

Astronomy History

I have been interested in astronomy ever since I was a kid, but never really pursued it until recently. Here is the story of my journey learning telescope astronomy.

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Initial Astronomy Attempt - 2021

In July 2021 I purchased a basic telescope which I hoped would let me start enjoying the wonders of astronomy.



[Celestron - AstroMaster 130EQ-MD Newtonian Telescope - \\$231](#)

I was pretty happy with the telescope; it seemed sturdy and well built. As I was to later find out this appearance was based on me knowing almost nothing about telescopes – but I'm jumping ahead now.

I used it for the usual things: looking at nearby mountains, the moon, stars, etc....

I even tried to see if I could spot the Apollo lunar lander that was left on the moon in the 1960s. But I couldn't see it. I later ran across an article that explains this (see [What Can You See With a Telescope - Deep Sky Watch](#)):

Note that even through a very large 20" amateur telescope the resolution will be about 0.35 arcseconds, which means the smallest object you can see on the lunar surface is over 500 meters. So no, you won't be able to see the flag or the Apollo spacecraft.

Except for the moon, which was kind of cool because I could see some nice detail of the craters, it was kind of disappointing because it seemed to me to be no more powerful than say a good pair of binoculars. Looking at stars and planets revealed nothing more than a point of light which I could see with my naked eye.

So, like so many other things in life, the telescope sat in the corner of my living room for 2 years collecting dust and being nothing more than a novelty.

Second Attempt – October 2023

I got interested in astronomy again late in 2023. Basically, I realized that I had completed all of the other projects that I wanted to do, and was looking at the back yard realizing that it is almost a perfect telescope observation platform.



- All of the houses behind mine are way lower – so the light pollution is coming from ‘below’ the telescope.
- My house location is on the edge of town so there is very little ambient light.
- My house has a high elevation (1/2 way up Black Mountain) thus:
 - above the smog layer of Vegas – thus less atmospheric obstruction and chromatic distortion.
 - 10-15 degrees cooler than the city of Vegas – thus less atmospheric distortion.
- And of course, Vegas weather is almost always clear skies, so clouds only rarely get in the way.

Step 1 – Learning about telescopes

So, I spent some time learning more about how telescopes actually work and how to properly use them. Here are some of the websites that I found helpful for a beginner:

- [Can You Use a Telescope In The City? \[Is It A Waste Of Time?\] \(astronomyscope.com\)](https://astronomyscope.com)
- [Equatorial Mount Vs Alt-Azimuth Mount \(Read This First!\) \(telescopeguides.com\)](https://telescopeguides.com)
- [How To Take Photos Using a Telescope - Master Photography Podcast](#)
- [">\\$5000 to spend on a telescope - what to get and why? : r/telescopes \(reddit.com\)](https://www.reddit.com/r/telescopes)
- [Telescope, CCD and Eyepiece Calculator - Deep Sky Watch](#)
- [How To Actually Use That Damn Telescope! - YouTube](#)

This is the point at which I realized that I had basically been doing everything wrong!

Step 2 – Getting a Better assortment of Eyepiece Lenses

My first action was to purchase a better assortment of eyepieces, so I got a set of Plossi lenses with three Barlow lenses.

- [Celestron 1.25 inches 14 piece Eyepiece and Filter Accessory Kit](#)
- [SVBONY 1.25 inches 3X Barlow Lens](#)
- [SVBONY 1.25 inches 5X Barlow Lens](#)



The assortment of lenses allows you to change the telescope magnification, and the Barlow lenses allow you to add an additional magnification factor to any lens. When using a Barlow lens, the Barlow goes between the lens and the telescope eyepiece.

This made a big difference. The telescope I had only came with two eyepieces: 10mm & 20mm which worked OK for viewing the moon, but were useless for basically anything else.

I eventually realized that the Plossi lenses were OK, but not great for a lot of applications. I ended up buying a set of 7 (2.5mm-25mm) [Alstar Planetary eyepieces with 58 degree field of view](#) (left below) for viewing planets. These are much better-quality optics and the FOV makes planetary observation much easier.



