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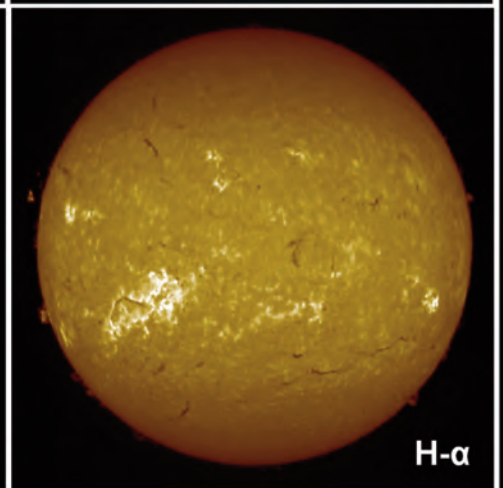
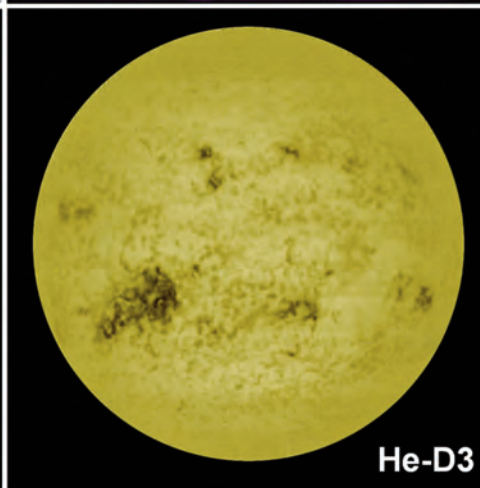
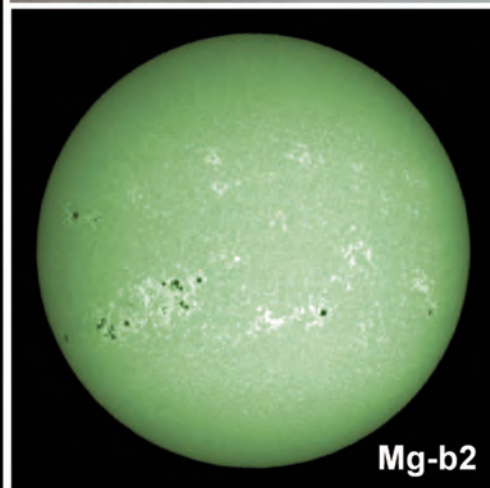
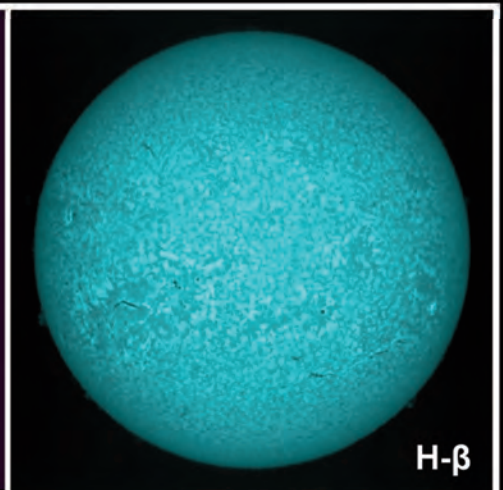
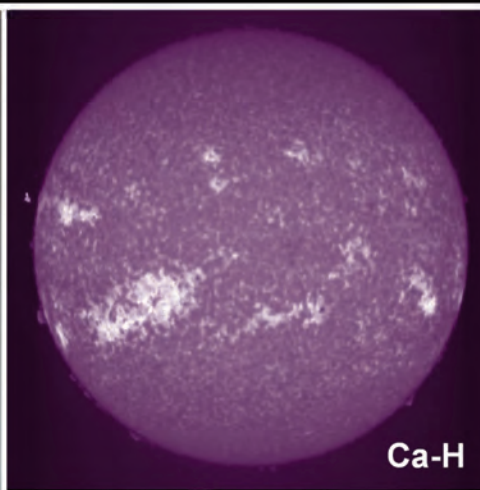
Your Complete Guide to Astronomical Equipment

THE NEW SHG700 SPECTROHELIOGRAPH • SUPER SIZE YOUR SOLAR SETUP

LOOKING BACK AT THE TOTAL SOLAR ECLIPSE OF APRIL 8, 2024

INDUSTRY NEWS • NEW PRODUCTS

THE NEW SHG700 SPECTROHELIOGRAPH



Cover Article - Page 49

It is interesting that we received three articles on solar observing all at around the same time and are glad to share them with you here. The recent introduction of the SHG700 SpectroHelioGraph has been making waves in solar observing and imaging circles and Larry Alvarez was able to get his hands on one of the first models. In his article he shares his thoughts and experiences.



