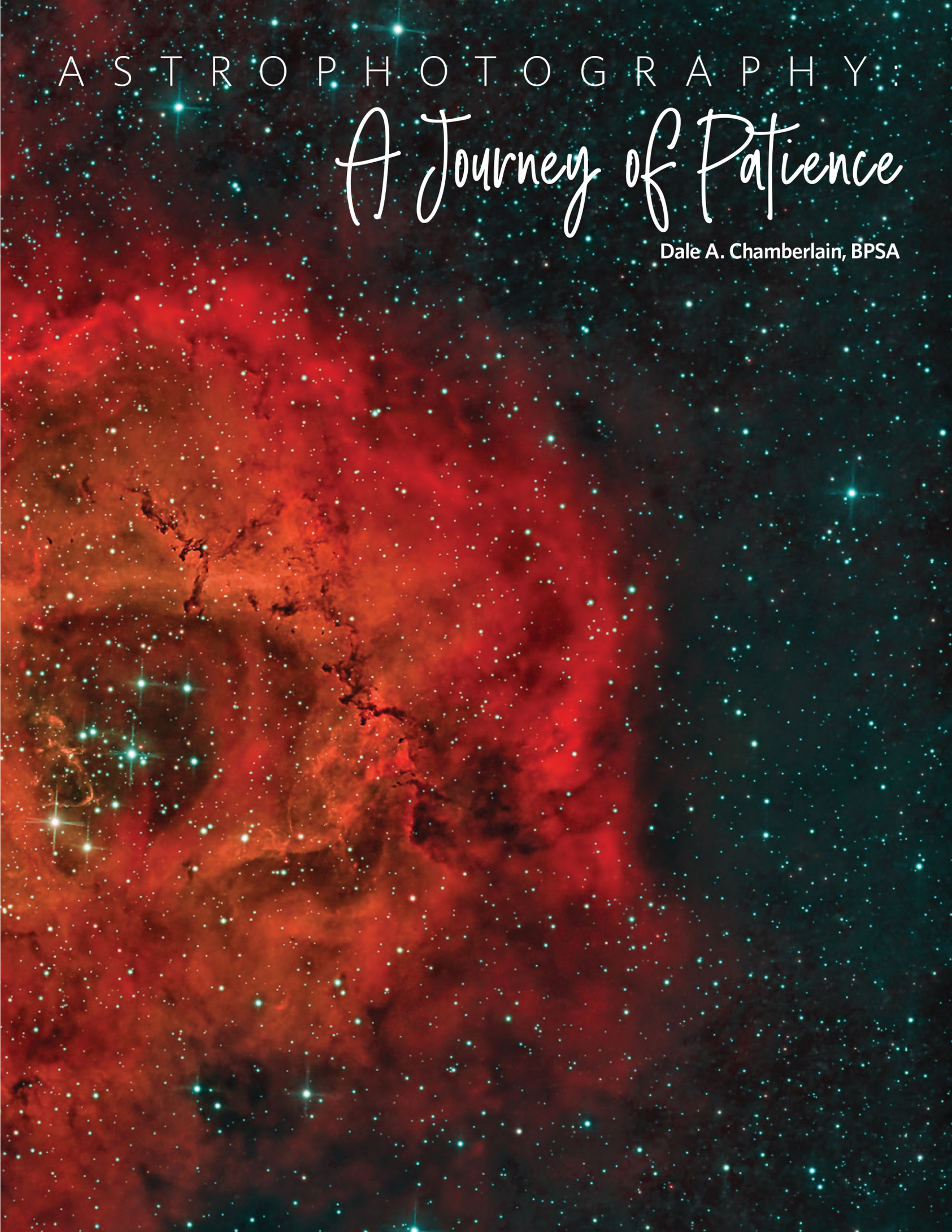
AN INTRODUCTION TO



The Rosette Nebula © **Dale Chamberlain, BPSA**

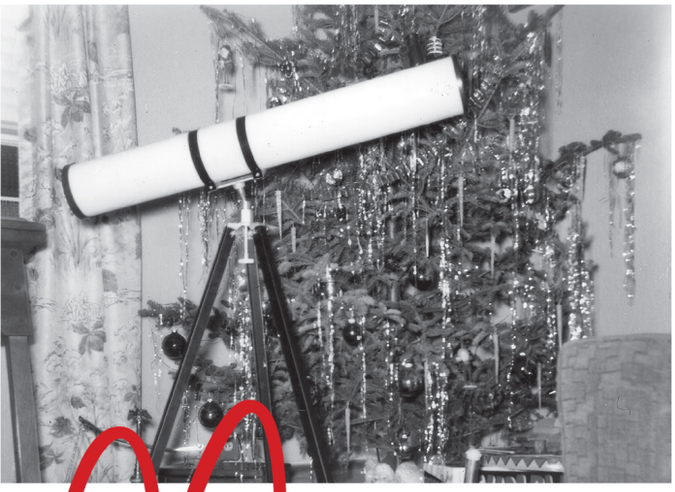


ASTROPHOTOGRAPHY:
A Journey of Patience

Dale A. Chamberlain, BPSA

The Dumbbell Nebula © **Dale Chamberlain, BPSA**

Orion Nebula © **Dale Chamberlain, BPSA**



Many people often inquire about my journey into the captivating world of astrophotography. It's a tale of unyielding passion, a quest to encapsulate nature's boundless beauty, peppered with numerous trials and errors and countless moments of triumph. My odyssey commenced at nine when my grandmother gave me a modest reflector telescope as a Christmas gift. The first celestial body I set my sights on was the moon, a cosmic entity that had captured the world's imagination due to the Apollo missions. The sight that greeted me was nothing short of breathtaking. I could discern intricate craters and the play of shadows on the moon's surface, and I found myself pondering where the first human footsteps would land. This moment was the catalyst that ignited my passion for astrophotography. Subsequent visits to the McDonnell Planetarium in St. Louis, Missouri, and the awe-inspiring film slides of deep space objects only strengthened my resolve to capture such images one day.

Astrophotography is a journey, a unique path for everyone. The beauty of embarking on this journey today is the plethora of hardware and software choices unavailable when I first started. The rapid advancement of technology has revolutionized astrophotography. If you've ever managed to capture the ethereal beauty of the Milky Way, you're already on the path to capturing deep-sky images. This article aims to guide you in your initial steps toward deep sky astrophotography, a realm beyond the Milky Way.

The basics of astrophotography are not as complex as they may seem. Like any other photography, you need a camera, a lens (or telescope), a stable platform (a tripod or pier), and a way to control the shutter. The only additional component you need is a mount or star tracker. Let's break it down:

