

ANNULAR SOLAR ECLIPSE

OCTOBER 14, 2023

TOTAL SOLAR ECLIPSE

APRIL 8, 2024

Dave Lynch – Des Moines Astronomical Society

# ANNULAR SOLAR ECLIPSE

OREGON

CALIFORNIA

UTAH

COLORADO

NEW MEXICO

TEXAS

## ANNULAR SOLAR ECLIPSE

On Saturday, October 14, 2023, an Annular Eclipse of the Sun will begin a short journey across parts of the western United States. From first contact, when the body of the moon passes in front of the disk of the sun, this annular eclipse will last for only 1 hour and 40 minutes.

### SUNS PATH - UNITED STATES

**OREGON.** All of those living in Coos Bay will be the first in the United States to see this eclipse. Maximum totality here in this coastal city will be 4 minutes and 13 seconds. After passing Coos Bay, the sun's path takes it over mostly unpopulated and heavily forested areas of the state.

**CALIFORNIA-UTAH.** The eclipsed sun will just brush the northern tip of California and the same will happen in Utah.

**COLORADO.** Once the sun's path takes it over southwestern Colorado weather more than location will have a major role in observing this annular eclipse. Colorado, especially by mid-October, may be experiencing unstable weather conditions ranging from cloudy skies to occasional snow showers.

**NEW MEXICO.** Weather permitting, the lucky ones are those living in Albuquerque where the eclipsed sun will pass directly overhead. Maximum totality here has increased to 4 minutes and 50 seconds. Still tracking south, the eclipsed sun will pass over another city with a colorful history. Roswell, New Mexico, considered home base for many UFO and Alien enthusiasts. Here totality has almost reached its peak of a full 5 minutes.

**TEXAS.** For anyone wishing to see or photograph this annular eclipse, Texas should be considered the place with the best chances considering both weather and locations. The eclipsed sun enters Texas between the northern cities of Midland and Odessa and continues on a southern track almost splitting the state in half. The eclipsed sun finally exits Texas after passing directly over the city of Corpus Christi. Here totality will have reached its peak of 5 minutes and 2 seconds.

## CENTRAL - SOUTH AMERICA

After passing over the western parts of the United States, the eclipsed sun crosses southern Mexico and then over parts of Central America. From here it crosses a short section of water and then across northern South America. This annular eclipse of the sun will finally come to an end over the waters of the southern Atlantic Ocean.

## OCTOBER WEATHER "PREDICTIONS" United States Weather Service

Weather will always play a critical role with every eclipse. Especially one this late in the year. Different weather conditions may or will spring up in every state along the sun's path. For this event, weather more than observing location will have an important role in determining the best location from which to observe this annular eclipse.

**OREGON.** Coastal Oregon can be stormy with high winds and rain in mid October. On average, central Oregon will have only a 50% chance of clear sky conditions. You can expect low temperatures throughout the state in October.

**CALIFORNIA-UTAH.** The eclipsed sun doesn't touch enough of either of these two states to be even considered for observing locations.

**COLORADO.** Once the sun's path takes it over Colorado anything as far as weather is concerned must be taken into account. The entire state, especially at the higher elevations, on average, usually have snow on the ground by the end of September. Expect cloudy conditions throughout the entire state by mid-October.