Additionally, I realized I needed a [reticle eyepiece](#) (right above) when polar aligning the mount.

Step 3 – Getting a Good Sky Viewing Software Program

After doing some research, I found a fantastic program, which is free, here:

[Stellarium Astronomy Software](#)

As you can see in the picture below, this allows you to see the sky, for your exact location, as it appears at any time. This is fantastic for being able to find where to look for objects in the sky.

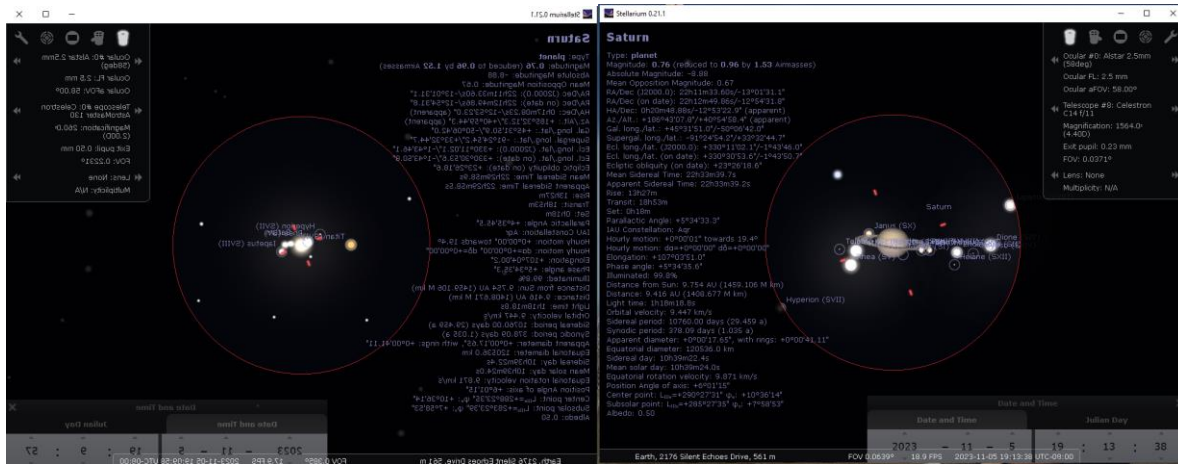


Step 4 – Seeing How Different Telescopes Work

Additionally, the Stellarium program has a mode where it will let you define a set of telescopes and lenses, and let you see the sky object ***as they would appear through each combination of equipment.*** This is fantastic for determining what kind of telescope you should buy to get the results you want without paying too much money for something you don't really need.

For example, below you can see two screen shots of what Saturn would look like with a 2.5mm eyepiece.

- On the left is the Celestron AstroMaster 130 (the scope I purchased) which has a 5” aperture and costs around \$230.
- On the right is the Celestron C14/f11 which has a 14” aperture and costs around \$7,000.



There is clearly a huge benefit from getting the bigger telescope; you can see much more detail about the planet, its colors, details, moons, etc. The big question is: is it worth the extra money.

IMPORTANT – this telescope simulation does **NOT** take into account the maximum practical magnification factor (which is around 50x the aperture in inches.) This fools you into thinking you can see things that are not practical if you are not careful.

So, for example, if you simulate an 8” scope with a 2350mm focal length, using a 2.5mm eyepiece. This produces a magnification of 940 (2350/2.5) but an 8” scope has a maximum practical magnification of x400 (8*50.) So, the image displayed to you by the program is impractical. In this example you would need to limit yourself to looking at eyepieces with focal lengths greater than 5.875mm (2350/400.)

Even this is the maximum limit which requires perfect conditions. A more practical limit would be to use around ½ of the maximum limit for normal everyday viewing. In the example above this would drop the top magnification from x400 to x200 and limit eyepieces to be 12mm and larger.

