Digital technology, now offers unprecedented possibilities for the amateur astronomer, and professional astrophotographer alike. These new technologies now available to the common person holds promise for many new discoveries in a world where we have before been unsatisfactorily left in the dark; where only Nasa and large observatories could lay claim to the newest discoveries.

Especially, discoveries of the *fringe variety.*

As little as two years ago, I never thought possible the kind of imagery I am acquiring with my now, not-too-modest equipment. If you're thinking about getting into astrophotography, be prepared to shell out the big bucks.

Since the dawn of time humankind has been obsessed with the stars in the night sky. The velvet blackness of space, studded with jewels captivates the imagination in many profound ways. In the beginning humankind's very survival depended largely upon understanding the celestial bodies, their movements and cycles which determine the seasons.

Since its inception Nasa has been a dire disappointment; giving an all too narrow view of the cosmos, and especially the lack of revealing anything truly wondrous other than the destructive black leviathans and big bang theories, and artful conceptions of other worlds. Notwithstanding, the world of amateur astronomers has been equally disappointing, forever staying far away from any *fringe topics,* or the possibilities of extraterrestrial intelligent life.

The rocket scientist is not needed to realize that there is "archeology out there, and very ancient archeology right in our own solar system, but get Nasa to admit it, or even an amateur astronomer, well forget that!

I have had a long-time interest in the cosmos, but mostly of the spiritual nature for all of my life. Around two years ago I took my first image of the night sky; The Great Orion Nebula, or "M-45". Using a tripod and a 300mm F 5.6 lens mounted on a Nikon D7100 dslr camera. I didn't capture much of this huge nebula, but I did capture enough to fire my interests. From those early images I could faintly make out what appeared to me to be a face of some great wizard or shaman (I fantasized).

Since I didn't have a tracker I was only able to leave the shutter open for about two and one half seconds without "star streaking". Star streaks are caused by the movement and rotation of the earth against the mostly "fixed star" background. When I advanced to a 600mm lens with a 2x extender the need for tracking became an absolute necessity. After purchasing the Sigma 150mm to 600mm lens I soon after bought the Star Adventurer pro tracker for around three-hundred bucks, but by the time I bought a decent tripod and polar wedge, and ball mount I was into my little tracker for a little over five-hundred dollars. OR—you might consider this new one I just found with "goto" Complete -- All still much cheaper than the more serious trackers (*EQ mount with goto system).

This tracker allowed me to safely take images for longer than thirty-seconds, even accomplishing a four-minute exposure of Andromeda with a minimal amount of movement. The Star adventurer does not have a goto system and only a tracking motor for the Right Ascension axis. This was long before I knew anything about "guiding" with a secondary guide scope and video gui9de camera, and long before "off axis" guiding.

After imaging with the Sigma 600mm lens, it wasn't long before I desired a high quality refractor and we purchased the 70mm Stellarvue triplet. We then immediately became aware that our camera (Nikon D7100), was under sampling, and our stars became pixelated squares, even though the 70mm Stellavue had a far less optical magnification at 460mm (focal).

When we purchased our first pro telescope we were in for a rude awakening. It didn't' come with anything! No attachments, no eyepiece, nothing! It6 seems that6 all of the necessary attachments for astrophotography for a telescope ae highly overpriced. The first addition we bought was a "field flattner" for the Stellarvue which not only acted as an eyepiece for the camera, but also reduced the field and removed distortions caused y the wide frame of the camera—which is less on a DX crop sensor than the full frame FX model.

A laptop is needed in addition to run your scopes and camera's, I made the mistake of not getting one with a lighted keyboard. You will need at least 8 gigs of memory (Ram), to run the necessary programs.

Even with the largest telescopes in the world, very little is seen live through the eyepiece. However, with the ability to track the target and take a long time lapse exposure you now have "Hubble-like" abilities. And these imaging potentials expand exponentially through composite images where tens, even hundreds of hours of open shutter time on a specific target is then stacked to create one image. I use several software programs for guiding, imaging, and processing today, some free, some quite expensive.

Here are the programs I am currently using, for imaging, guiding, and processing. Nikon Backyard (also available for Canon costs $ 50.00), [https://www.otelescope.com/] PHD ("Push Here Dummy"), guiding software, [http://www.stark-labs.com/phdguiding.html] Sharpcap, imaging software (free) [http://www.sharpcap.co.uk/sharpcap/downloads], StarryNight Pro astro software (about $300) [https://www.starrynight.com/ProPlus7/index.html].