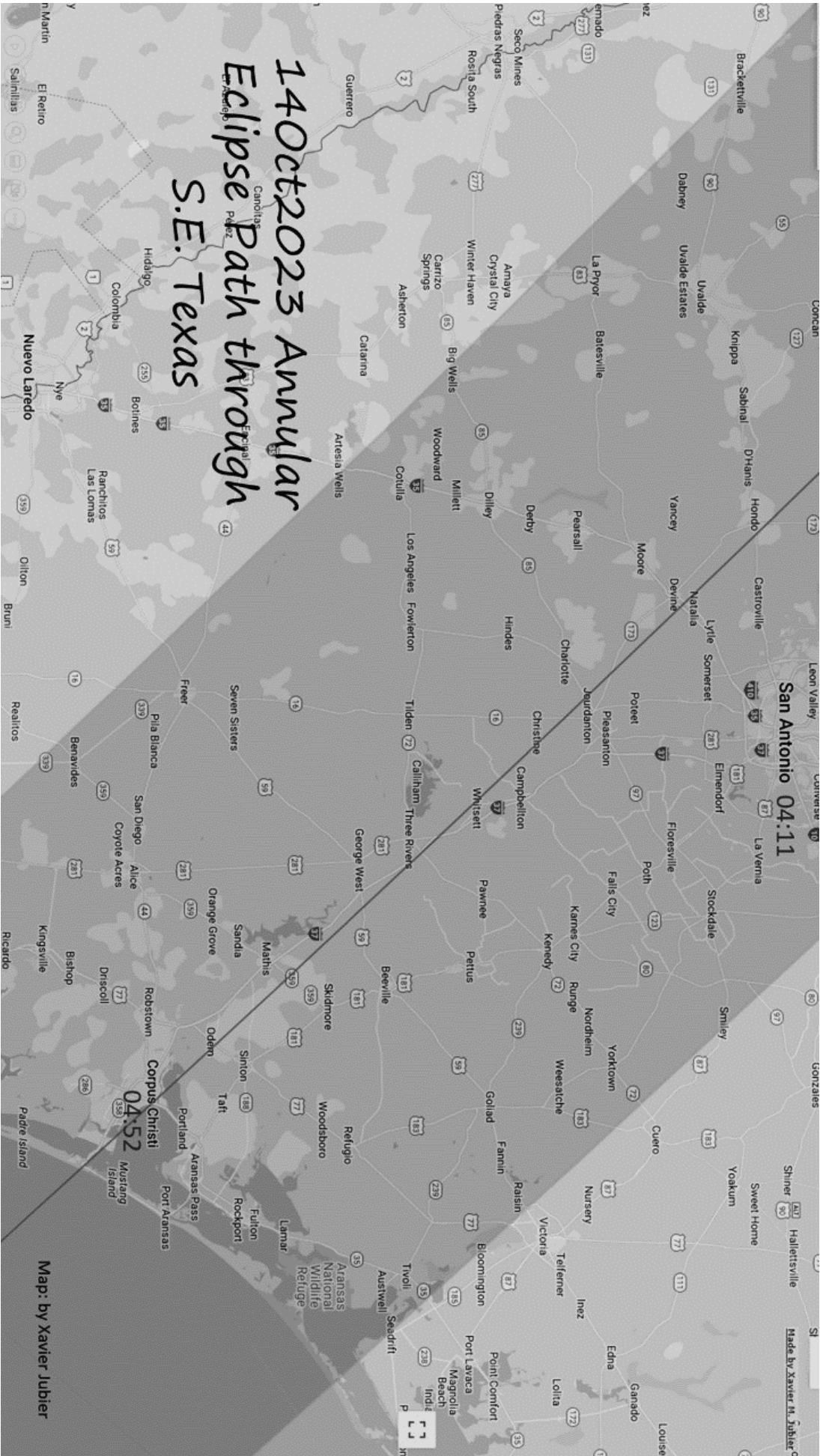
**NEW MEXICO.** New Mexico, especially in northern parts, can expect a mixed bag of weather any time after September. Central to southern New Mexico should be enjoying nice fall weather at this time of the year. It rarely snows or even rains in this part of the state at this time of the year. Clear and cloudless skies are normal for mid-October.

**TEXAS.** Of all the states within the United States this annular solar eclipse will pass over, Texas, due to its size and seasonable October weather, should offer the best choice of location for observing this eclipse. In northern Texas, on average, only seven days out of the month have some form of cloudy conditions. Further south in central to southern Texas, cloudy conditions drop dramatically to just two days out of the month. Closer to the Gulf region, expect higher temperatures along with higher levels of humidity.

# CENTERLINE

## TEXAS CITIES AND TOWNS

	Partial Eclipse Begins	Annular Eclipse Begins	Annular Eclipse Ends	Time of Annularity	Percent
Andrews	11:17:53	12:42:19	12:47:19	4m 55s	89.91%
Gardendale	11:18:07	12:42:53	12:47:17	4m 53s	89.82%
Odessa	11:18:18	12:43:13	12:48:02	4m 49s	89.83%
Midland	11:18:56	12:44:10	12:49:17	4m 56s	89.85%
Midkiff	11:18:56	12:44:10	12:49:17	4m 56s	89.85%
Stiles	11:19:18	12:44:10	12:49:43	4m 56s	89.85%
Bamhart	11:19:53	12:45:40	12:50:37	4m 55s	89.89%
Eldorado	11:20:35	12:46:48	12:51:44	4m 55s	89.91%
Sonora	11:20:35	12:47:04	12:52:01	4m 55s	89.92%
Vanderpool	11:22:29	12:49:46	12:54:46	4m 59s	89.92%
Hondo	11:23:13	12:50:54	12:55:54	5m 00s	89.98%
Jourdanton	11:24:11	12:52:22	12:57:23	5m 01s	90.03%
Christine	11:24:11	12:52:39	12:57:39	5m 01s	90.03%
Three Rivers	11:25:01	12:53:37	12:58:38	5m 01s	90.06%
Mathis	11:25:43	12:53:37	12:59:41	5m 00s	90.08%
Corpus Christi	11:26:27	12:55:47	1:00:49	5m 02s	90.10%
Flour Bluff	11:26:41	12:56:08	1:01:10	5m 02s	90.11%



