PREPPING A CELESTRON CPC 1100 FOR IMAGING

LESSONS IN ASTROPHOTOGRAPHY TROUBLESHOOTING

By Paul Temple

After successfully running an Astro-Tech 8-inch f/4 astrograph with a ST-7E Camera for two years, I felt like it was time for something a bit larger. So, four years ago, I bought a Celestron 11-inch CPC GPS from a friend who was getting out of astronomy. He had built a custom carbon-fiber tube, added a MoonLite focuser and hyper-tuned the mount, which all sounded great, but little did I realize how much work and frustration I was in for.

First Challenge: A Faulty Power Connection

The first issue I noticed was the intermittent power supply. After aligning the scope, I would slew to an object, and then the power would blip, and I had to start all over! Since the power plug moves with the telescope, and the wiring would flex, it eventually worked itself loose internally. So, I just soldered permanent wires in place, sealed them in the hole with silicone sealer and added an external, inline plug so I could disconnect the power supply when I need to move or service the base (just visible in **Image 1**).

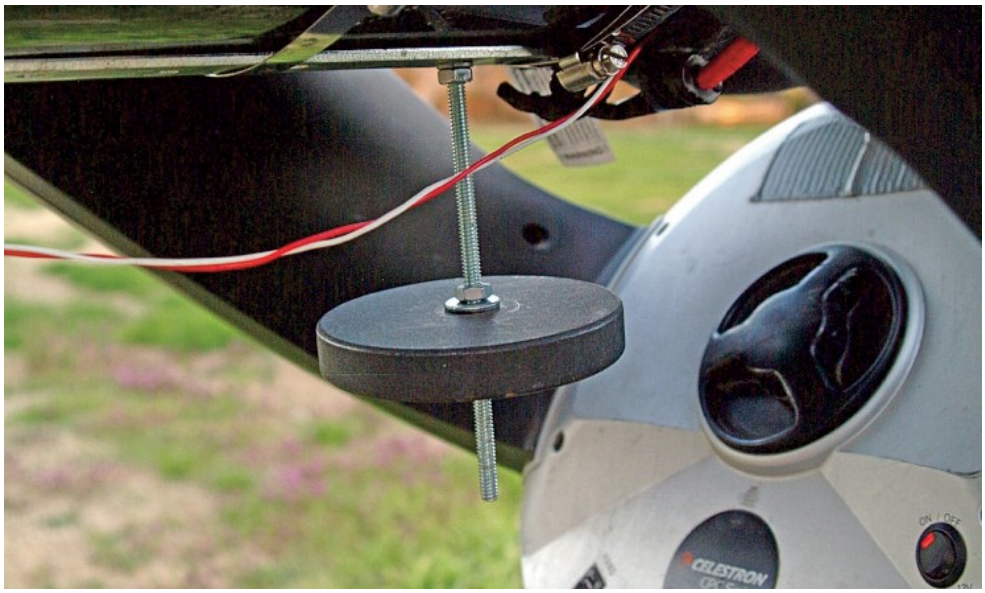

Image 1 - Weight assembly on bottom of tube. This was made from a large wood strap and some cheap hardware store parts. The assembly is held on by two tube clamps made from two large hose clamps put together. In the bottom right corner, you can just see where the permanently attached wires come out of the base.

A Temporary "Observatory"

The scope worked for two years in Northern New Mexico where we lived, but with a high level of frustration. It never completed a full night of imaging and would often quit after an hour or so. Sometimes, the drive would slip in the middle of a session, especially with multiple targets that would be on opposite sides of the sky. Still, there were

Image 2 - A large trailer hold-down screw and tie-downs secure the assembled CPC 1100 on paving stones, where a high-quality canvas protects it from the worst of the elements. Not the prettiest solution, but surprisingly functional.

enough good images to give a taste of what it could do.