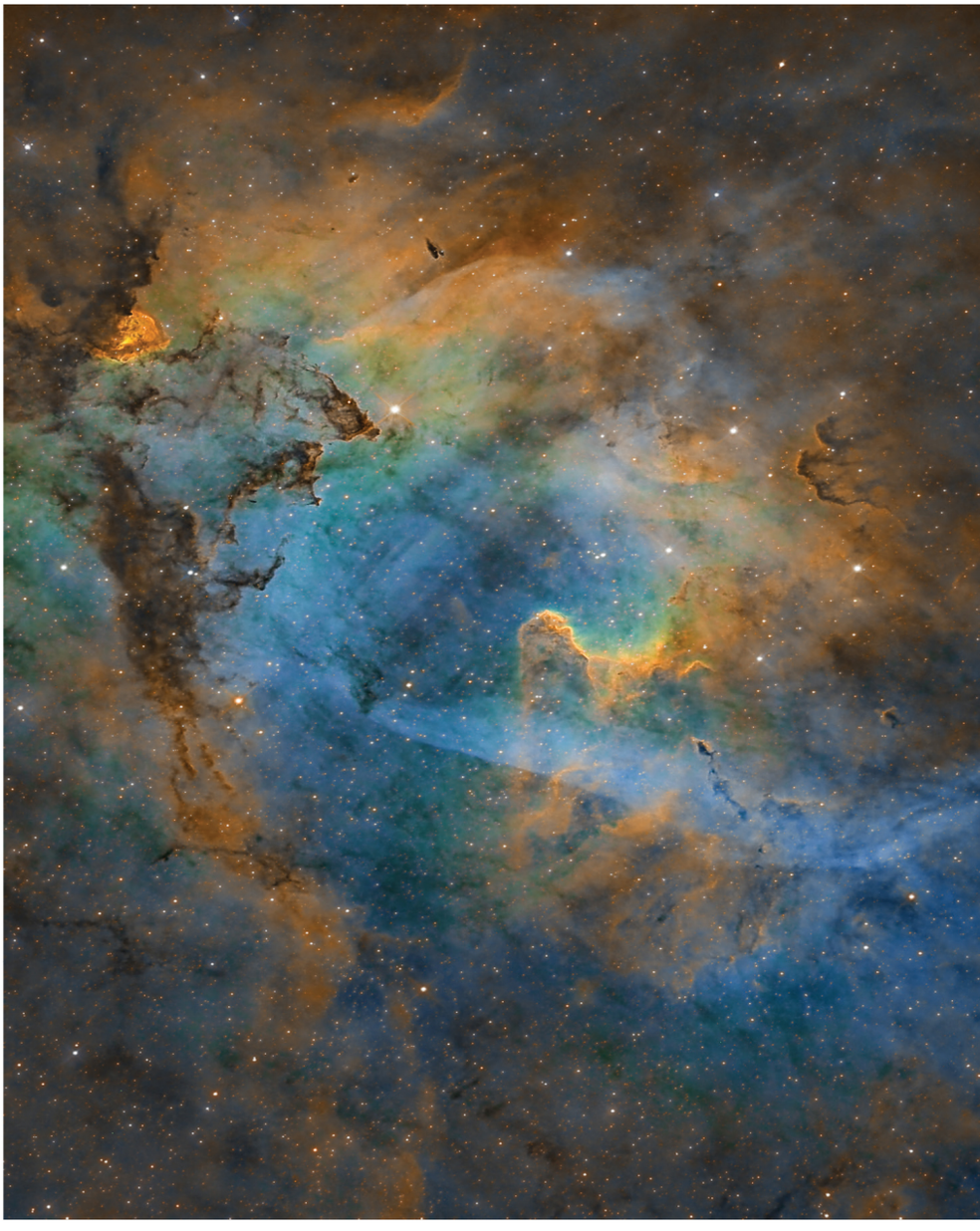
Equipment

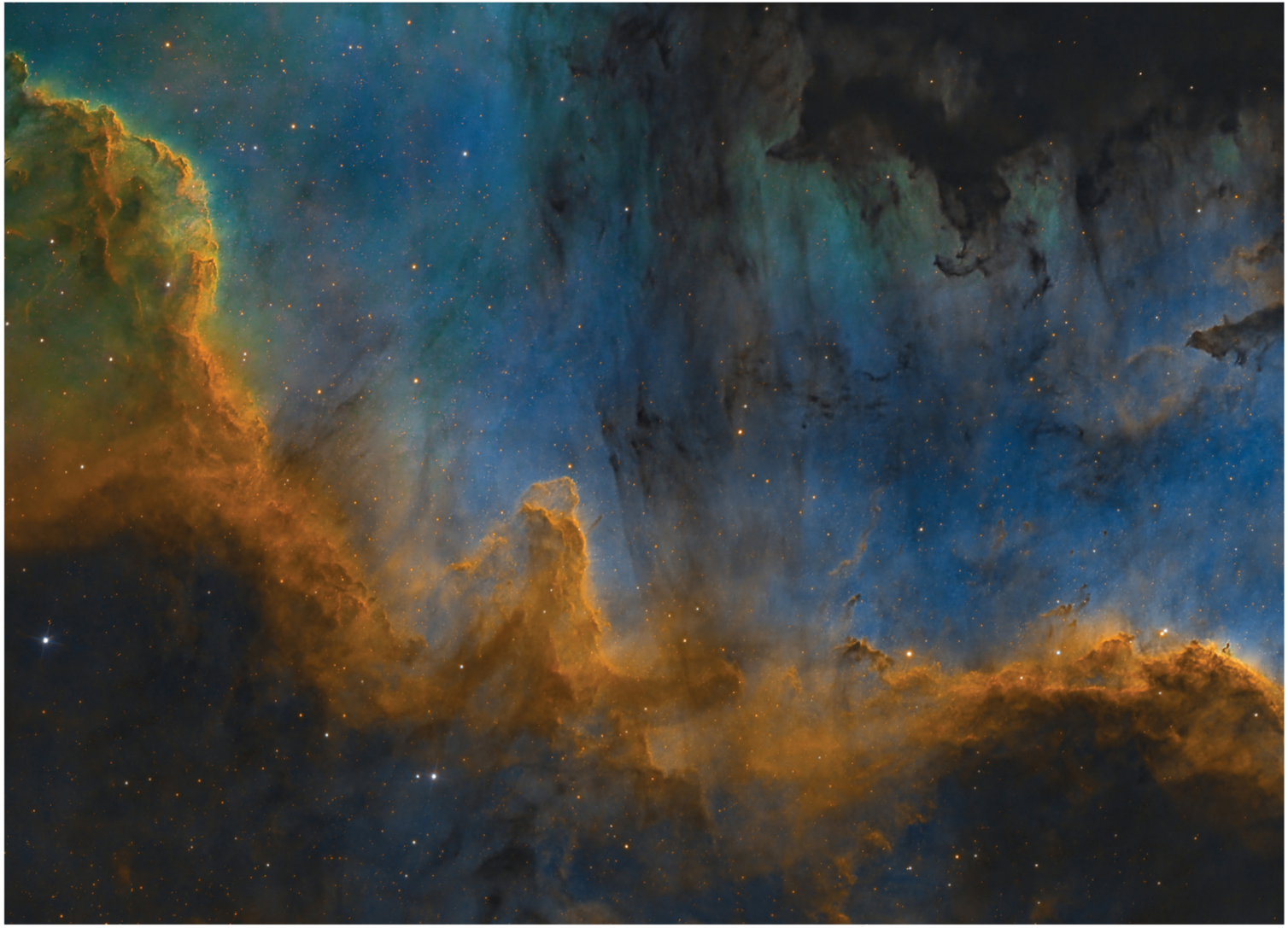
Camera: A DSLR or mirrorless camera with manual settings is ideal for astrophotography. These cameras allow you to control settings such as ISO, aperture, and shutter speed, which are crucial for capturing clear and detailed night sky images. As your journey progresses, you will probably desire a cooled sensor camera designed specifically for astrophotography. These cameras offer ways to minimize noise dramatically. Eventually, your quest could lead to a full-spectrum camera combined with various filters that allow you to take pictures looking like they came from the Hubble Space Telescope. With backlit CMOS sensors boasting high resolution, deep well depth, and zero-amp glow, they are now the gold standard in astrophotography.

Lens: A wide-angle lens with a fast aperture is recommended for capturing night sky views. Alternatively, a telephoto lens can zoom in on specific celestial objects such as the moon or planets. Ultimately, a telescope can be your lens. Just think of a telescope as a long focal length prime lens. You can start with a telescope capable of 300-400mm focal length, which could capture objects such as the Andromeda galaxy, Rosette Nebula, the Orion Nebula, or the moon. A longer focal telescope is necessary to capture faraway galaxies and deep sky objects that appear smaller, such as the Dumbbell Nebula or the Elephant Trunk Nebula. The longer focal length telescopes are physically larger than the typical shorter focal length. My long telescope is a 14" reflector (uses mirrors) of 2850mm focal length at f/8. With a focal reducer, it becomes an 1850 mm f/5 telescope.

Astrophotography is a journey, a unique path for everyone.

The Core of the Lion Head Nebula
© **Dale Chamberlain, BPSA**





Cygnus Wall
© **Dale Chamberlain, BPSA**

Astrophotography is a skill that requires practice and patience to master.

Tripod/Pier: A sturdy tripod is essential for keeping your camera steady during long exposure shots and preventing blurriness in your images. The tripod must be strong enough to handle the weight of the camera and lens/telescope. A permanent steel pier may be necessary for handling heavy equipment.

