Eclipse Ahead

Les Murray NASA Solar System Ambassador

NASA Solar System Ambassadors

- NASA **Volunteers** dedicated to science education and NASA outreach since 1997!
- Sponsored by NASA JPL
- Goals
  - Inform the public about ongoing NASA Missions
  - Publicize Educational Resources available through NASA and others
  - Public Science outreach and Education
- We are a resource for you, invite us out for a talk!
- https://solarsystem.nasa.gov/solar-system-ambassadors/directory/
- My web: www.sky-ambassador.com

Eclipse Talk

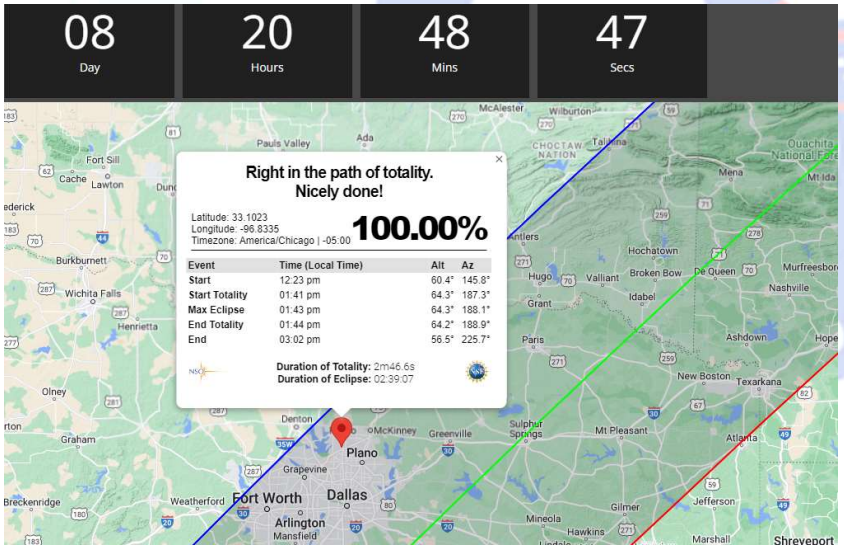
- What types of Eclipses are there
- Upcoming Eclipse Info
- Eclipse Safety
- Things to Observe During the Eclipse
- History of Eclipses

Eclipse Types

- Types of Eclipses
- Partial Solar Eclipse: Aug 21st 2017
- Annular Solar Eclipse: Oct 14th 2023
- Total Solar Eclipse: April 8th 2024
  - Partial in many parts of the US.