I retired from full-time church ministry and took a position teaching high-school physics in Southern New Mexico. During this time, the scope was stored in the garage. There was not a large enough place in the backyard to assemble it, so given the demands of coaching football and a part time job, the scope just stayed in storage. After nine months, a church called, and I came out of retirement and moved from New Mexico to Missouri. It was finally time to get the scope out of mothballs.

Missouri's climate is not the greatest for astronomy, especially after living in New Mexico for nine years. So how do you set up a scope that weighs 120 pounds assembled without being able to build a permanent facility? Especially with thunderstorms, snow, blizzards, microbursts and even tornadoes from time to time? Since we live in a rental house, a permanent facility is not an option.

After a bit of thought, I cemented a large trailer hold-down screw into the ground, placed paving stones under the legs of the tripod to provide a solid base, and attached the tripod to the screw with heavy wire, turnbuckles and tie downs. I then covered the assembled scope with a high-quality canvas cover (**Image 2**).

At first, I placed the canvas cover over a waterproof plastic tarp, but after the tarp was blown away one morning (I forgot to put the cover back on!), it turns out that the plastic tarp was not needed – the canvas alone provides a very waterproof covering. Bungie cords hold everything tight and have withstood 60-plus mph wind and thunderstorms.

Gear Slippage

But, the scope was still almost impossible to use due to gear slippage. This issue was made worse by the really bad weather we have had since we moved to Missouri. 12 clear nights with five of those near full moon. So, there would be weeks between making an adjustment then trying it out.

To get the telescope to function at all, I had to hang weights all over it, and even then, it would still slip at certain angles. Sometimes, I would get a few good images out of a run, and sometimes I couldn't get any good images. After two months of fooling with slipping and balance issues, I decided that I needed to check the gears. Both worm gears were barely touching the main gear! Any imbalance, breeze or touch would cause the gears to slip, and the alignment was gone.

After wrestling with *Torx* screws in tight places to remove the cover on the fork arm, it took about 30 seconds to adjust the worm gear and the problem was solved. I had assumed that the friend I purchased it from had correctly adjusted the gears when he hyper-tuned

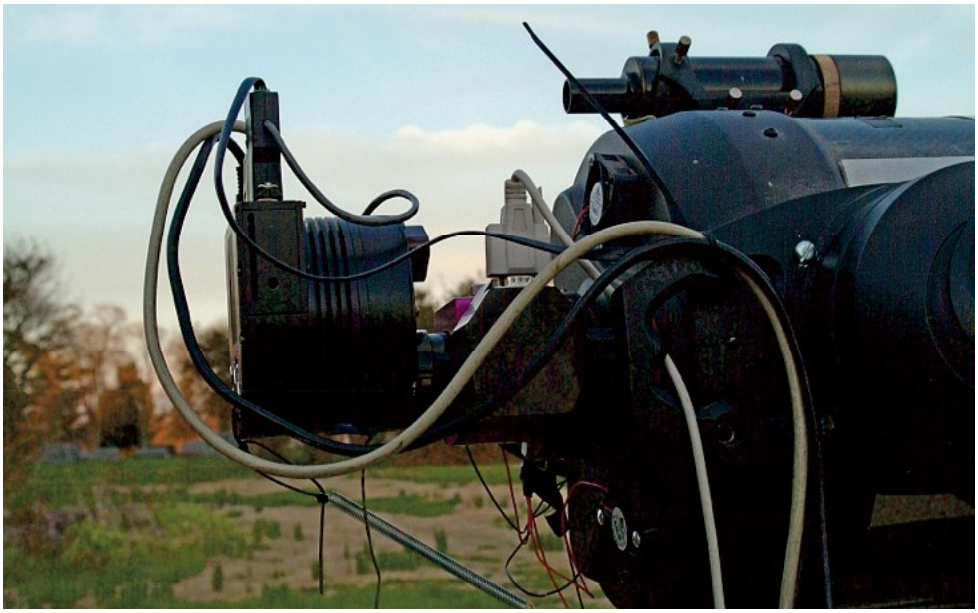

Image 3 - Camera and wire configuration. When the wires simply hung down, they would bind the focuser. By tying them near the pivot point, the problem was solved. The closer you can get the weight of the wires to the pivot point, the less leveraged drag they exert.