$300 like Stellarium, [http://www.stellarium.org/] but much better), PixInsight astro processing software (about $400, [https://pixinsight.com/] Adobe photoshop RAW lab (about 800 bucks but you can rent it for around one-hundred for a year, or ten bucks per month)[http://www.adobe.com/creativecloud/photography.html?sdid=KKTGD&kw=semgeneric&mv=search&s_kwcid=AL!3085!3!217292573724!e!!!!adobe%20photoshop&ef_id=WaBBdQAAAG4uOlu8:20170901004638:s] , Registax stacking software (free--(planetary) [http://www.astronomie.be/registax/], DSS (Deep Sky Stacker), deep space stacking software (free). Autostakkert (free stacking software) [https://www.autostakkert.com/wp/download/]' Both Registax and autostakkert allow you to stack video stills acquired through either Sharpcap or any other method to stack thousands of frames of the moon and planets—I generally stack about ten gigabytes of frames into one image. Sharpcap additionally has a polar alignment feature that is pretty good. Two things are of the utmost importance concerning tracking, first you mount has to be perfectly level, second you must be polar aligned as best as possible. But there's another way to align for tracking, as in "star align", and of course if your tracker is encoded this will help with "Polar Drift". What is Polar drift? The pole star (Polaris) is the most fixed part of the sky, to the observer it seems to stay in the very same place in the sky all through the night, but it doesn't, the earth has a slight wobble that takes place over a period of hours throughout the night, this is polar drift. ASCOM, if you get this far—[http://www.ascom-standards.org/]

Our new tracker is encoded, so now we are learning the ASCOM platform, well—sort of--. We just acquired the new Skywatcher EQ 6 tracker with goto system and we are still learning the encoding. This

is a smart tracker; it knows where it's at in the sky, and this is important, because not only do deep sky targets focus differently in different parts of the sky, but they additionally move (track), at different speeds.

At this point, astrophotography becomes extreme. The longer you can successfully track a target, and track perfectly, because any movement will cause the image to blur (or worse; smear and streak). The fainter light from distant object millions of light years away will be gathered in the sensor of the camera, thus forming your image. I must point out, that in this way current digital imaging of the cosmos now available to each and every one of you (that has the bucks, or join the AA team), is truly beyond imagination, and more importantly, we now have the capabilities to make huge astonishing discoveries, even aiding in the vigilant watch for dangerous comets and asteroids.

The very first decision you will need to make is what kind of camera will you choose for imaging. If you already have a dslr, then start with it. IF you have a point and shoot; such as a Nikon P900, or a "powershit", these will be of no real use for astrophotography.

I have decided for now, to go with upgrading my dslr to the Nikon D810 NOT the "A"—I shoot everything; not just astro, and I'm not too fond of the artistic look of IR, additionally the Nikon 810 A is only good for up to fifteen minutes of exposure time (with cooling). For A CAMERA THAT IS ONLY GOOD FOR ASTRO IMAGING I SIMPLY CANNOT JUSTIFY THIS HEFTY PRICETAG.

On the other hand, the higher end CCD (eyepiece cam), CMOS camera with cooling fan, will run you over a thousand-dollars for a good one. However, you can pick up the Sony, QHY 5 series II color for planetary and guiding for less than three-hundred bucks, and this works good for the moon and the planets in the solar system. But it's useless for deep space imaging of distant galaxies and nebula.

Some of you, have bought large telescopes (ten-inch or more), and have been sorely disappointed when viewing your first target other than the moon through the eyepiece. Let me reiterate; the eyepiece of the telescope sees very little. But track the target, and leave your shutter open even for a few seconds, at say ISO 800 and you will now have a "Super Scope"!

I suppose we need to talk about "sampling rate" here, (the number of pixels used for the sensor size {well that's part of it)). In general, the eyepiece camera (CCD astro), is better for imaging with a scope and its designed to do so, but it is useless for any other application other than a telescope or microscope. These kinds of cameras are of the highest scientific standards, and may well be worth their hefty price tags, but I suggest you get some experience first, without breaking the bank on a two-and-a-half-inch camera.

You also will need to make another very important decision. Do you want to image the moon and planets; objects in our solar system, or deep space targets such as distant galaxies and nebula? OR like myself; is it BOTH you're after?

We purchased the RC (Ritchey-Chrétien), 8" reflector in addition to our 70mm refractor. The eight inch RC is about twice the price of the *Schmidt-Cassegrain*, and the RC won't image the planets quite as well (not much difference). But the RC is capable of Focal Ratio F-6, and this is the important part. Most all Newtonian reflectors have a focal ratio of F-10 which is too constricted of an aperture opening to let in the faint light of targets millions of light years away.

The RC is the same design as the Hubble, it is designed specifically for astrophotography with the parabolic quartz mirror, its short carbon fiber tube and its increased focal ratio (the lower the number the larger the opening; the more light it lets in—well that's sort of right- with telescope's its more to do with the focal ratio in distance from the optical mirror, Cass' are different cause they use both mirrors and lenses).

At this point be sure to watch these three videos.

1. https://youtu.be/9d0292TBMHo Astrophotography P1: Telescope OTAs
2. https://youtu.be/zQB6UnrTEEM Astrophotography P2: Choosing & Using Telescope Mounts

3. https://youtu.be/sW8NyT3r2LU Astrophotography P3: Guiding Your Telescope

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