Partial Solar Eclipses

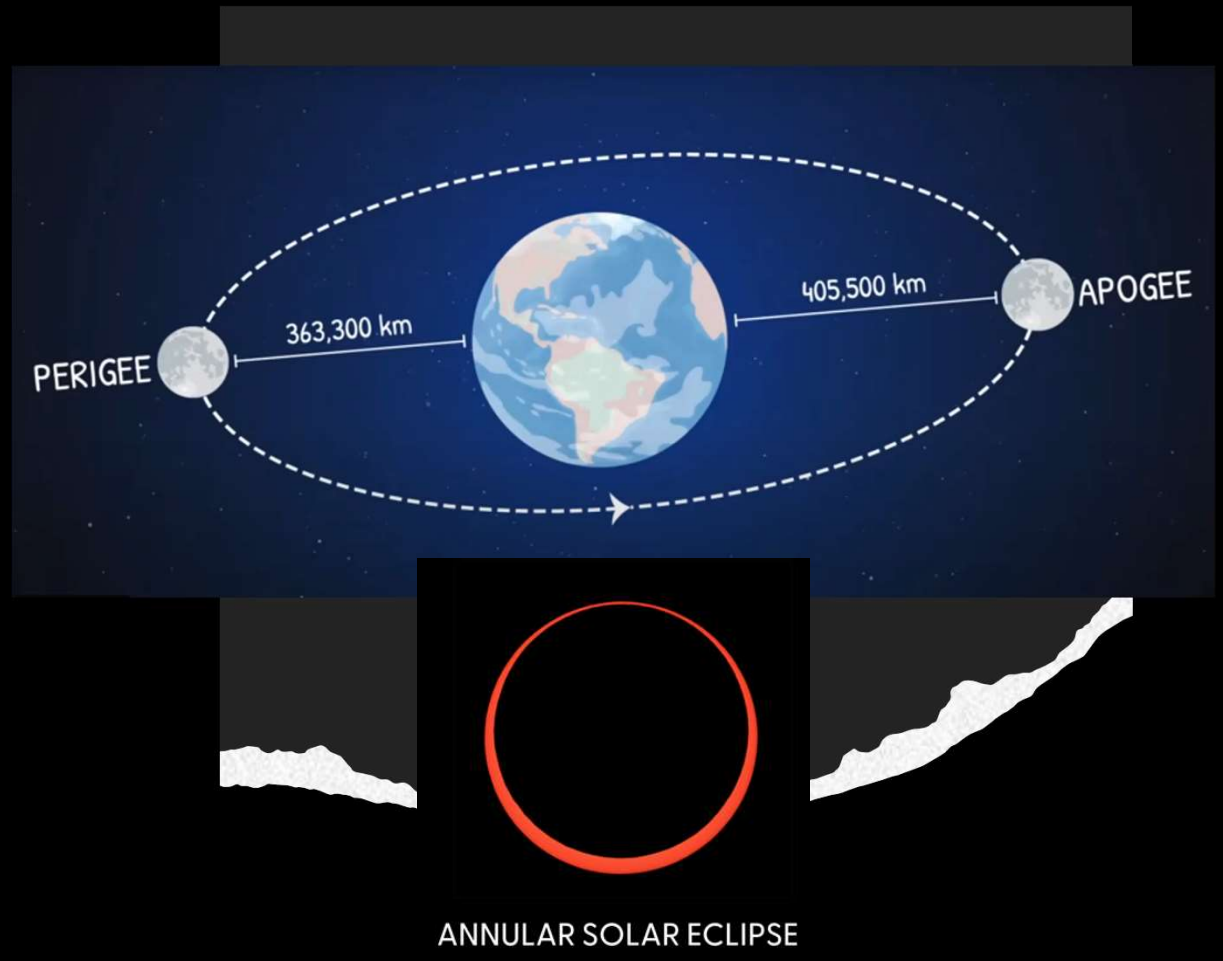
- Partial Solar Eclipses are observed when you are off the center line of totality.
- Center passed outside St. Louis in 2017, was 80% in Dallas
- Within the red lines will be 100% but shorter duration
- Distance from center determines duration