Image 4 - Celestron CPC 1100 (or Temple 28) with ST-8E camera, in all its duck-taped glory. The bungie cord and tape hold the filter material covering the vent holes. It looks messy but is now quite functional.

the mount, but we're all subject to error. Lesson learned: Never assume; always check.

Adjustable Equatorial Wedge

With this improvement, it seemed I had all major issues licked. The scope came with a welded equatorial wedge for the latitude of southern New Mexico, around 33 degrees. This could be made to work in our northern-New Mexico location of 36 degrees, but it was top heavy. To adjust the Polar Alignment, I had to physically move the whole scope assembly and adjust the length of the legs. Awkward at best.

Since we had moved to Missouri at 39 degrees latitude in March of 2017, there was some question of whether the mount could be adjusted with the current wedge at all. I knew the Polar Alignment was off but since it wouldn't track had not tried to do anything other than just get it to where I could test the gears. While trying to get the legs adjusted to accommodate the mismatched fixed-latitude wedge, the whole assembly tumbled to the ground. Fortunately, the telescope and I both survived. Still, it became apparent that the welded wedge would not work.

So, I obtained a Celestron HD Pro Wedge. Many reviews of wedges for the larger CPCs were very negative, but when my sample showed up, I was pleasantly surprised with how sturdy it was. It is made of well-machined, heavy, aircraft-style aluminum. As important, it is easy to adjust and holds adjustment well once set. When I added the wedge to the scope last summer, once again, I believed the major issues were finally solved.

Balance is balance, right?