14 Oct 2023 Annular  
Eclipse Path through  
S.E. Texas

San Antonio 04:11

Corpus Christi 04:52

Map: by Xavier Jubier

Made by Xavier M. Jubier

# TOTAL SOLAR ECLIPSE

APRIL 8, 2024

TEXAS

ARKANSAS

MISSOURI

ILLINOIS

OHIO

NEW YORK

CANADA

MARITIME PROVINCES



*Pictures do not convey the experience of totality. Nothing you read, see, or hear can prepare you for the spine-tingling, goose bump inducing experience of a total solar eclipse. The eerie twilight that confuses birds and other animals, and at times humans, is like no other experience you have had. It is impossible to be a passive observer. You do not see a total eclipse - you experience it.*

*Dr. Kate Russo*

## ECLIPSE HISTORY

### SAROS CYCLE 139

The Total Solar Eclipse in 2024 is associated with the Saros Cycle 139 Solar Activity Pattern. This series dates back hundreds of years and usually, but not always, produces an eclipse every 18 years and 11 months. Altogether, astronomers estimate there will be seventy eclipses attributed to this series. The eclipse in 2024 will be number 31 of this series.

The Saros Series 139 began in May of 1501. Of all the eclipses linked to this series, it is estimated that only 16 of them will be partial eclipses. 13 will result in hybrid eclipses and a total of 43 will make it all the way to a total eclipse. One outstanding feature of this series is time of totality. This series, most of the time, produces eclipses where totality has lasted for more than four minutes. This series holds the record of producing the longest periods of totality since record keeping began around 2000 B.C.

From August 1627, through December 1825, this series produced only hybrid eclipses. Then suddenly it began producing only total eclipses and will continue to do so well into the 22nd century. After that, astronomers predict this series will slip back into producing only hybrid eclipses once again.

One particular eclipse from this series, on June 13th, 2132, will produce a total eclipse where totality will last longer than 7 minutes, earning it the longest total eclipse ever recorded. That eclipse will erase the record of 6 minutes and 55 seconds set on July 11th, 1991, in Baja, Mexico.

# TOTAL SOLAR ECLIPSE PATH

## NORTH AMERICA

A Total Eclipse of the Sun will be visible across parts of North America on Monday, April 8, 2024. This eclipse will plunge the sun into darkness for a period lasting 4 minutes and 28 seconds. The shadow from this eclipse is predicted to be the widest in modern times stretching out over 100 miles in width while passing over three countries. Even for all of those living outside the shadow's path, a partial eclipse will be visible over almost all of North America. The path of the sun will take it over Mexico, nine states within the United States, two provinces of Canada and the Maritime Provinces of Canada.

**PACIFIC OCEAN.** This total eclipse will begin around dawn just south of the Starbuck Islands in the South Pacific's Line Island Chain. Even this early, the width of the shadow will have reached over 90 miles wide and totality is already at 2 minutes.

**MEXICO.** After crossing the Pacific Ocean, the sun's path will take it just south of the Islands of Isla Revillagigedo and Isla Socorro off the west coast of Mexico. It first touches mainland Mexico just south of Mazatlan in the state of Sinaloa. By now the shadow has grown to 123 miles wide and totality has increased to 4 minutes and 28 seconds. From Sinaloa the eclipsed sun then moves over the state of Durango with totality still at its peak of 4 minutes and 28 seconds. Still tracking east-northeast, the sun then moves over the state of Coahuila. All of those living here will enjoy this eclipse at its fullest. From Coahuila, the sun then departs Mexico at Piedras Negras and enters the United States.

UNITED STATES. After crossing Mexico the eclipsed sun enters the United States at Eagle Pass, Texas. Totality is at 4 minutes and 27 seconds. The sun's path takes it across Texas just south of Ft. Worth where totality has dipped slightly to 4 minutes and 20 seconds. Exiting Texas the sun will just brush Oklahoma and move over Arkansas. In Arkansas, the sun's path takes it directly over Lake Nimrod where in 2045 another total eclipse will pass over. The eclipsed sun will just miss Little Rock to the north and move into Missouri. St. Louis is unlucky once again as the shadow will just miss it and pass over Carbondale where in 2017 another total eclipse graced this city. Here totality had dropped to just 4 minutes and 9 seconds. In Illinois the eclipsed sun manages to miss most of the major cities before moving on to Indiana. Indianapolis, just off the centerline, will see this eclipse at its fullest. From Indiana the sun moves over Ohio where two large cities, Columbus to the south and Cleveland to the north, are next to see this eclipse. After passing Cleveland, the eclipsed sun moves out over Lake Erie and parallels the lake all the way to Rochester and Buffalo, New York. Totality has rapidly dropped to just 3 minutes and 45 seconds. The width of the shadow has also decreased to just 111 miles wide. After the eclipsed sun grazes Buffalo, the sun's path takes it just north of Niagara Falls. From there it just brushes Vermont and enters Canada in the Province of Ontario.