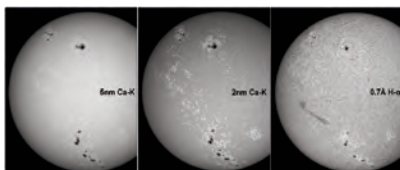
In This Issue

49 THE NEW SHG700 SPECTROHELIOGRAPH

Would I recommend the SHG700— Ab “Sol” utley recommend! What I liked about it: The SHG700 delivers 0.3 angstrom images for a ton of wavelengths. The micrometers are perfect for the purpose and the lenses inside do a great job and deliver sharp images. The price was a real value for what it delivers and what it delivers are images that are not obtainable through any other method at this price point.
by Larry Alvarez

61 SUPER SIZE YOUR SOLAR SETUP

In this article I present a review of the many different products available for solar observing. Many of which can simply be added to your existing observing setup, saving you time and money.
by Jim Thompson



73 LOOKING BACK AT THE TOTAL SOLAR ECLIPSE OF APRIL 8, 2024

I have been chasing solar eclipses for nearly forty years. These are my experiences chasing the solar eclipse of 2024 Great North America Solar Eclipse.
by Dr. James Dire



Sky-Watcher Evoguide 50ED
50mm f4.8 doublet with a
Starizona EvoFF V3 Field
Flattener. Canon 40D camera
1/500 s each @ ISO200
BP-1212 - Silver-Black
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585M Mono Cooled Camera





Larry Alvarez has been an avid solar photographer since 1999 when he built his first telescope. He has a BSEE degree in engineering and lives in Texas. He spends his days imaging the Sun, working on projects, cataloging findings, and looking for better ways to capture the Sun.



Dr. James Dire has a M.S. degree in physics from the University of Central Florida and M.A. and Ph.D. degrees from The Johns Hopkins University, both in planetary science. He has been a professor of chemistry, physics and astronomy and an administrator at several colleges and universities. He has played a key role in several observatory projects including the Powell Observatory in Louisburg, KS, which houses a 30-inch (0.75-m) Newtonian; the Naval Academy observatory with an 8-inch (0.20-m) Alvin Clark refractor; and he built the Coast Guard Academy Astronomical Observatory in Stonington, CT, which houses a 20-inch (0.51-m) Ritchey Chrétien Cassegrain. Dire is a seasoned visual observer and veteran astro-imager.



Stuart Parkerson has been the publisher of Astronomy Technology Today since its inception in 2006. While working primarily in the background of the company's magazine and website business operations, he now has a more active role in contributing content to the magazine. He also is the founding publisher of App Developer Magazine which launched in 2012. He grew the company to become one top software magazines and websites globally and sold his ownership interest in 2016.



Jim Thompson acquired his passion for astronomy growing up under the dark skies of Eastern Ontario (Canada) cottage country. He has over 25 years of experience working as an Aerospace Engineer in the defense industry and enjoys applying that same skill set to his amateur astronomy hobby. Jim is a strong advocate for Electronically Assisted Astronomy (EAA) which he uses frequently from his urban home in Ottawa, Canada. The severe light pollution in his backyard is the primary impetus for him becoming an expert on astronomical filters. You can follow Jim's efforts at his Abby Road Observatory website (<http://karmalimbo.com/aro/>) where he documents his journey with amateur astronomy.

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A LOOK BACK AT THE TOTAL SOLAR ECLIPSE OF APRIL 8, 2024

By Dr. James R. Dire

The solar eclipse of Monday, April 8, 2024 will forever be known as the Great North America Solar Eclipse. The shadow of the Moon entered North America (**Image 1**) on the Pacific Coast of Mexico near Mazatlán at 18:07 UT1/GMT (10:07 am Pacific Time). Twenty minutes later (12:27 pm CDT), the shadow crossed the Rio Grande into the US centered a few miles north of Eagle Pass, Texas. The centerline of the eclipse passed through ten US States (Texas, Oklahoma, Arkansas, Missouri, Illinois, Indiana, Ohio, Pennsylvania, New York and Vermont) before entering southeastern Quebec, Canada.

The centerline then returned into the US in Maine before crossing into New Brunswick and then Newfoundland, Canada. It should be noted that the centerline did not pass over land in Pennsylvania, but over Pennsylvania waters in Lake Erie. Besides the ten US States listed earlier, the umbral shadow did cover parts of four other US States – Tennessee, Kentucky, Michigan and New Hampshire – and three other Canadian Provinces – On-