However, regardless of what I did, it still wouldn't track consistently. It

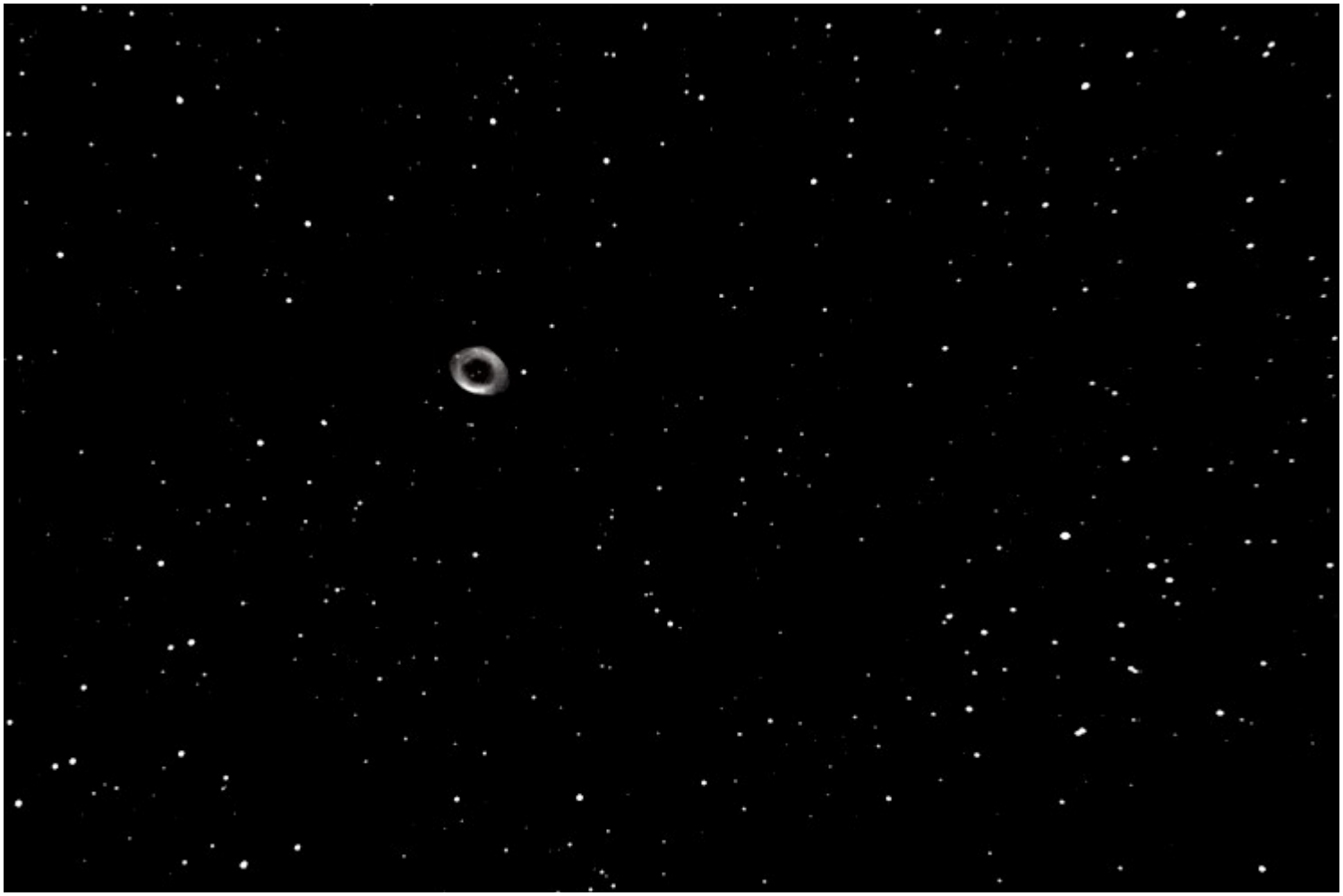

Image 5 - M 57 50 X 60 second image through a Sloan g filter.

would take a few good images then lose tracking and shut down. The auto-guiding would work well for one image then go crazy as the evening went on. It was obviously out of balance. I added weights to top and bottom, moved the weights and took the weights off, put them back and tried everything I could think of.

Then I tried to balance it by removing the SBIG ST-8E that I had acquired a few months earlier and replacing it with the lighter SBIG ST-402 and ST80 autoguider scope. When that didn't work, I added a smaller, homemade auto-guider scope made from a 70-mm binocular objective. Tracking was a little better but still not reliable. So, after serious contemplation on selling the thing, I decided to go back to the ST-8E camera. This would be simpler to balance, since no external guide scope is needed.

Not too long after obtaining the scope, I noticed that many of the CPCs online had a weight sticking out of the bottom of the tube. I made a weight system similar to the expensive off-the-shelf solutions, and … it still wouldn't balance.

To top it all off, the hand controller wouldn't work right when it was cold out. It was almost impossible to get the buttons to work. I took apart the hand controller, cleaned it with Q-tips and alcohol and then shot lock graphite onto the contacts. This fixed most of the problem. When it is cold, I still had to push the buttons hard, but they worked. Since the scope is run remotely with *TheSky 6 Pro* and *CCDCommander*. I don't use the buttons much once it has been aligned.

By this time, I was really getting frustrated. I had run a f/4 Newtonian with an ST-7E camera with no issues. My Meade 8-inch LX200 GPS worked well in tracking and balance regardless of the camera hung on the tube. I also used the ST-8E with an AR102 refractor mounted on the Sirius mount. The