NASA's Perseverance Rover
Sees Solar Eclipse on Mars

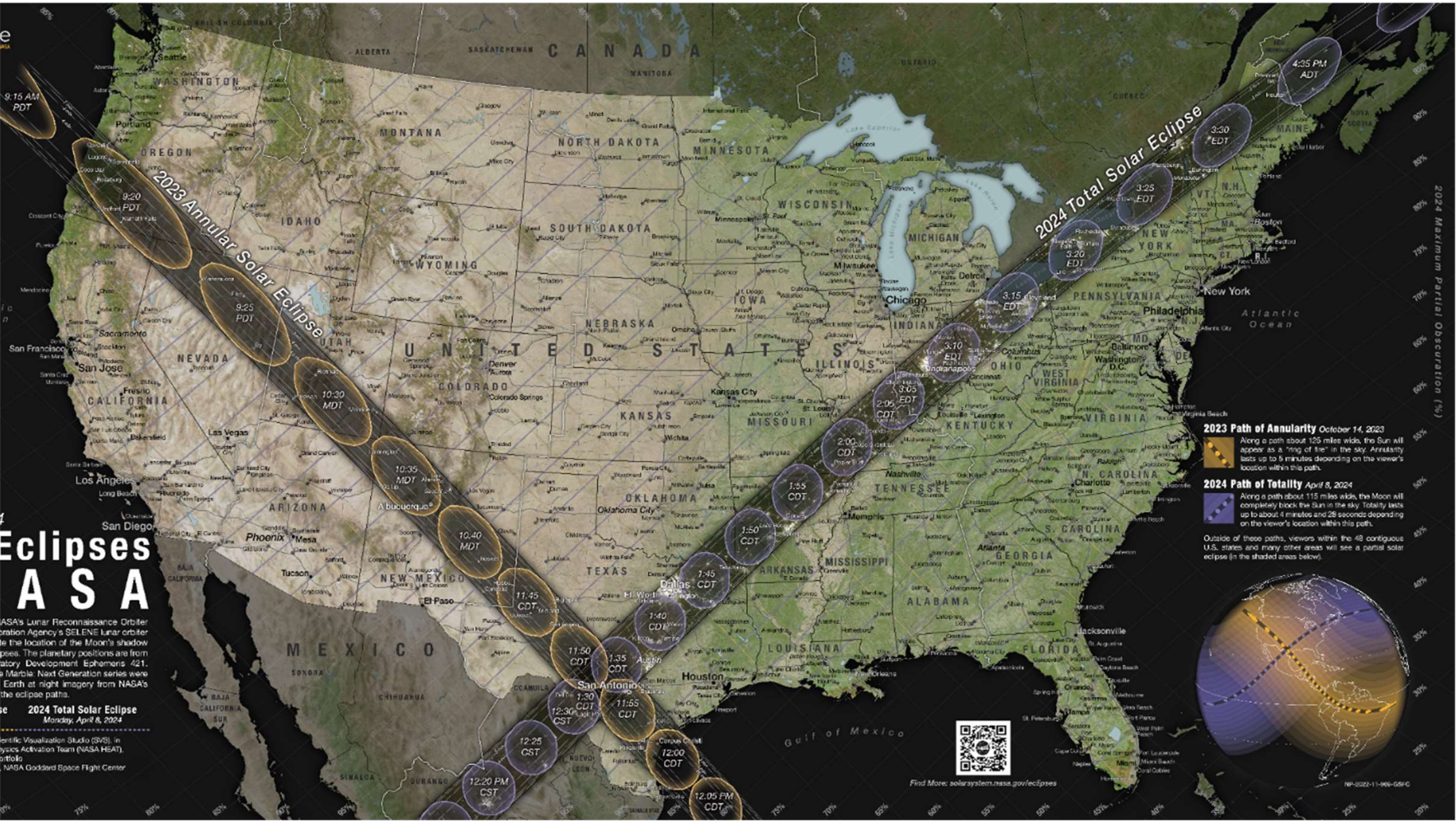
Annular Eclipse

- Moon and Sun are Aligned
- Moon is not at Perigee
- Sun not completely covered



Total Eclipse

- Moon and Sun are Aligned
- Moon is at Perigee making it larger
- Sun completely covered



Eclipses
A S A
ASA's Lunar Reconnaissance Orbiter
eration Agency's SELENE lunar orbiter
te the location of the Moon's shadow
pses. The planetary positions are from
ratory Development Ephemeris 421.
e Marble: Next Generation series were
Earth at night imagery from NASA's
the eclipse paths.
se
2024 Total Solar Eclipse
Monday, April 8, 2024
entific Visualization Studio (SVS), in
ysics Activation Team (NASA HEAT),
ortfolio
, NASA Goddard Space Flight Center
C A N A D A
U N I T E D S T A T E S
M E X I C O
2023 Annular Solar Eclipse
2024 Total Solar Eclipse
9:15 AM PDT
9:20 PDT
9:25 PDT
10:30 MDT
10:35 MDT
10:40 MDT
11:45 CDT
11:50 CDT
11:55 CDT
12:00 CDT
12:05 PM CDT
12:20 PM CST
12:25 CST
12:30 CST
1:30 CDT
1:35 CDT
1:40 CDT
1:45 CDT
1:50 CDT
1:55 CDT
2:00 CDT
2:05 CDT
3:05 EDT
3:10 EDT
3:15 EDT
3:20 EDT
3:25 EDT
3:30 EDT
4:35 PM ADT
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
S. CAROLINA
N. CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
MAINE
Seattle
Portland
San Francisco
San Jose
Los Angeles
San Diego
Las Vegas
Phoenix
Tucson
Denver
Albuquerque
El Paso
Dallas
Austin
San Antonio
Houston
Chicago
Indianapolis
New York
Philadelphia
Atlantic Ocean
Gulf of Mexico
2023 Path of Annularity October 14, 2023
Along a path about 125 miles wide, the Sun will appear as a "ring of fire" in the sky. Annularity lasts up to 5 minutes depending on the viewer's location within this path.
2024 Path of Totality April 8, 2024
Along a path about 115 miles wide, the Moon will completely block the Sun in the sky. Totality lasts up to about 4 minutes and 28 seconds depending on the viewer's location within this path.
Outside of these paths, viewers within the 48 contiguous U.S. states and many other areas will see a partial solar eclipse (in the shaded areas below).
2024 Maximum Partial Obscuration (%)
Find More: solarsystem.nasa.gov/eclipses

Upcoming Eclipse

- Total Eclipse (April 8th 2024)
  - Begins around 12:20 and ends around 3pm
  - Only remove glasses during the total eclipse.
  - 3 mins 1 seconds of totality
  - All other times, sun only viewed with eclipse glasses or solar telescopes.