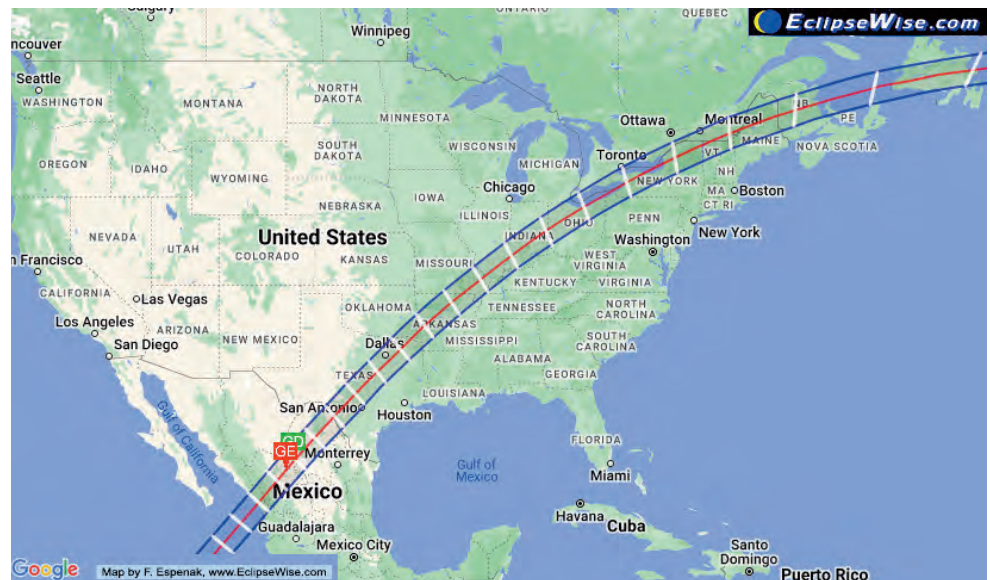


Image 1 – Path of the April 8, 2024 Total Solar Eclipse courtesy of Mr. Eclipse, Fred Espenak (www.EclipseWise.com).

tario, Prince Edward Island and Nova Scotia.

I have been chasing solar eclipses for nearly forty years. For most eclipses, the Moon's shadow spends more time over water than over land, limiting land options for viewing the eclipse. For those rare eclipses that cover a lot of land, where to head depends on several factors such as location of maximum totality, best prospects for clear skies, easiest access

to the eclipse path, and local lodging, transportation, food and water availability.

The 2024 solar eclipse was the second in seven years to grace a path across much of the US. This made logistics for both eclipses readily available. In 2024, my goal was to drive to a location with the best weather prospects. Driving my personal vehicle allowed me to transport the most equipment possible for studying the

A LOOK BACK AT THE TOTAL SOLAR ECLIPSE OF APRIL 8, 2024

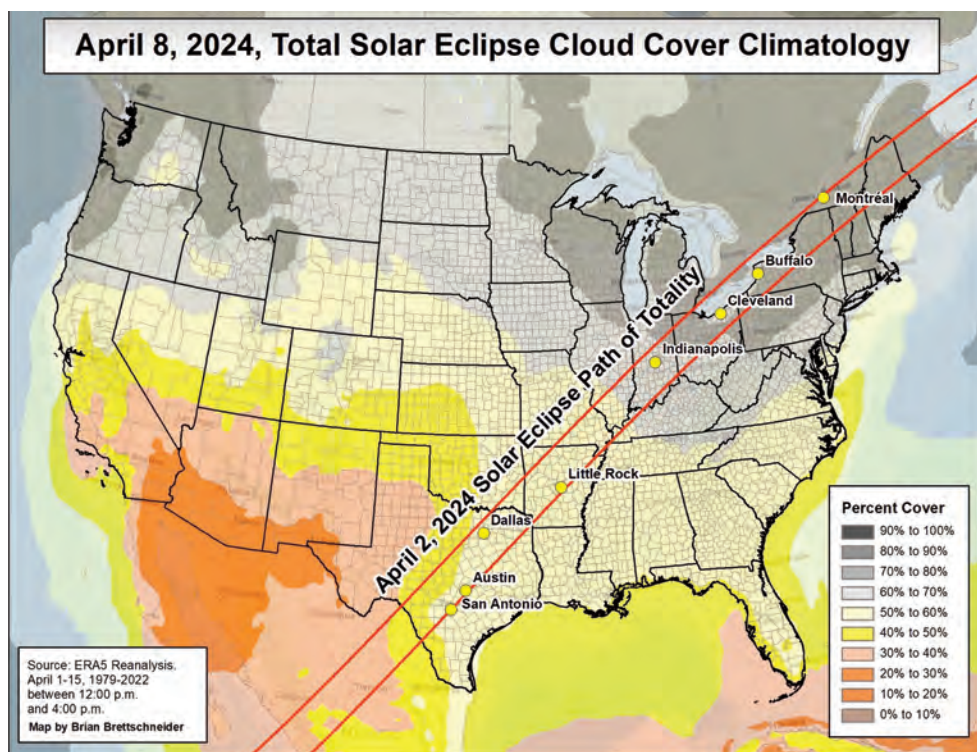


Image 2 – Cloud cover statistics for early April courtesy of Brian Brettschneider, NOAA. (The eclipse date over Texas should have read April 8 not April 2).

eclipse. This is in contrast to when I travelled to Africa, South America, Europe and Asia for other solar eclipses. When travelling alone, I brought minimal equipment. When traveling with a small research team, it was possible to bring more equipment than one person could carry.