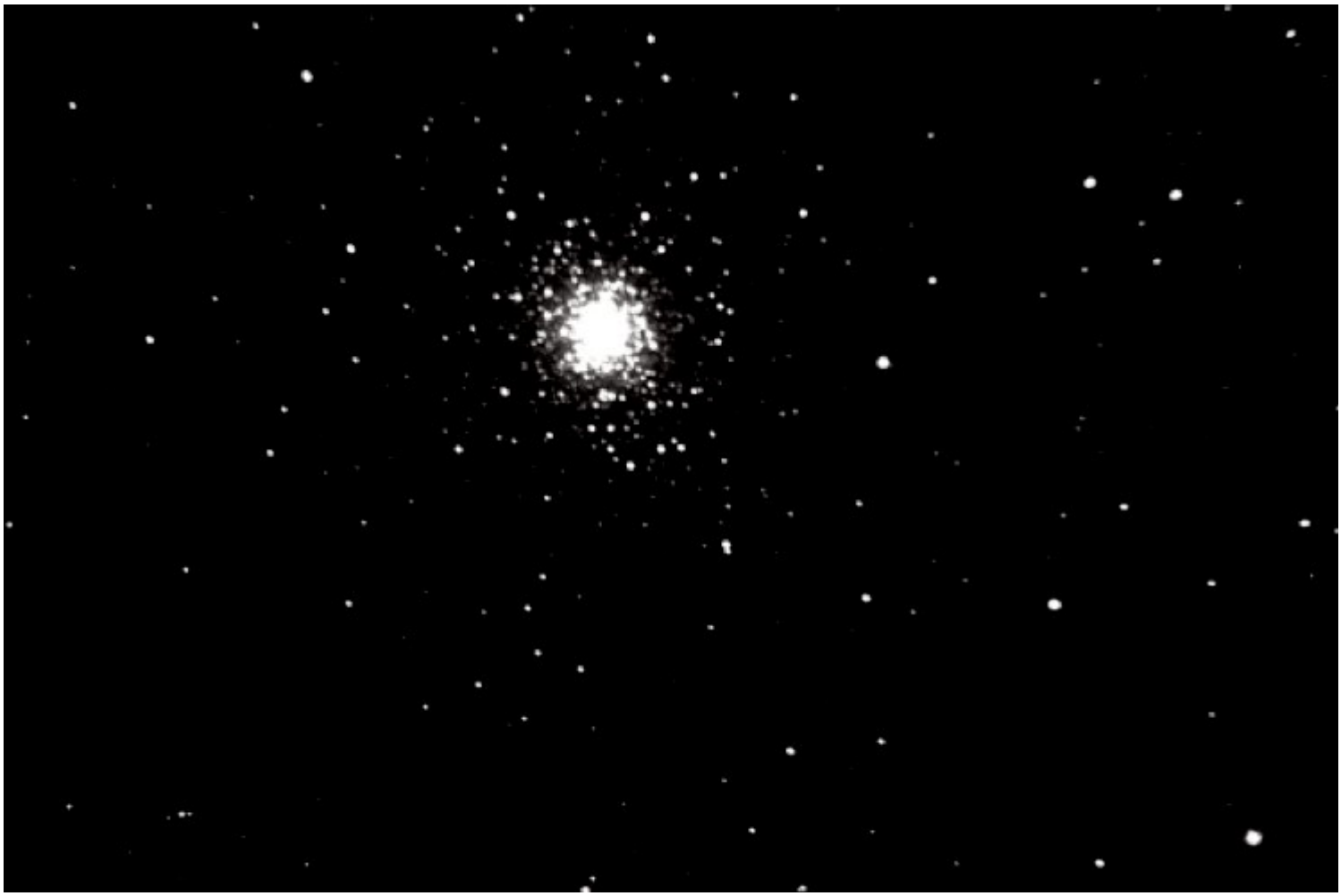

Image 6 - NGC 6341 50 X 60 second image with a clear filter.

kicker was my 6-inch refractor worked great with the ST7E hung on it, even with the long unwieldy tube and heavy camera. I write papers, magazine articles and give astronomy lectures – most would consider me of at least average astro-tech competence. Why couldn't I get this thing to work?

So, I took drastic action: I researched the problem.

When all else fails, read and follow directions!

There was little available for balancing a CPC 1100, so I widened the search out to balancing a fork mount in general. After running across an article on balancing a fork-mount telescope on the Starizona website, I printed it out for in-depth study and … within seconds, my heart dropped to my feet. I had been doing it right but just backwards this whole time! Talk about feeling stupid.