CANADA-UNITED STATES-CANADA. Once the sun's path takes it into Canada, the eclipsed sun will pass directly over Hamilton before briefly dipping back into the United States in far northern Maine.

Re-entering Canada, this time in the Province of Quebec, the eclipsed sun will pass directly over Montreal where totality is a respectful 3 minutes and 27 seconds. From Quebec, the sun's path takes it northeast to the Maritime Provinces of Canada. The first to see this eclipse is New Brunswick where the sun will pass directly over Prince Edward Island. Then over Magdalen Island and on to Newfoundland. After passing over Newfoundland, the sun still eclipsed, moves out over the open waters of the North Atlantic where all stages of this eclipse will finally come to an end 1,426 miles from land.

## ECLIPSE DAY

I have no doubt that the total eclipse coming in 2024 will generate as much or more excitement as the last total eclipse to cross this country back in 2017. Although this eclipse will not cover as much ground as the last one, it still will cross a large portion of the western and central parts of the United States. The tremendous interest in the 2017 total eclipse and the crowded observing sites and ensuing traffic jams I feel will be repeated once again. My best advice to anyone wanting to see and photograph this eclipse is **plan early and plan often.**

## WEATHER "PREDICTIONS" - UNITED STATES

### United States Weather Service

The weather for this eclipse will be much more difficult to predict when compared with the previous eclipse in 2017. April weather, especially in the central United States, based on average past years, can and will be every type of weather Mother Nature can dream up.

For all those living east of the Mississippi River, from Ohio and all the way to the eastern seaboard, on average for early April, there is a 60 to 70 percent chance of some form of cloudy conditions. From the lower Mississippi Valley, throughout the central basin and across the southern tier of states, precipitation is normal for this time of the year. Only Arkansas and a small part of Missouri have a slightly higher chance of seeing clear and cloudless skies. Further to the west, central and southern Texas will have a much better chance of clear seeing conditions. In April, in Texas, based on previous years data, there is only a 20 percent chance of precipitation of cloudy conditions.

April in the United States is well known as one of the rainiest months of the year. In early April, anywhere along the path of the sun in 2024, there is no guarantee you will not encounter some form of cloudy conditions or precipitation. In early April, low pressure systems streaming north and east collide with high pressure flowing north from the warmer Gulf region trigger clouds, rain storms and occasionally snow showers at the higher elevations. April is just too unpredictable of a month to guarantee the weather anywhere along the sun's path for this eclipse.

## OBSERVING/PHOTOGRAPHIC LOCATIONS TEXAS - MISSOURI

Based on the time of the year this Total Solar Eclipse will occur, and the high probability of inclement weather, I have concentrated on just two states for this eclipse. Texas is by far my first choice and Missouri, where I don't have a high degree of confidence in the weather, is my other choice. I picked Missouri simply because it's close to home.

### TEXAS

The sun, already eclipsed, enters Texas at Eagle Pass on the Texas/Mexico Border. From here the sun's path takes it mostly over open ranch land before encountering the communities of Rio Frio and Vanderpool. Both will see four minutes plus of totality. From Vanderpool the eclipsed sun then passes over the Hill Country. Here it will pass over Lake Buchanan and very close to Kingsland. Austin, the capitol of Texas, to the south, will see only slightly more than one minute of totality. Moving out of the Hill Country, the sun's path takes it close to Killeen and the sprawling U.S. Army Base of Ft. Hood. Totality here is still four minutes plus. After passing Killeen the eclipsed sun moves over Gatesville and Mills Valley. The sun then crosses Interstate 35 at Waco where totality has increased slightly. Next to see this eclipse are the two large cities of Ft. Worth and Dallas, the two largest cities in the country to see this eclipse. In the same area the suburbs of Arlington, Grand Prairie, Mesquite, Richardson and Plano will all see a four minute eclipse. After passing the suburbs the eclipsed sun moves over Kaufman, Sulphur Springs and Clarksville. All will see slightly less than four minutes of totality. The sun then departs Texas, just touches Oklahoma and moves over Arkansas.

## MISSOURI

The eclipsed sun enters Missouri in the far southwestern corner of the state and continues tracking northwest. This far corner of Missouri is heavily forested with not a large number of cities of any size. there are several State and Federal National Parks around here so it is a very popular vacation destination in the summer months. Due mainly to the geographical nature of southern Missouri, I can only recommend four of what I consider excellent observing/photographic site for this eclipse. Two are slightly north of the centerline and two others much closer to the centerline.

I have deliberately avoided choosing locations where in 2017 there was a huge turnout of people watching that eclipse. The crowds and traffic jams were a nightmare. Today, May 2023, some of these same cities are already advertising for people to come there in 2024. I expect good observing sites to be not only crowded but the price of everything else to be elevated. I think the sites I have chosen may be well off the radar of the expected crowds of curious who missed the last eclipse and will want to see this one.