Image 2 shows the cloud statistics for this solar eclipse. The highest probability of clear skies was in Mexico and southwest to central Texas. Since I live in Texas, my plans were to drive 140 miles west to Burnet County where my brother has a ranch near the centerline. Burnet and Llano Counties in Texas had the highest probability of clear skies in the US. Because of a geologic feature called the Llano Uplift, these counties typically had dryer air in April than the lower el-

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evations in the Rio Grande Valley near Eagle Pass.

The prospect of clear skies diminished along the eclipse path heading northeast across the US and into Canada. Ten days prior to the eclipse the weather forecast for Texas was not looking good. It actually wasn't looking good anywhere along the path except for the region from New York to the Canadian Maritimes. Five days out, the forecast pushed the prediction of clear skies eastward across New York State. Texas was still looking bad with thick clouds, overcast and thunderstorms predicted for much of the eclipse path. However, an area of mostly clear skies was now predicted for a region from northern Arkansas to southern Illinois.

On Saturday morning, April 6, I came to the conclusion that Texas was going to have too many clouds to deal with. Holding advanced degrees in astronomy and meteorology, I predicted that it would be clear at the time of the eclipse where the centerline crossed from Arkansas into Missouri. On April 5, a friend from southern Louisiana found a condo for rent in Cherokee



Image 3 – My vehicle was packed with all the gear for my road trip to find a clear spot along the path of totality.

Village, Arkansas. Cherokee Village is in Sharp County (population 18,000), which borders Oregon County, Missouri. He invited me to join him and

his wife there for the eclipse weekend. So, Saturday morning, I loaded all of my gear into my Subaru (**Image 3**) and hit the road to northern Arkansas.

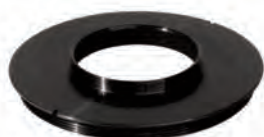
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Image 4 – I ended up in the sparsely populated Sharp County, Arkansas for this eclipse.

All in all, I took two telescopes, three cameras, two telescope mounts and a camera tripod. I also loaded up enough food and water to last three days as well as some camping equipment in case the forecast changed on Sunday and I had to move again (it didn't and I didn't, but it's best to be prepared!)

I expected a lot of people would be heading towards the clear areas. Although, I suspected most would wait until Sunday or early Monday morning to depart. By leaving on Saturday, I experienced no heavy traffic or delays along I-30 and US67 in Texas and Arkansas. All along I-30 between Texarkana and Little Rock there were signs saying "Solar Eclipse Monday, Expect Traffic Delays. Arrive Early, Leave Late."

While they were celebrating having a solar eclipse in Sharp County (**Image 4**) and there was an eclipse festival in Cherokee Village April 6-8, I did not notice the presence of many eclipse chasers in that remote Arkansas region. I was thankful for the lack of traffic heading in and out of the county.

Image 5 shows the cloud cover over most of North America mid-morning on April 8. Clouds paralleled most of the eclipse path through much of North America. Between this time and first contact, the clouds moved south and thinned out for the eclipse path through much of Arkansas, Missouri, Illinois, Indiana and Ohio. The small

A LOOK BACK AT THE TOTAL SOLAR ECLIPSE OF APRIL 8, 2024

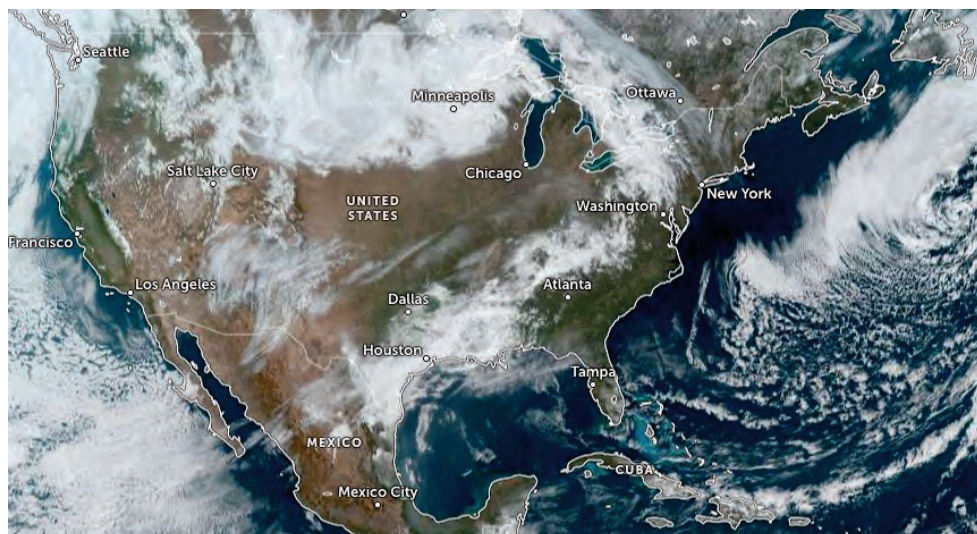


Image 5 – Weather satellite imagery courtesy of NOAA the morning of the eclipse around 10:00 am CDT.