Though I am a true dyslexic, that was not the problem. Intuitively, you would think that you should balance the tube in a horizontal position first. It just seems to be logical. Thus, I had been balancing the telescope horizontally first, then vertically. However, balancing the horizontal first was just enough to make sure it would never balance correctly! Given the guidance from Starizona, I first balanced the assembly vertically, as the tutorial instructed, then balanced it horizontally.

Amazingly, after four years of struggle, the thing was finally balanced, and it took just five minutes. Now I can loosen the clutches and swing it up, down or sideways, and it moves smoothly in complete balance.

Plate Solving and Focus Issues

The two remaining problems were plate solving and auto focus. For whatever reasons, my preferred camera-control program, *CCDSoft*, won't plate solve, autofocus or guide with the ST-8E camera. *CCDSoft* worked fine with the ST-402 and ST-7E but not the ST-8. *Maxim DL 5* runs all these functions

Image 7 - M 109 through high cirrus clouds and a CCD chip that was frosting over. 3 X 120 seconds with a clear filter.

flawlessly on any of the cameras. I still use *CCDSoft* to save time by using the 9x9 bin. This bin really helps in alignment and image acquisition. If you center the align star on the chip using the 9x9 bin mode, it increases accuracy and saves a lot of waiting. The ST-8E is a parallel-port camera and takes 67 seconds in a 1x1 bin to upload an image to the computer, so a 9x9 bin speeds that up to just a second or two. This makes alignment or centering much easier and less time consuming.

In addition to all the other challenges, the auto focus worked as it moved the camera away from the optical tube – down – but not when moving the camera toward the tube, or up. My assumption was that it was a gravity and weight issue, since the ST-8E with the CFW-8 filters combined weigh around 3.5 pounds (1.59 kilograms). The camera did need a light spring added to help pull it against gravity, but it turned out that the main issue was the weight of the cables binding the focuser.

The best configuration of the camera is bottom up (where the cables come out) to be positioned straight up with the cords hanging down from it, but this makes a U-shape with the cables, and the hanging cords lever the focuser down, binding the tube. So, I used an electrical tie and bound the cable to the actual telescope tube near the pivot point on the fork mount, so that the whole telescope tube bears the weight of the cables, not the camera (**Image 3**). Now the focus works like it is supposed to.

Summing Up

After writing the rough draft of this article, I checked the telescope run and noticed that the screen was totally black. Only a few minutes before, it was working well. The camera was running at minus 10 C, and it looked like it had iced up. I changed the temperature to zero C, and most of the image came back. I had baked the desiccant plug for four hours at 350 F just a month before. Surely, it shouldn't have gotten moisture in it that quickly.