OBSERVING LOCATIONS - TEXAS  
NORTHERN SHADOW LIMIT

	Eclipse Begins	Totality Begins	Totality Ends	Time of Totality
Carta Valley	11:12:06	12:30:06	12:32:31	2m 35s
Junction	11:14:40	12:32:24	12:35:37	3m 09s
Brady	11:16:30	12:34:40	12:36:50	2m 09s
Comanche	11:20:18	12:37:56	12:38:53	1m 01s
Stephenville	11:20:18	12:38:56	12:40:04	1m 09s
Ft. Worth	11:22:25	12:40:17	12:43:03	2m 46s
Antlers	11:27:37	12:45:47	12:37:34	1m 47s
Talihina	11:28:25	12:47:50	12:48:56	1m 05s
Poteau	11:30:32	12:48:50	12:50:04	1m 14s

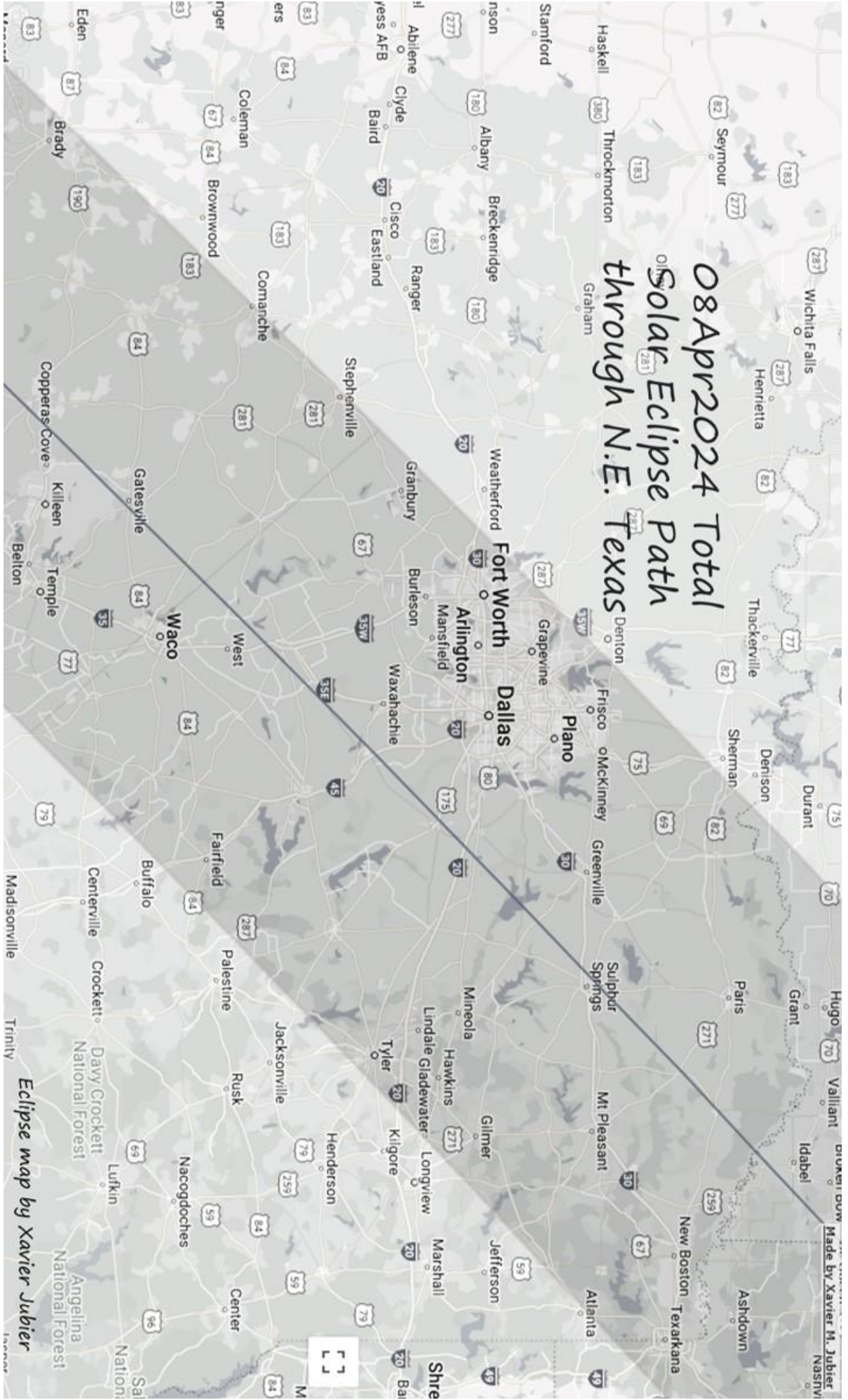
CENTERLINE

Rio Frio	11:13:00	12:30:48	12:54:14	4m 26s
Vanderpool	11:13:30	12:31:28	12:35:54	4m 26s
Kerrville	11:14:44	12:32:06	12:36:36	4m 26s
Fredericksburg	11:15:32	12:32:06	12:36:36	4m 23s
Marble Falls	11:16:49	12:34:18	12:38:37	4m 20s
Granite Shoals	11:16:57	12:34:18	12:38:37	4m 23s