Step 5 - Buying a Descent Telescope

For some people it would be worth the extra money to buy the best telescope there is, but for me, I decided on something more in the middle and ended up purchasing the following, which is an 8" telescope about half way between the two models shown in the [previous section](#) and costs about \$1,350:



[Celestron C8-A \(XLT\) Tube with StarBright XLT 91024-XLT](#)

Step 6 – Mounts

The telescope mount is basically the thing that holds it and allows you to move it through the sky.

There are basically three types of mounts as follows:

1. A basic manual mount (cheapest, no frills)
2. A motorized mount that lets you track an object as it moves through the sky
3. A motorized and computerized mount that does all the work for you of pointing the telescope at the object you wish to see and tracking it as it moves.

As you can imagine the mounts get more expensive as you add more features. Below are some pictures of these different types of mounts that are quality products:

1. Left - Celestron CG-4 (\$330)
2. Middle - Dual Axis motor drive to add to CG-4 (+\$180)
3. Right - Sky-Watcher AZ-EQ6 (\$2,200)



My experience so far had been with the mount that was provided with my basic 5" AstroMaster telescope. It looked solid and reliable to me when I first got it, but as I tried to look at more and more objects with the telescope, I realized that it had many shortcomings.

- It was "wobbly" – if the wind blew a little the image would start shaking. It took 5-10 seconds after you removed your hand from making an adjustment before the image would stabilize.
- The adjustment controls were "loose" – you could move the adjustment a bit without the telescope actually moving because the gears were not in tight alignment.
- The adjustment controls were not "smooth" – you could tell that there were no ball bearings, just metal to metal contacts on the motion axes.
- The "tracking motor" that came with the unit was a joke. The tiny motor didn't even have enough strength to actually move the control. I ended up taking it off and throwing it away. It was horrible!

All of these issues made trying to look at stellar objects very painful – something you should not have to deal with as a beginner as it may make you give up on pursuing astronomy.

Tracking Considerations

When considering a mount, it is important to understand why you might want to have (or not have) motorized tracking built into the mount. I didn't really understand this at first and it cost me a lot of grief.

The primary reason you need a motorized mount is if you plan to do astronomical photography. The reason is very simple when you think about it and is based on the difference between your eye and a digital camera.

Your eye can see most (that are reasonably bright) objects almost instantly, whereas a digital camera usually needs to "see" the object for a longer period of time before it can create a proper image of the object.

Therefore, you can just glance in the telescope with your eye and say "wow, that looks really cool!" But you have to track the object – often for multiple seconds – through the sky to get a good digital photo.

Since everything is constantly moving – you need a mount that can accurately track objects on its own if you plan on doing any kind of reasonable photography of stellar objects.

You can take pictures of things on earth (mountains, etc.) without tracking because you are not moving in relation to each other. For more detail see the [photography section](#).

Initial Mount Ordered Fiasco – Amazon AZ-EQ6

I had initially decided to go for a reasonably top of the line mount – the [Sky-Watcher AZ-EQ6 Mount - \\$1,979](#).



When I was reading reviews of the mount, I kept seeing what a nice mount it was, but that many people had issues ordering it from Amazon. It came in two separate boxes and many people only got one or the other box instead of both boxes.

I just assumed this was a past issue and Amazon was a smart enough company to have resolved this by now. Sadly, this was not true! I only received one box as well (the tripod – with no mount.)

It took me days of aggravation dealing with Amazon to try and resolve this. They eventually agreed to allow me to send the tripod back and get a refund. I am still waiting for the refund which can take up to several weeks – so I can't say if this will work or not yet, but the last Amazon representative I spoke with was very helpful so I am keeping my fingers crossed.

I initially considered re-ordering the mount at a more reputable astronomy retailer, but was concerned about doing this until I actually got my refund from Amazon. If they changed their mind and wanted to send me another unit, I didn't want to end up with two expensive mounts.

Second Mount Ordered – AZ-EQ5

So, while I was waiting for Amazon to straighten out the [fiasco with the AZ-EQ6 mount](#), I decided to order another less expensive mount ([Celestron CG-4 German Equatorial Mount and Tripod - \\$329](#)) so I could keep working on my astronomy skills.