Remote shutter release: A remote shutter release or timer function on your camera can help reduce camera shake when capturing long-exposure shots. Ultimately, if your journey expands to a mount (described below), you will need a computer with image acquisition software to control the mount and capture the images to a disk. An example of such software is N.I.N.A. (Nighttime Imaging 'N Astronomy).

Star tracker or equatorial mount: To capture detailed images of deep-sky objects such as galaxies and nebulae, a star tracker or equatorial mount can help compensate for the Earth's rotation, allowing for longer exposure times without star trails. A motorized equatorial mount is the best way to compensate for the Earth's rotation. The equatorial mount is always aligned with either the north or south poles and is angled to match the latitude of your observing location. It allows for heavier equipment to be handled in your setup and can allow for a computer interface for locating and tracking deep-sky objects. Avoid mounts described as "Alt-Az" or "Altitude/Azimuth" because they are more for visual observing rather than photographic observing. The mount will be your most important piece of equipment. Do not skimp on the mount when budgeting for your astrophotography journey.

Today, I have a Paramount ME II GEM mount with adjustable counterweights and plenty of weight capacity to hold a 14" Ritchey–Chrétien (RC) telescope and a piggybacked 80mm aperture SkyWatcher Esprit triplet refractor. All these are housed on a permanent steel pier in a SkyShed POD MAX dome observatory with all the automation, such as dome and slot control.

This SkyShed POD MAX was the first constructed in the United States. Prototypes were built in Canada, where SkyShed is headquartered. This was so new that the instruction manuals had not yet been written when I received the materials. This was the next step in the journey. Working together on revisions as they came concurrently for each phase of dome construction was

crucial. This is included here just as a reference for how far you can go if you choose to do so. But having a backyard observatory is not for everyone.

Location

Find a dark sky location away from light pollution: Light pollution from cities can wash out the faint details of the night sky. Look for a location with minimal light pollution to capture clearer and more detailed images of celestial objects.

Check the weather forecast: Clear skies are essential for astrophotography, so check the weather forecast before photographing the night sky.

Consider the moon phase: The moon's brightness can affect the visibility of stars and other celestial objects. For optimal astrophotography conditions, consider shooting during a new moon or when the moon is below the horizon.

Focus

Manual focus: Switch your lens to manual focus mode and set the focus to infinity. You may need to fine-tune the focus manually to ensure that stars appear sharp in your images. Once you have the focus where you want it, a small piece of gaffer tape can be placed on the focus ring to keep it from moving while shooting.

Use live view: Utilize your camera's live view mode to zoom in on a bright star or celestial object and manually adjust the focus until it appears sharp.

Other focusing aids include a Bahtinov mask, which is placed over the opening of the lens and allows you to adjust focus by aligning lines of light from a bright star. Also, if you use a computer for image acquisition combined with an electronic telescope focuser, the computer can make automatic focusing adjustments.