Image 6 – Thin clouds blanketed the sky over Cherokee Village at 10:00 am the morning of the eclipse.

clearing to the right of the word Dallas expanded a little and moved slightly south, too, by first contact. **Image 6** was taken at 10:00 am at my location in Cherokee Village. But by noon most of the clouds were gone and the sky was predominantly clear (**Image 7**).

Thin clouds hampered the eclipse viewing along the coast of Mexico. But

all who travelled there were still able to see the entire total eclipse in all its splendor. There were fewer clouds in the path of totality north of Durango, Mexico allowing the multitude of international travelers there to enjoy nearly four and a half minutes of totality.

Texas was not so lucky between the Rio Grande River and Waco. The skies

were more than 90% overcast. Members of the Brazos Valley Astronomy Club traveled to Concan, Texas west of San Antonio. They saw portions of the eclipse through breaks in the clouds. Farther north in Burnet and Llano counties my brother reported seeing the eclipse through breaks on the clouds for about ten seconds every few minutes. That allowed him to see parts of the partial phases between first and second contact and third and fourth contact. He only saw about 20 seconds of totality including third contact through breaks in the clouds. The cities of Burnet and Lampasas expected thousands of visitors for the eclipse. The cloud forecast kept most of them away.

The eclipse path from Waco to Texarkana had thinner clouds, so many saw most of the eclipse either through the thin clouds or between them. The weather cooperated much better from Russellville, Arkansas to Cleveland, Ohio despite having higher statistical cloud cover. East of Cleveland through Watertown, New York was plagued by clouds. However, clear skies were reported in Northern Vermont and Quebec along the path of totality, as well as on Prince Edward Island!

During the 2017 total solar eclipse, I traveled to my hometown, St. Joseph, Missouri, which was on the centerline. Similar poor weather forecasts materialized a few days before that eclipse. Therefore, I departed St. Joseph at 6:00 am the morning of the eclipse and drove 250 miles to find a clear spot and was able to see the entire eclipse cloud free. The same occurred in April 2024, but this time I travelled 550 miles to a clear region. My location for

A LOOK BACK AT THE TOTAL SOLAR ECLIPSE OF APRIL 8, 2024



Image 7 – By noon, most of the clouds had dissipated! It was clear though fourth contact.

both eclipses is plotted in **Image 8**. I was amused by the fact that for both eclipses, I was on the same meridian.

The morning of the 2024 eclipse was a brisk 45°F at sunrise. The temperature was 53°F when I began setting up my equipment. By 10:00 am it had

warmed up to 78°. I set up my equipment on grass adjacent to the north side of the parking lot in front of the condo building (**Image 9**). I photographed the eclipse with a Stellarvue 70mm f/6 triplet refractor on a Celestron CGEM II mount using a Canon 600D camera. The second instrument

I used was a Sky-Watcher Evoguide 50mm f/4.8 doublet refractor with a Starizona EvoFF V3 field flattener and a Canon 40D camera.

The contact times for my location are shown in **Image 10**. The local time was 5 hours earlier than the times in the chart. So, first contact occurred at 12:37 pm. I took a few images through both telescopes as soon as I observed first contact. Then throughout the partial phases, I captured an image every five minutes. I did the same in reverse during the partial phases after totality. **Image 11** shows a sample of the partial phases taken with the smaller telescope.

During totality, I only shot through the larger telescope. I bracketed 20 images with exposures from 0.004 s to 0.08s at ISO200. Then I spent approximately 4 minutes of totality observing the sky visually searching for planets and stars, gazing at the 360 red horizon, and examining the corona, chromosphere and prominences through binoculars. I spent less

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Image 8 – Eclipse paths for both Great American Solar Eclipses. The red dots indicate where Dr. Dire observed both eclipses, coincidentally on the same meridian!



Image 9 – The author set up his telescopes and camera on the north side of a condo parking lot to have a clear view of the Sun to the south.

time collecting data and more time actually watching the eclipse than during any other total solar eclipse I have witnessed.

Image 12 is a montage of the entire eclipse with first contact in the upper left corner and fourth contact on the lower right corner. In each image, north is up and east is to the left. Throughout the sequence, the Moon is moving from lower right to upper left, which corresponds to the path or totality moving from southwest to northeast across North America! The middle row contains three images taken during the total eclipse. The one on the left was taken seconds after second contact. The one in the middle was taken mid-eclipse, and the one on the right was taken seconds before third contact.