One of the reasons I chose this mount was the in the reviews someone had said that it worked great for his Celestron 8" telescope tube – the same as the [one I had ordered](#).

Saddle-Mount Mismatch Issue

When this came in, I was immediately impressed with the construction of the mount and eager to try it out with my new larger 8" telescope. Sadly, my aggravation with mounts was only to continue as I realized that the mount was a V (1.5") mount, and the rail on the 8" telescope was a D (3") saddle. This was not good for my blood pressure and for a time I was considering if it was worth all this aggravation, but eventually I calmed down.

I eventually found a company (after reading the following thread: [Converting the CGE C8 EdgeHD to CG5 dovetail - Cats & Casses - Cloudy Nights](#)) that sold an adapter that would allow these two products to be used together. So, my blood pressure returned to normal and I could move on again.



[V2D Converter- Converts V Series Mounts to a D Series Mount. - ADM Accessories - \\$139](#)

I ordered and received the adapter a day early which was nice. It worked perfectly as can be seen below. The only drawback was that, because it moved the weight of the tube further away, I needed to add more counter-weights.



New Mount with Old Telescope

I ordered the adapter plate – excited to actually be able to use my new telescope soon. In the meantime, it turns out that my old telescope was the correct size (V) to fit on this new mount so I started using this combination. Below you can see the difference between the two mounts using the same 5” telescope.



This new mount was AMAZINGLY better than the old mount. It is rock solid all of the adjustment movements are very tight. I am now able to position and track objects very nicely by hand – even without any motors or computers.

One thing that made it possible track by hand was learning the proper way to actually setup an equatorial mount telescope. I found the following video to extremely helpful:

[How To Actually Use That Damn Telescope! - YouTube](#)

At this point I am questioning if I really need a fancier mount for the time being and plan on using this mount until I find a real reason to upgrade.

Step 7 - Photography

I'm still getting started with astro-photography, but have a few good tips to share.

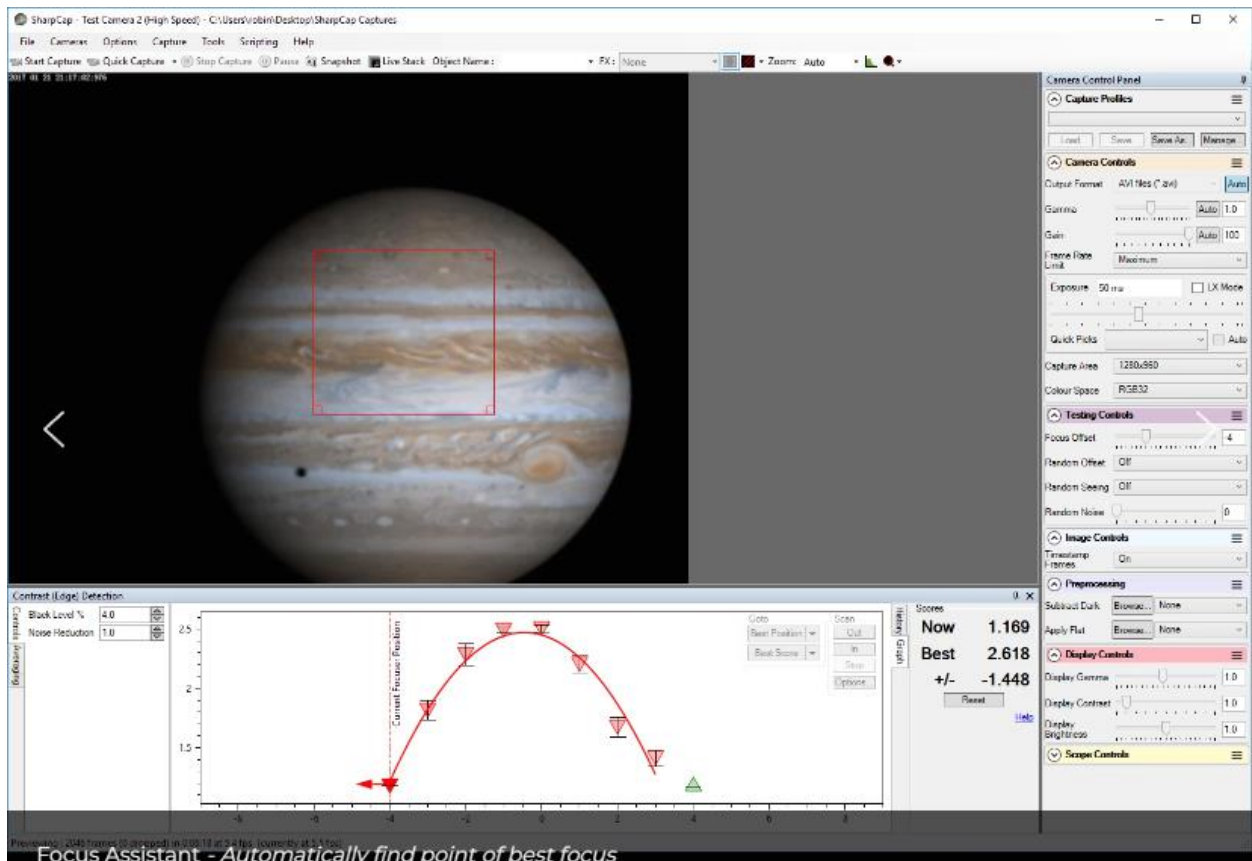
I got a basic telescope digital camera which works pretty well for me. I did read a lot about how fancier, more expensive cameras are needed to photograph deep space objects due to exposure and heat generated in the camera which affects the image, but this is a good starter camera in my opinion.