Eclipse Calculators

- National Solar Observatory Eclipse Calculator
  - https://nso.edu/for-public/eclipse-map-2024
- Naval Observatory Eclipse Calculator
  - https://aa.usno.navy.mil/data/SolarEclipses

Duration

- 100% Total
- 2m 41s

Solar Eclipse Computer

Solar Eclipse of 2024 April 08
Delta T: 72.8s
Sun in Total Eclipse at this Location

Stuarts Creek Park The Colony
33.089° N, 96.8863° W
Height 169m

Phenomenon	Day	Time (UT1)	Local Time (CST)	Sun's Azimuth (°)	Position Angle (°)	Vertex Angle (°)
Eclipse Begins	8	17:23:42.0	12:23:42.0	145.6	225.8	254.6
Totality Begins	8	18:41:33.5	1:41:33.5 pm	187.1	355.1	349.5
Maximum Eclipse	8	18:42:53.1	1:42:53.1 pm	187.9		
Totality Ends	8	18:44:14.6	1:44:14.6 pm	188.6	279.6	272.7
Eclipse Ends	8	20:02:47.5	3:02:47.5 pm	225.6	49.8	12.8

Duration	2h 39m 05.5s
Duration of Totality	2m 41.1s
Magnitude	1.006
Obscuration	100.0%

Duration

- 100% Total
- 2m 52s

Solar Eclipse Computer

Solar Eclipse of 2024 April 08
Delta T: 72.8s
Sun in Total Eclipse at this Location

Bedford, TX
32.83° N, 97.15° W
Height 0m

Phenomenon	Day	Time (UT1)	Sun's Altitude (°)	Sun's Azimuth (°)	Position Angle (°)	Vertex Angle (°)
Eclipse Begins	8	12:22:50.0	60.3	144.5	225.8	255.5
Totality Begins	8	1:40:37.0	64.7	186.0	358.2	353.5
Maximum Eclipse	8	1:42:03.0	64.6	186.9		
Totality Ends	8	1:43:30.5	64.6	187.7	276.4	270.2
Eclipse Ends	8	2:02:05.1	57.0	225.3	49.6	12.8

Duration	2h 39m 14.8s
Duration of Totality	2m 52.6s
Magnitude	1.007
Obscuration	100.0%

Duration

- 100% Total
- 3m 29s

Solar Eclipse Computer

Solar Eclipse of 2024 April 08
Delta T: 72.8s
Sun in Total Eclipse at this Location

Plano, TX
33.02° N, 96.7° W
Height 0m

Phenomenon	Day	Time (UT1)	Sun's Altitude (°)	Sun's Azimuth (°)	Position Angle (°)	Vertex Angle (°)
Eclipse Begins	8	12:23:50.0	60.5	146.0	226.1	254.6
Totality Begins	8	1:41:21.1	64.4	187.4	10.0	4.1
Maximum Eclipse	8	1:43:04.9	64.4	188.4		
Totality Ends	8	1:44:50.6	64.3	189.4	264.7	257.2
Eclipse Ends	8	2:03:00.8	56.5	226.0	49.5	12.2

Duration	2h 39m 10.7s
Duration of Totality	3m 29.5s
Magnitude	1.011
Obscuration	100.0%

Eclipse Safety

- Do NOT observe the sun directly.
  - Only through solar glasses
    - Must be ISO 12312-2 safety standard approved
  - Or solar telescopes (never normal telescopes OR Binoculars)
    - Solar Telescopes are specifically designed for observing the sun and pass 1/10th of 1% of the suns light.
  - Or Welders Glass #14 or above
- Do NOT use sunglasses, there are NO sunglasses that can be used to safely view the sun.

AMERICAN ACADEMY™
OF OPHTHALMOLOGY
Protecting Sight. Empowering Lives.