Examining the leftmost picture in the middle row of Image 12 shows that at the beginning of totality, several prominences were visible on the north limb of the Sun. Several others were visible at the three o'clock, five o'clock and nine o'clock positions. The prominence at the five o'clock position was visually the brightest one and the brightest I have seen during any eclipse.

The Moon quickly covered up the prominences on the north and east sides of the Sun but uncovered more of the much larger prominences on the west and south sides. These were absolutely fantastic to view through binoculars. As can be seen on the rightmost image in the middle row of Image 12, the bright prominence and five o'clock was a monster while the one at 3 o'clock appears to be detached.

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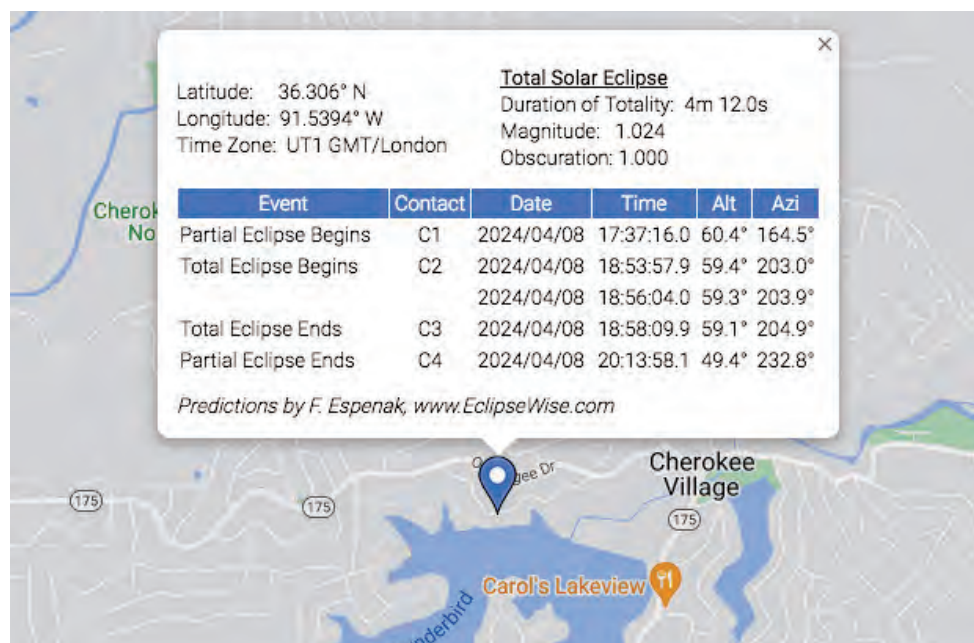


Image 10 – Eclipse parameters for Cherokee Village, Arkansas courtesy of Mr. Eclipse, Fred Espenak (www.EclipseWise.com)

I decided to watch second contact rather than take pictures of the diamond ring and Bailey's Beads. I

watched Bailey's Beads through the filtered 9x50 finderscope and then took the filters off the telescope. However,

at third contact I was behind the camera again. **Image 13** shows Bailey's Beads, the chromosphere uncovered (albeit over exposed) and more detail in the larger prominences.

During previous solar eclipses when I had research students with me, we would conduct temperature studies, and measure changes in scattered light, temperature, barometric pressure and atmospheric carbon dioxide during the eclipse. All of the instruments were recording data every minute. For this eclipse, I did not have any research help, so I decided to keep it simple. For a temperature study, I brought the digital clock out of my bathroom, which has a built-in thermometer. Starting before first contact, I took a photo of the device giving me a temperature and the time it was recorded. I took similar readings approximately

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Image 11 – Partial phases taken through a 50mm refractor with a 240mm focal length.

every five minutes until after fourth contact.

During previous solar eclipses, I used four or five temperature recorders. I would place one or more in direct

sunlight at different heights above the ground, one suspended above the ground in shade, one on the ground, and once even submerged one in a shallow stream. All devices recorded a

temperature drop during the eclipse. The magnitude of the temperature drop for the same eclipse varied significantly depending on where the thermometer was placed.

A temperature device suspended well above the ground, away from structures, but in the shade, did the best at measuring the actual air temperature during an eclipse. The temperature change was always greatest for a device in direct sunlight well above the ground. It could be argued this device was more representative of what the temperature change feels like to a person. When the Sun is shining on our skin, it always feels warmer than the actual air temperature. So as the Moon covers the Sun, we perceive that the temperature has dropped more than the actual air temperature.

For this eclipse I place my sole thermometer above the ground, in the shade away from any building. A plot of my temperature data appears in **Image 14**. Between 10:00 a.m. and second contact the temperature pretty much fluctuated between 76° and 79°F. At first contact the temperature was 77 degrees. After first contact, less sunlight was reaching the planet. However, the temperature did not drop because the afternoon heat was kicking in. The lower amount of sunlight was just countering the afternoon heating. To the skin it did feel cooler as less sunlight was hitting us. But the thermometer told us it really wasn't getting colder.