One thing that is not mentioned anywhere in the specs is that this camera has a rather narrow FOV – similar to a 5mm eyepiece.



[SVBONY SV305 Telescope Camera, 2MP Astronomy Camera, 1.25 inch Planetary Camera - \\$149](#)

You can download a free version of the [SharpCap software](#) that allows you to control this camera over a USB cable.



The screenshot displays the SharpCap software interface. The main window shows a live video feed of Jupiter with a red focus box overlaid on the planet's bands. The interface includes a menu bar (File, Camera, Options, Capture, Tools, Scripting, Help) and a toolbar with buttons for Start Capture, Quick Capture, Stop Capture, Pause, Snapshot, Live Stack, and Object Name. The right-hand side features a 'Camera Control Panel' with sections for Capture Profiles, Camera Controls (Capture Format: AVI H264 C-avi, Gamma: 1.0, Gain: 100, Frame Rate: Maximum, Exposure: 50 ms, LX Mode, Quick Picks: Auto), Testing Controls (Focus Offset: 4, Random Offset: Off, Random Seeing: Off, Random Noise: 0), Image Controls (Timestamp: On), Preprocessing (Subtract Dark: None, Apply Flat: None), Display Controls (Display Gamma: 1.0, Display Contrast: 1.0, Display Brightness: 1.0), and Scope Controls. At the bottom, the 'Focus Assistant' window is visible, showing a graph of Contrast (Edge) Detection with a red curve and a vertical line indicating the 'Current Focus Position'. The graph shows a peak in contrast, and the 'Scores' section displays: Now 1.169, Best 2.618, and +/- -1.448. A caption at the bottom of the Focus Assistant window reads: 'Focus Assistant - Automatically find point of best focus'.

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I chose to purchase a cheap [mini-laptop - \\$134](#) that works very well for this application – although to be honest probably any laptop will work fine. I like this because it is very light weight and the battery will run the camera for a good 30-60 minutes.

Example of Terrestrial Telescope Photography

This is a shot pointed at a mountain about 13 miles away from my house - I was looking at the radio tower on the top.



This is a shot of the same mountain from my backyard (same spot) using my phone camera (on x9 magnification.) You can't even see that there is a tower there.