Solar Eclipse Eye Safety

Looking directly at the sun during a solar eclipse is unsafe, except during a brief phase when the moon entirely blocks the sun's bright face. This phase is called totality. The path of totality for the Aug. 21, 2017 eclipse stretches from Oregon to South Carolina. Unless you're in the path of totality, keep your solar eclipse glasses on throughout the eclipse. Four manufacturers have certified that their eclipse glasses and handheld solar viewers meet the standards for eye protection: Rainbow Symphony, American Paper Optics, Thousand Oaks Optical, and TSE 17

✗ NOT SAFE

Ordinary sunglasses are not strong enough to protect your eyes.

✓ SAFE

Use specially designed solar eclipse glasses and viewers to block the sun's harmful rays.

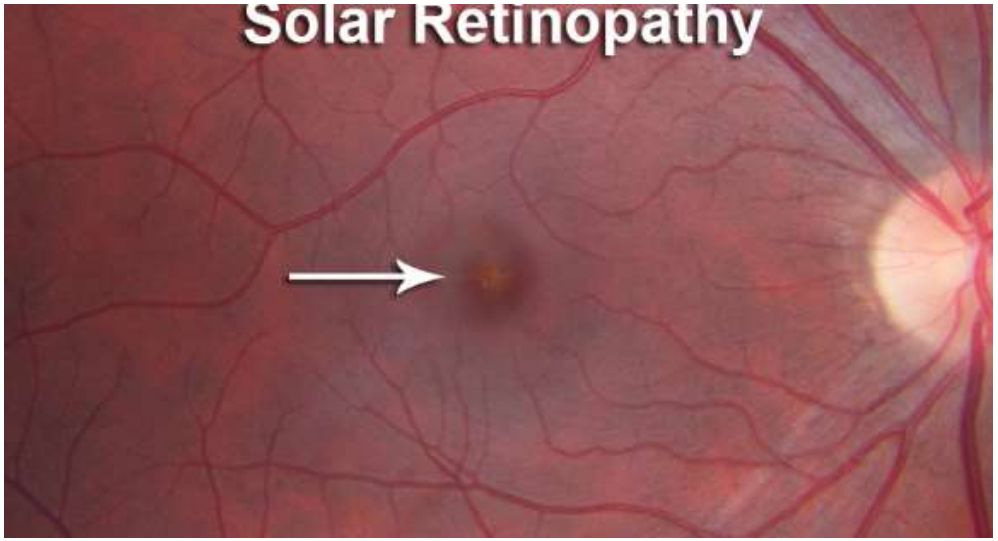
✗ NOT SAFE

Wearing solar eclipse glasses to look through a camera, binoculars or a telescope will not protect your eyes.

✓ SAFE

Use only specially designed filters for lenses.

Source: American Academy of Ophthalmology and American Astronomical Society



- Blurry vision
- Headache
- A blind spot in your central vision in one or both eyes
- Increased sensitivity to light
- Distorted vision, in which a straight line looks bent, or a door jamb looks curvy
- Changes in the way you see color, known as "dyschromatopsia"

Approved Vendor List

- The AAS (American Astronomical Society) has an approved vendors list of ISO compliant glasses.
- https://eclipse.aas.org/resources/solar-filters
- Alpine Astronomical
- American Paper Optics / eclipseglasses.com / 3dglassesonline.com (custom-printed viewers available)
- American Paperwear* (custom-printed viewers available)
- Astronomical League*
- Baader Planetarium* [see note]
- Bookishbunny* (custom-printed and child-size viewers available)
- Cangnan County Qiwei Craft Co., Ltd.*
- Celestron
- DayStar Filters;(custom-printed viewers available)
- Eclipse Texas (custom-printed viewers available)
- Explore Scientific (custom-printed viewers available)
- Flip'n Shades (available with visor or cap too)
- Halo Eclipse Spectacles*
- Jaxy Optical Instruments* (wholesale only; no retail sales)
- PNJ Solar*
- Rainbow Symphony (custom-printed viewers available)
- Seymour Solar (sheets only)
- Solar Eclipse International (SEIC)* (custom-printed viewers available)
- Solares, LLC*
- Spectrum Telescope
- Thousand Oaks Optical (sheets and rolls available too)
- Totality Over TX* (custom-printed viewers available)
- TSE 17*

Things to Look For

- Shadow Bands – Wavy shadow/white bands just before totality.
- Sharp Shadows – The shadows have much less fuzzy edges
- Baileys Beads – Suns light beaming through crater rims just before totality,
- Diamond Ring – Last step before totality, begin to see corona with just the tiniest sliver of the sun showing.
  - After Diamond ring disappears, GLASSES OFF
  - Happens just before/after totality. GLASSES ON NOW!
- Totality
- Comet, Venus and Jupiter