When I removed the desiccant plug, I

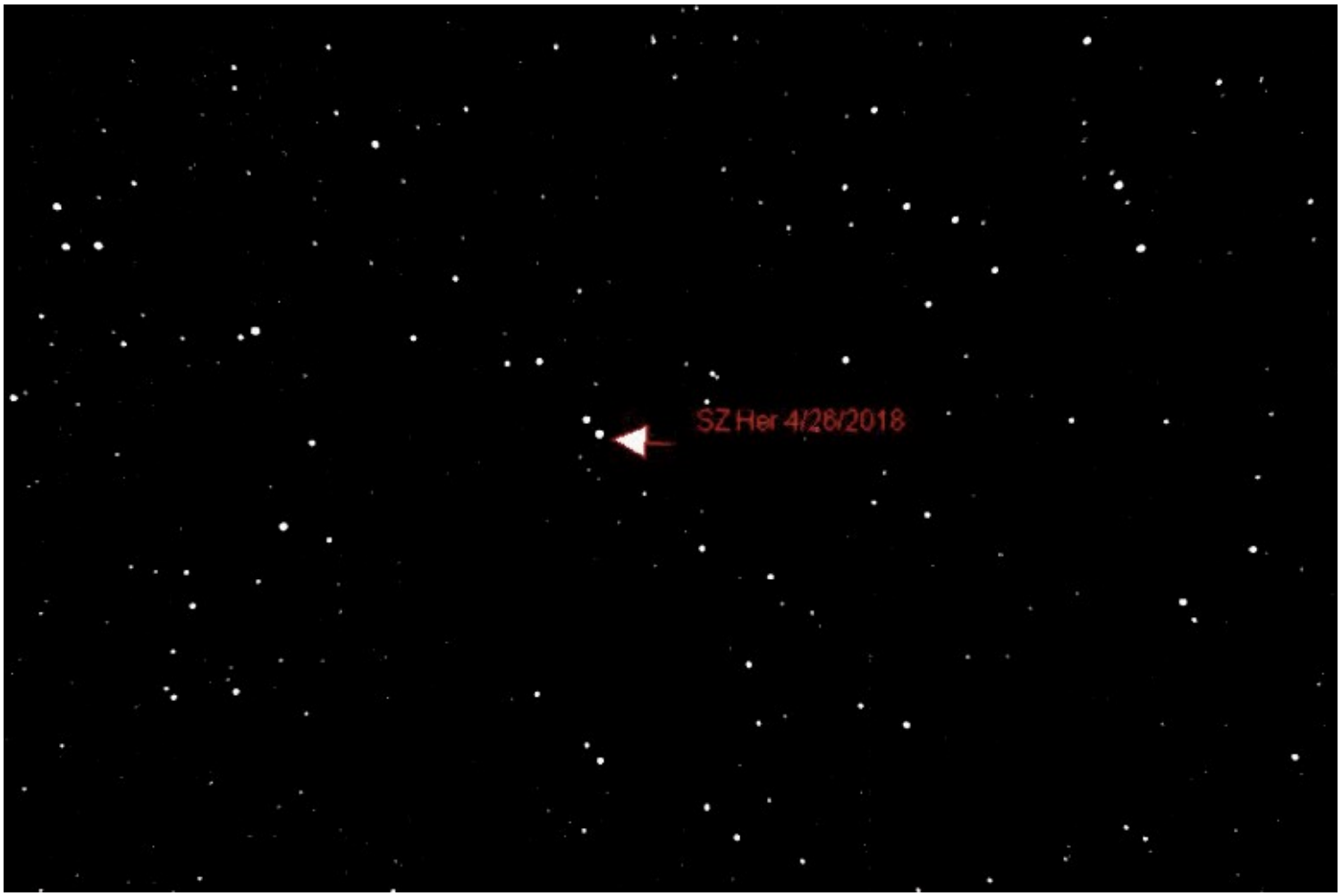

Image 8 - SZ Hercules, a close binary star. This is a typical image for photometry work.

noticed that it was a dummy plug! These come with the old ST series cameras, so you can seal the chamber when baking the functional plug to remove moisture. No wonder it had iced up – there was no desiccant material in the chamber! Fortunately, I have two working STs, plus one that isn't, so had a spare ready. I baked the correct plug out of the non-working camera then re-installed it. Lesson learned: When you think you have everything sorted, think again.

With everything working – for the moment – the CPC is a real joy to use (**Image 4**)! At present, *CCDCommander* controls the scope. A simple 12-point T-Point model in *TheSky 6 Pro* is putting the object almost smack in the middle of the image every time. *Maxim DL 5* plate solves and then centers the object. *TeamViewer 13* allows easy control of the telescope from my computer, tablet or phone. There have been numerous nights when, having checked on the progress of the telescope, I decided to change the target or duration by my cell phone.

The high level of automation has made my life much easier. Being a busy person, the idea of staying up all night every clear night is not attractive nor practical. With the CPC finally set up and adjusted, it is easy to program each night's sessions and then retire to bed. In the morning, I upload the night's images using *TeamViewer 13*.

50 years ago, when I started astronomy, being able to program your telescope then go to bed was just fantasy. Then, it became a reality at professional level telescopes. Now, it is available to anyone at a relatively modest price especially using used components. ATT