Right before second contact the temperature was 78°F. However, during totality (represented by the horizontal red bar on the graph) the

temperature started dropping and it continued dropping for another 40 minutes. The minimum temperature was 71°F. So overall from first contact the temperature dropped a total of 7°F. It is not uncommon for the minimum temperature to occur well after third contact. By 40 minutes after third contact, the ever-increasing amount of sunlight and afternoon heating caused the temperature to rise rapidly. By fourth contact the temperature had risen to 84°.

I started packing up my gear after 4th contact. By 4:30 pm, I was on the road back to Texas. It was now 88°F according to my car thermometer, a warm day for early April. I experienced no traffic all the way from Cherokee Village to Little Rock where I picked up I-30. To my surprise, I encountered no traffic delays along I-30 from Little Rock to Texarkana. However, severe thunderstorms were everywhere with torrential rain all the way. I decided to stopover in Texarkana for the night. Apparently so did everyone else. While I had no trouble find a hotel room Saturday night in Texarkana on the drive into Arkansas, it appeared everyone else departing Arkansas also decided to wait out the rain in a hotel. It took me an hour to find a hotel with a vacancy.

I departed Texarkana at 6:00 am Tuesday morning. The heavy rain and thunderstorms continued all the way south to my home in Bryan. I made it to work before noon. I didn't mind driving home in the heavy rain. I was still extremely happy that I found a clear spot along the path of totality to view yet another total solar eclipse! ☀

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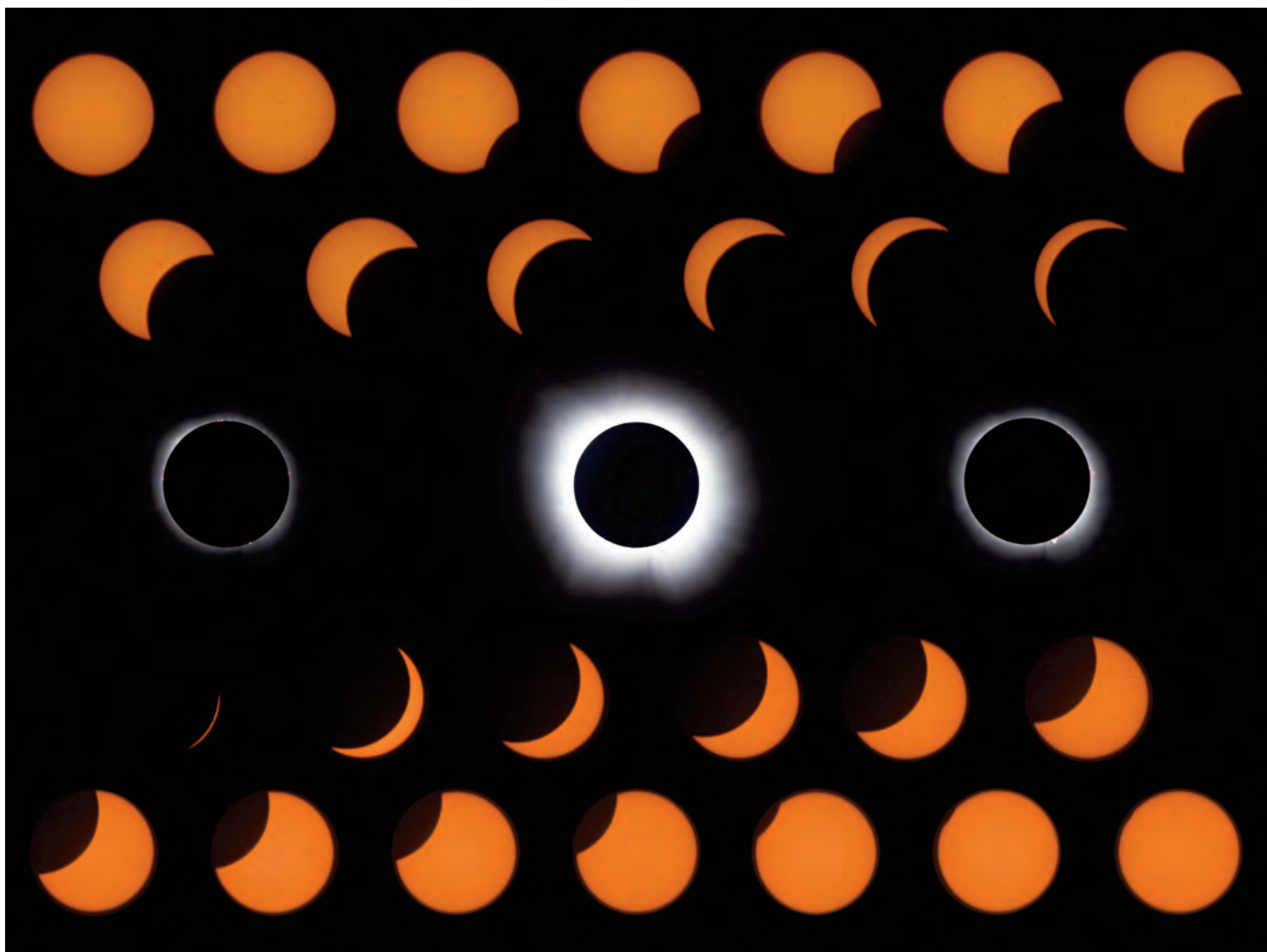


Image 12 – Montage of the entire eclipse taken through a 70mm f/6 apochromatic refractor.