Shadow Bands

- They are shadows around the edge of the moon sun boundary
- Caused by the atmosphere causing distortions (our best guess)
- Occur 2 minutes before and after totality

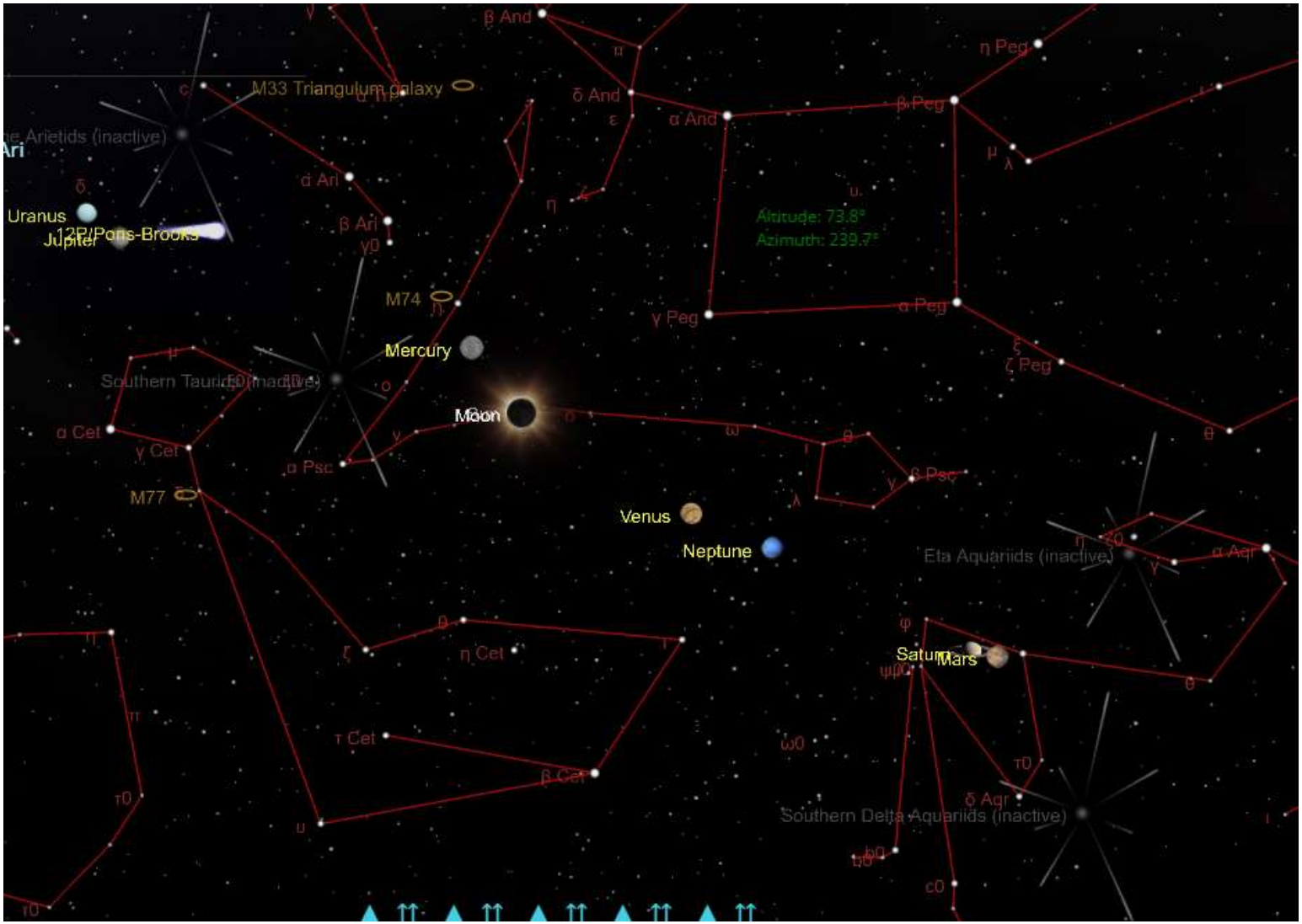
Credit Thierry Pauwels

- Diamond Ring
- Last bit of suns light passing through valleys on the moon
- Glasses Still On

- Baileys Beads
- Light shining through the valleys on the Moon.
- Glasses are still ON

- Totality
- Sun is totally covered
- Glasses are OFF
- One of the most amazing things you will ever see.

