

Photonic Cleaning Technologies presents:

From Toy Refractors to Robotic Telescopes - Andrew Barton



Dolphin Nebula (Sh2-308) in HOO
All Images by Andrew Barton

My lifelong passion for astronomy has matured through three phases. The first was marked with youthful excitement and exploration. It began with a very special Christmas gift, a Sears refractor. With it, I examined the planets and moon but it was deep sky objects that kept me setting up evening after evening. One late afternoon, I spotted something strange glowing brightly in the clear dusk air. I fetched my telescope and was stunned to see an oblong shape with two antennas sticking up. I ran into the house to grab my incredulous parents who were stumped by what they saw. It turns out we were viewing a weather balloon. I had forgotten that my scope inverted the image and the antenna were pointed towards the ground. Even though my "UFO" sighting had a mundane explanation, the possibility of discovery began my lifelong obsession with astronomy.

Eventually I became dissatisfied with the limitations of my small refractor and purchased my first book on telescope building, "All About Telescopes" by Sam Brown, fifth edition 1981 from Edmund Scientific. I still have it. That book gave me ideas for upgrades I could build myself. For my birthday my parents purchased a good 6" mirror and some core components. With those, a stove pipe from the hardware store and some spare lumber, I built my first 6" Newtonian reflector and a wooden mount cradle. I then attempted my first astro-photo of the Orion nebula with a homemade afocal rig and a 35 mm film camera. The results were disappointing. My moon photos were a bit better but also less than I had imagined. After a couple more attempts, I gave up on astrophotography but continued to explore the night sky and sun.



Tulip Nebula (Sh2-101) Narrow Band



Croc's Eye Galaxy (M94)



Ghost Nebula (Sh2-136)

The second phase of my astronomy journey began in 1998, when my wife and I moved to Tucson, AZ so she could take a faculty position in biomedical engineering while I rebooted my software business. Now I had access to much darker skies than my previous fog and light-drenched residences. We decided to purchase a Celestron CPC 800 goto scope from Starizona. Dean Koenig, the owner of Starizona suggested that this scope could be upgraded for use in astrophotography. A couple years later, I purchased a Hyperstar system and an Atik CCD color camera. I was blown away by potential in my first images, but what surprised me the most was that I now had the capability to take images that rivaled those from the books and magazines of my childhood.

As I gained experience and developed my skills in astrophotography, I moved through a series of upgrades and additions to my kit. I also learned some valuable lessons. The first was to start simple and focus upgrades on the most significant pain points. An example was focusing the Hyperstar system. At $f/2$, the focus zone is very small. Combined with the mirror flop of an SCT and dependence upon temperature, the focus was nearly impossible to find. An autofocus system yielded immensely better and less frustrating images. Your own optical system (reflector vs refractor, short vs long focal ratio), camera and mount will determine your pain points. The second lesson was to get the best mount one can afford. If you can't track your target accurately, you will never get a good image. At some point I decided to swap my CPC8 fork mount for a German equatorial mount. Unfortunately I chose an undersized mount. No matter what I did, I could not get decent guiding. My wife, sick of my frustration, suggested I purchase a quality mount that would end my misery. I went with an Astro-Physics Mach 1 and have never regretted it. My final lesson learned was to use the problems and limitations encountered along the way as opportunities to learn more about your tools. At some point my images suffered from optical aberrations in the corners. For me this was a good time to learn more about telescope optics. I found "Telescope Eyepieces Astrographs" by Gregory Hallock Smith et al. to be a great reference and my next telescope purchase was made with much more awareness of tradeoffs between various optical designs. Later, my biggest limitation was my ability to process my astronomical data. After some research, I purchased PixInsight and spent the time needed to learn to use the tool effectively. Every challenge is a chance to deepen one's understanding of the many fields of science and engineering that contribute to astrophotography.



Outside View of Observatory



Remote Control Telescope in Observatory



Pacman Nebula (NGC 281) Narrow Band



Hercules Globular Cluster (M13)

The third phase of my hobby began with the purchase of some land outside of the city, as both a wilderness retreat and dark sky haven. A special find was fifteen acres in the Patagonia Mountains of Southern Arizona with a small house and workshop. With the weekend help of a local neighbor, Josh Stewart, I built a roll-off roof observatory over a two year period. The observatory is now operational, and I am enjoying the benefits of Bortle 3 skies. For remote operation, I need an imaging system that will provide maximum flexibility for minimal maintenance. My setup includes a Stellarview SVX 130T with a NightCrawler WR35 focuser / rotator, filter wheel and CMOS camera and Alnitak Flip-Flat/flat fielding device. I repurposed my old ST80 as a guide scope and continue to use my original Lodestar guider purchased for my CPC8. I move my roof with a Chamberlain garage door opener with wifi capabilities for manual control. I also created my own roof controller on top of the Raspberry Pi platform.

Running a remote observatory requires diligent maintenance. One of those chores is cleaning optics. I have had many great optics teachers and mentors including my wife who uses optics in her biomedical research, but I have never been able to clean optics to my satisfaction. Further, every cleaning comes with the fear of damaging coatings and surfaces. When my wife recommended a product that she had discovered and started using in her lab, I was excited to give it a try. First Contact Polymer is a solution you can pour or spray onto your lenses or mirrors with minimal mechanical contact to optical surfaces. Once dry you simply peel it off. My optics are now cleaner than they have ever been, and I clean when needed with no fear of damaging my investments.

My love of astronomy continues unabated and I ponder the next phase of my hobby. I have enjoyed producing beautiful images but I might want to take things in a more scientific direction. Things I am considering include spectroscopy and citizen science.

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