Killeen/Ft. Hood	11:18:42	12:36:13	12:40:49	4m 16s
Gatesville	11:19:24	12:36:45	12:41:08	4m 24s
Mills Valley	11:19:24	12:37:31	12:41:53	4m 23s
Waco	11:20:27	12:40:21	12:43:05	4m 09s
Hillsboro	11:21:22	12:38:41	12:43:03	4m 22s
Dallas	11:35:15	12:40:39	12:47:58	4m 22s
Ennis	11:23:19	12:39:58	12:44:20	4m 22s
Kaufman	11:23:36	12:40:54	12:47:16	4m 22s
Sulphur Springs	11:25:38	12:44:23	12:47:16	4m 22s
Bogata	11:26:48	12:44:33	12:48:53	4m 20s

SOUTHERN SHADOW LIMIT

San Antonio	.999%			
Austin	11:22:15	12:36:16	12:37:37	1m 22s
Fairfield	11:22:14	12:40:48	12:43:12	2m 38s
Tyler	11:24:38	12:43:34	12:45:08	1m 33s
Gilmer	11:25:54	12:44:28	12:46:40	2m 11s
Texarkana	11:28:30	12:46:57	12:49:12	2m 15s

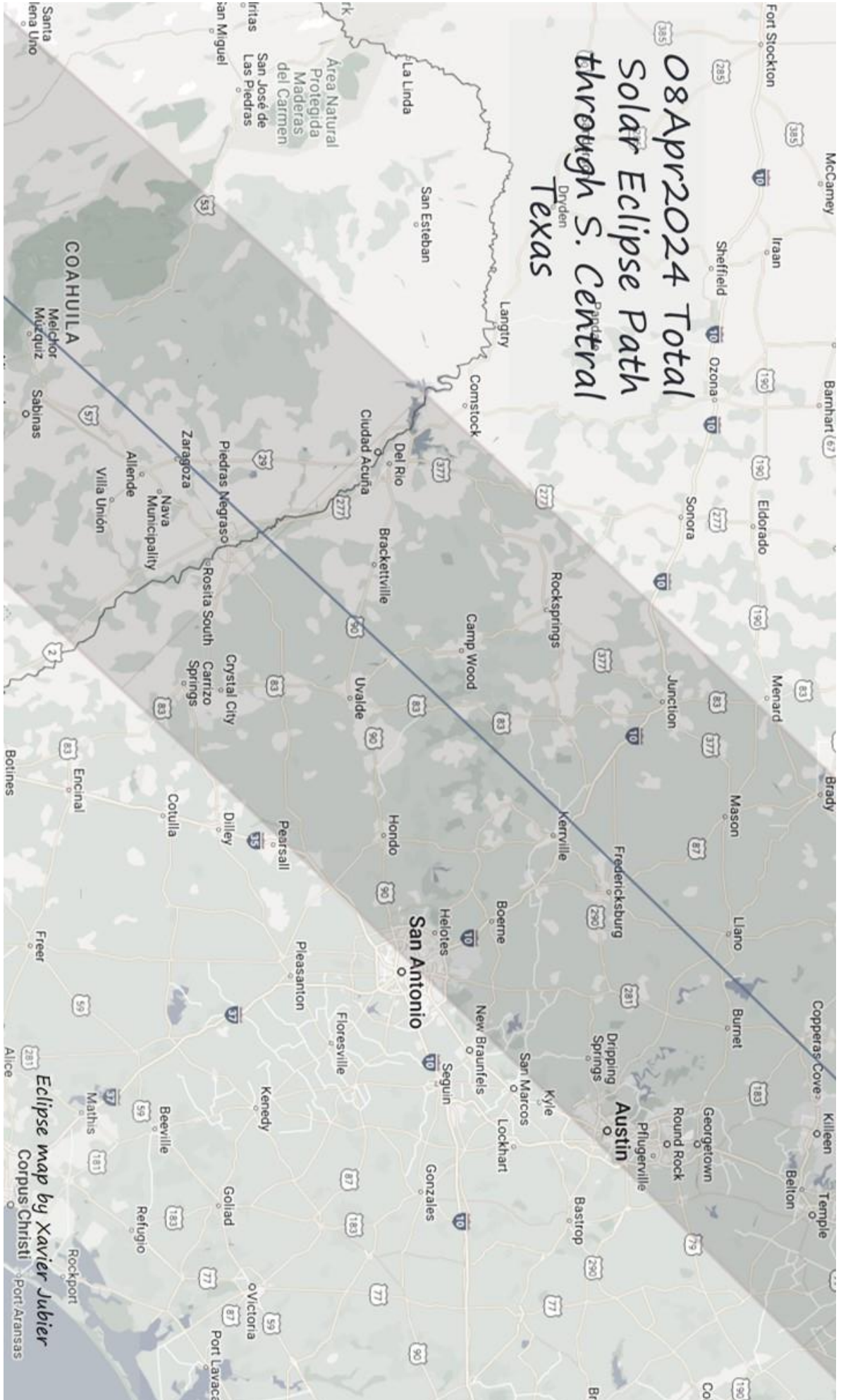
# 08 Apr 2024 Total Solar Eclipse Path through N.E. Texas