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Image 13 – Bailey's Beads and prominences at third contact.

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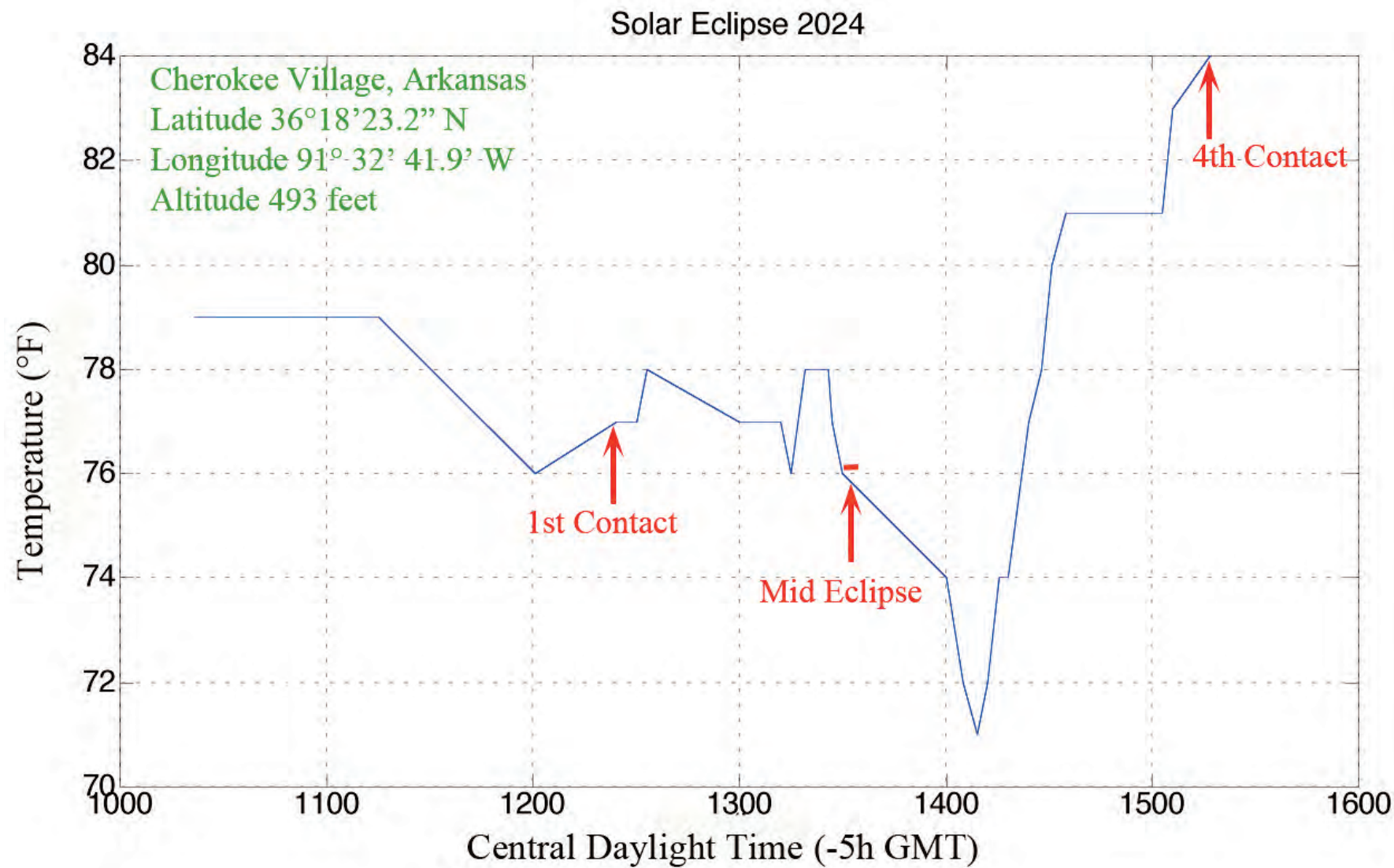


Image 14 – Temperature data taken roughly every 5 minutes during the eclipse.



Image 15 – A stack of nine images of various exposures shot during totality showing the structure in the corona. The images were stacked on the prominences, not the Moon.