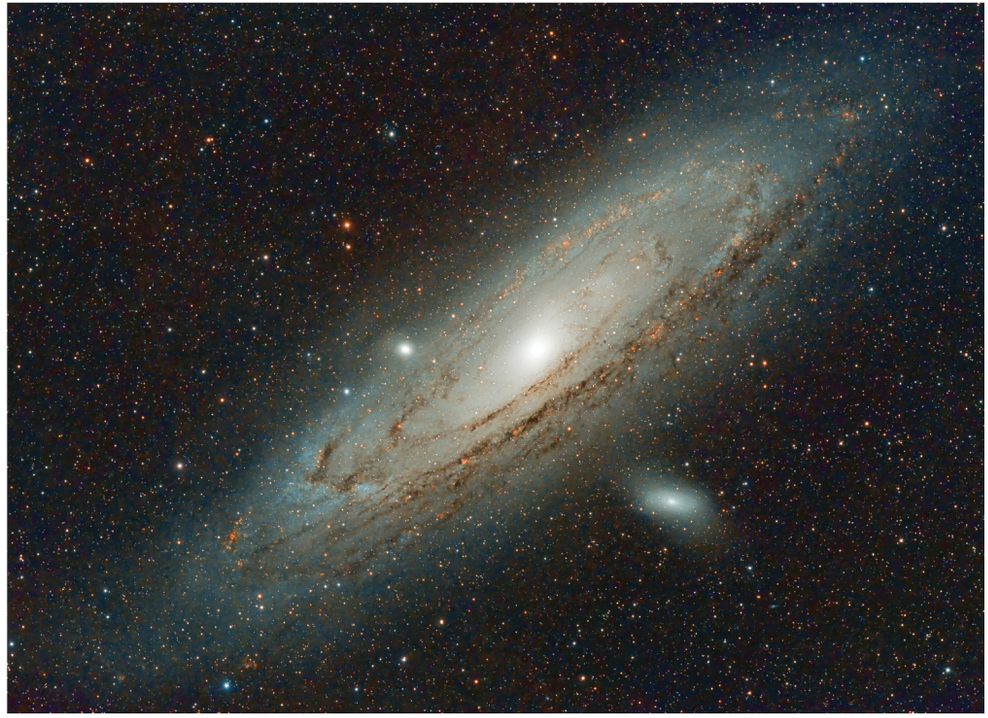
Post-Processing

Stack images: To capture faint objects or reduce noise in your images, consider stacking multiple exposures using software such as *PixInsight, DeepSkyStacker,* or *Sequator.* I use PixInsight for all astroimaging post-processing, and it does a beautiful job with stacking, exposure, contrast adjustment, color calibration, noise reduction, and selective sharpening through plugins. Most notable are the noise reduction, deconvolution, and star removal plugins developed by Russell Croman, the 2024 Recipient of the PSA Progress Award.

Practice and Patience

Astrophotography is a skill that requires practice and patience to master. Don't get discouraged if your first attempts don't appear as expected. Experiment with different settings, techniques, and locations to improve your astrophotography skills over time.

Combined with the power of PixInsight for image processing and Nighttime Imaging 'N' Astronomy (N.I.N.A.) for image acquisition, the quality of astroimaging has been unparalleled. For an amateur, imaging can occur fully unattended throughout the night, from astronomical dusk to dawn.



Andromeda Galaxy
© **Dale Chamberlain, BPSA**

With the myriad of hardware and software available, you likely will not find two configurations that are exactly alike. Getting all these components working together took a lot of patience and determination. I won't kid you. Sometimes, I felt like giving up, but having the resolve to see it through yields great rewards. I hope you can see this in my images. As technology and my skills improve, I find myself returning to the older images and replacing them with newer ones. My favorite targets are nebulas due to their beautiful colors and shapes.

There are many advantages to having a permanent outdoor setup in an observatory. Polar alignment does not need to be performed each observing session, and optical trains and balancing can be kept in place. Any future astrophotographer reading this will take the time to plan before buying and realize that there is never a point when you can declare the journey over. You can visit my website at **chamberlainobservatory.com.**

Dale Chamberlain, BPSA

Photography has been Dale's passion for most of his life. He was fascinated with his father's Argus and Agfa film cameras, the old 120 and 620 black and white types. After receiving a telescope as a Christmas gift, his passion for photography merged with astronomy interests. Eventually, he built a roll-off roof observatory in 2003 and began using a Canon 20Da DSLR camera with a 10" telescope. His astrophotography interests expanded further, and he replaced the observatory in 2017 with a new automated dome observatory in the backyard with dedicated cameras designed for astrophotography.

Self-taught in astrophotography, Dale attended a workshop on intermediate astrophotography at the Kitt Peak National Observatory near Tucson, Arizona. He joined the St. Louis Camera Club in 2015 and is currently a member. In 2020, he joined the Photographic Society of America and was awarded the Bronze Portfolio Distinction Award in 2023 for his "Nebulae of the Milky Way" composition. Professionally, Dale is retired after a long career in information technology as Chief Technology Officer for Express Scripts in St. Louis, Missouri. He seeks clear nights, a rare commodity, to observe the heavens.

Dale married another PSA and St. Louis Camera Club member, Madi Hawn, in October 2018. Thankfully, Madi has been very supportive of Dale's astrophotography interests!