Eclipse map by Xavier Jubier

Made by Xavier M. Jubier

08 Apr 2024 Total  
Solar Eclipse Path  
through S. Central  
Texas



Eclipse map by Xavier Jubier  
Corpus Christi

## OBSERVING/PHOTOGRAPHIC LOCATIONS - MISSOURI

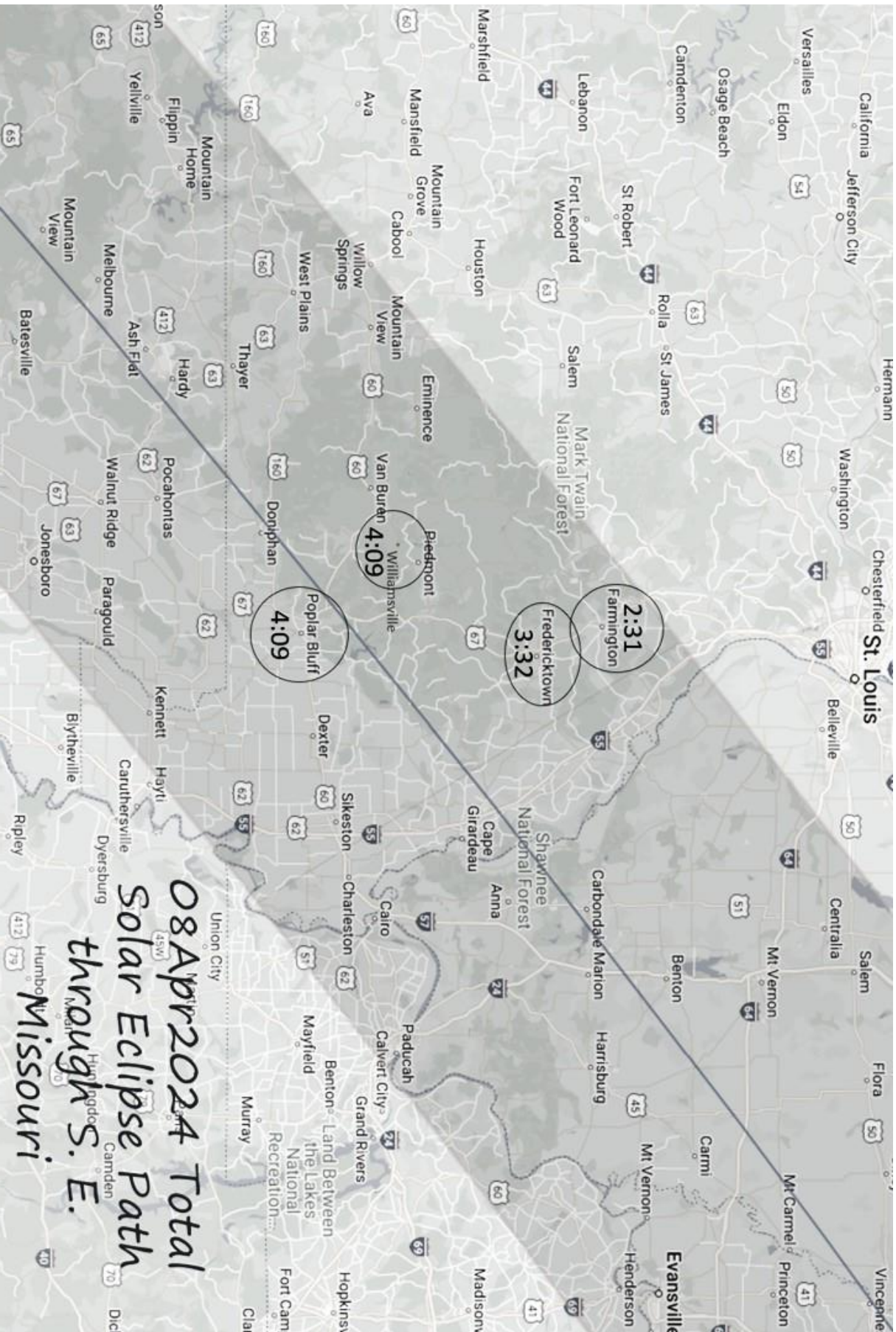
FARMINGTON. A good sized city and what I would describe as tourist friendly. Six City Parks and a number of motel/hotels available. Farmington is located on State Highway 67 and is around 60 miles southwest of St. Louis. Time of totality here is a decent 2 minutes and 36 seconds.