It happens that this is directly in the McCarran flight path and I was able to capture a plane flying by the mountain.

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This was taken with:

- the new tripod and mount
- the old mediocre 5" telescope
- no magnification lenses - the magnification actually made it worse (mostly because of the atmospheric distortion)
- my new telescope camera SV305 - basically a beginner camera

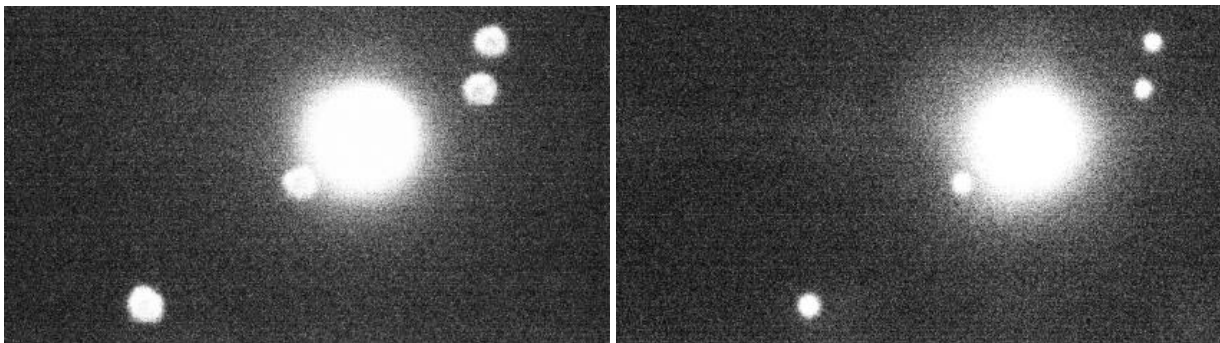
The camera was inserted into the telescope eyepiece and I was able to view what it was seeing on my laptop. I could then press a button to take a picture when I wanted to.

Example of Planetary Astronomy Photography

The following were taken with the new C8 telescope and AZ-EQ5 mount using a [MEOPTEX flip mirror](#) to combine the eyepiece and camera on the telescope at the same time. This makes it drastically easier to first find the target in the eyepiece and then simply flip the mirror so that the light goes to the camera instead of the eyepiece. Of course, time was spent getting the camera in focus, but this only has to be done once with this setup – not every time you switch between eyepiece and camera.



The target was Jupiter and you can see two of the pictures taken below. The one on the left was my first shot and a little out of focus. The one on the right is in better focus – the moons are sharper.



Neither picture is very good (none of the colors bands or details of Jupiter can be seen) but I was pretty happy with them for my first try with astrophotography! I will have to do more research into adjusting the software settings and possibly use a filter to reduce the glare. I feel like I have a basic setup now up and working and can move on to the next step now.

Evolution of my Telescope Setup

11/08/2023

On the right is my original Celestron 130EQ. On the left is my Celestron C8 on an upgraded CG4 mount. I used a SVBONY SV305 camera with these initially.



01/02/2024

Here is the Askar FMA180 with a ZWO ASI585MC camera, Williams Optic laser sight, and 80x50 RA finder



01/10/2024

Added the ASI AIR Plus computer system, and the Celestron tracking motors for the CG4 mount



01/11/2024

Added the ZWO 5 position filter wheel.



01/17/2024

Upgraded to Williams Redcat 71 telescope.



01/18/2024

Upgraded mount to use ZWO AM5 with full featured tracking.



01/19/2024

Added ZWO EAF auto focus with [BuckeyeStargazer](#) bracket.



01/20/2024

Moved ASIAir to lower body of mount so that it the it stopped hitting the tripod in certain positions.
Added USB hub on custom bracket to accommodate extra connection required by guide scope.



1/24/2024

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1/24/2024

Added a pier extension to move the mount head higher up. This prevents the telescope from being able to hit the tripod legs when it is pointing straight up. This is essential for tracking objects.



1/24/2024