FREDRICKTOWN. Also located on State Highway 67 but further south. Not a large city with no City Parks listed. The city is almost surrounded by the Mark Twain National Forest and what appears to be some operating lead mines in the area. Time of totality here is a good 4 minutes and 9 seconds.

WILLIAMSVILLE A very good site also located on State Highway 67 but deep into southern Missouri. Its close proximity to Lake Wappapello assures plenty of motel/hotel space will be available. Time of totality here is right at 4 minutes.

POPULAR BLUFF. This may far be the best location in the state. Plenty of motel/hotels around and very close to the centerline of this eclipse. I believe most people will be traveling to the eastern part of the state so this area may go un-noticed. Time of totality here is 4 minutes and 9 seconds.

TRAVEL TIP. No matter which location you choose for this eclipse, I strongly recommend to plan to arrive at your site at least one day in advance of eclipse day and plan to return at least one day after eclipse day. Allow the expected traffic to thin out before heading home. The 2017 eclipse was a traffic nightmare.



08 Apr 2024 Total  
 Solar Eclipse Path  
 through S. E.  
 Missouri

## PHOTOGRAPHING A SOLAR ECLIPSE

For anyone wishing to photograph a solar eclipse, either annular or total, the best advice is practice-practice-practice. On a clear day before any eclipse, take your camera with solar filter attached and take lots of pictures. Use different shutter speeds and f/ stops until you find the combination of both you like. You can use the same setting for both annular and total eclipses.

### ANNULAR SOLAR ECLIPSE

When photographing an annular eclipse you will not have to make any changes to your camera settings. Use the same shutter speed and f/ stop throughout all stages of the eclipse.

### TOTAL SOLAR ECLIPSE

When photographing a total solar eclipse start out with one setting and do not change anything until just seconds before totality. Only then remove your solar filter and take numerous photos of the Diamond Ring and Bailey's Beads. Now change your shutter speed only to BULB and take timed exposures of from one to three seconds. After you have taken a sufficient number of photos, take the time to just look at the eclipsed sun. Photographs are great but the memory of what you are seeing will last you a lifetime.

### CAMERA-LENS

Remember that today's Digital Camera's will increase the magnification of your lens by a factor of plus 1.6. Your lens may indicate 250mm but you are actually shooting at 400mm. Do not exceed 640mm when shooting totality. Leave room to enlarge your photos.

### RECOMMENDATIONS - NIKON CAMERA

#### Recommended Shutter Speed

ISO	100	200	400	True Magnification
f/4	1/1000	1/2000	1/4000	100mm - 160mm
f/4.5	1/750	1/1500	1/3000	135mm - 216mm
f/5.6	1/500	1/1000	1/2000	150mm - 240mm
f/8	1/250	1/500	1/1000	200mm - 320mm
f/9.5	1/180	1/350	1/750	300mm - 480mm
f/11	1/125	1/250	1/500	400mm - 640mm

# ECLIPSE DAY

## OBSERVING/PHOTOGRAPHING AN ECLIPSE

If you plan to observe or photograph any eclipse I strongly recommend the following....

Firm/Steady Tripod. When photographing a total eclipse long exposures of several seconds or more are required. You will not be able to hand hold a camera steady enough for these long exposures.

Cable/Shutter Release. Any movement of your camera during exposures will ruin a clear and crisp photograph.

Neutral Density #5 Solar Filter. A good and SAFE solar filter, of either glass or film, is absolutely essential. Never look directly at the sun without some form of safe eye protection.

Camera. I recommend a good 35mm camera either digital or film. Cell phones can be used as long as they are secured and set in movie format only.

Camera Battery. Always have a spare camera battery and also make sure your batteries are fully charged on eclipse day.

Duct Tape. When do you not need Duct Tape? Never leave home without it.

Water. Solar eclipses usually occur during the hottest part of the day. Along with all the excitement, you must stay hydrated. Leave the alcohol for the party afterward.

Sunscreen. An eclipse is something you will remember for the rest of your life. You will not want to remember the painful sunburn.

Head/Face Protection. Protect these body parts during any eclipse. They are the most vulnerable part of your body.

Chair/Blanket. Eclipses can last for hours. have a place where you can sit or lay down during any eclipse. Standing for long periods of time can be very taxing on your whole body.