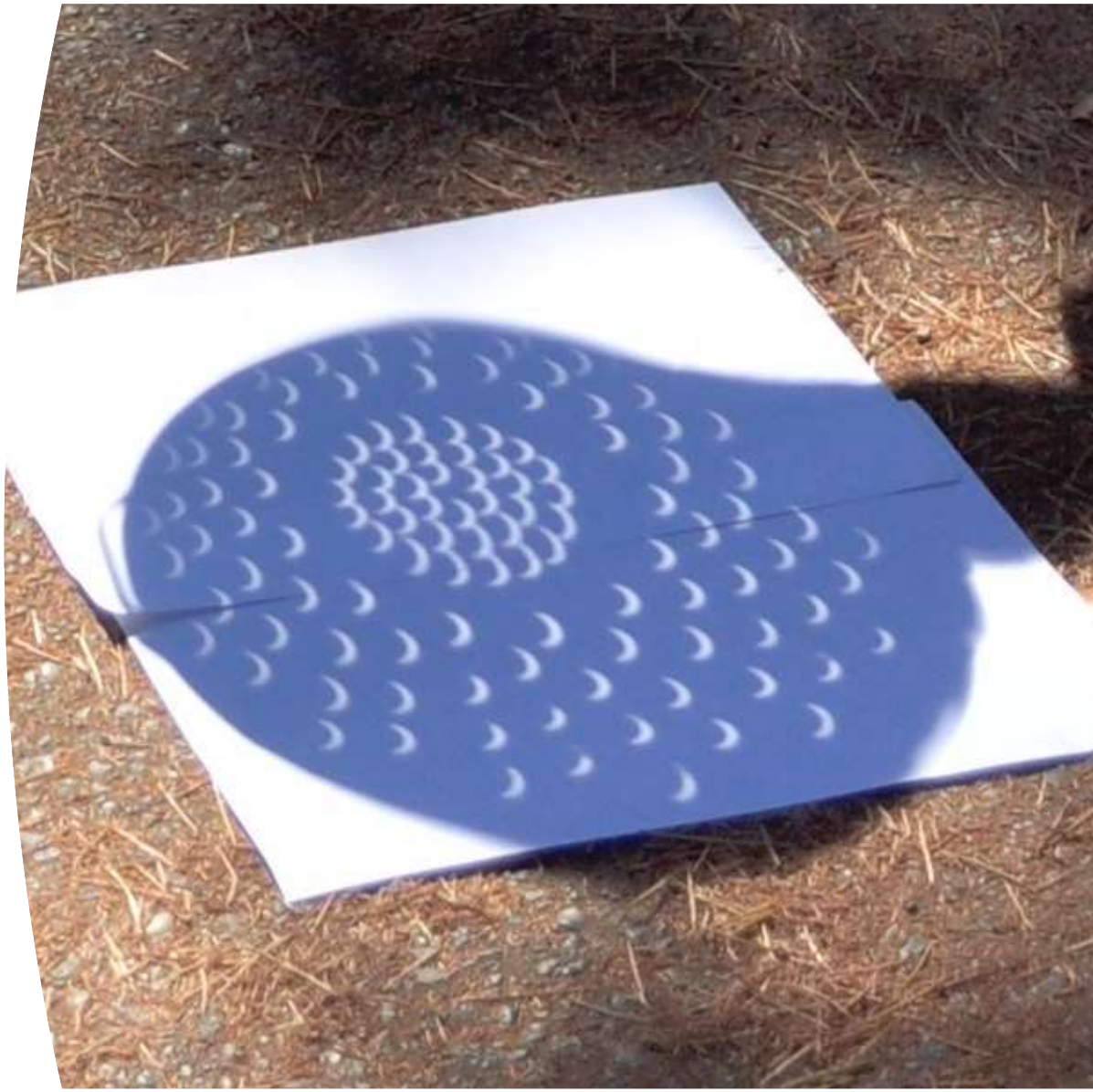
- Visible Planets
  - Venus
  - Jupiter
  - Saturn
  - Mercury
  - Mars
- Comet
  - 12P/Pons Brooks



Derek Muller https://www.youtube.com/watch?v=G10m2ZZRH4U

Colander

- Use a colander to safely view the eclipse
- Acts as a pinhole camera
- Small image of eclipse

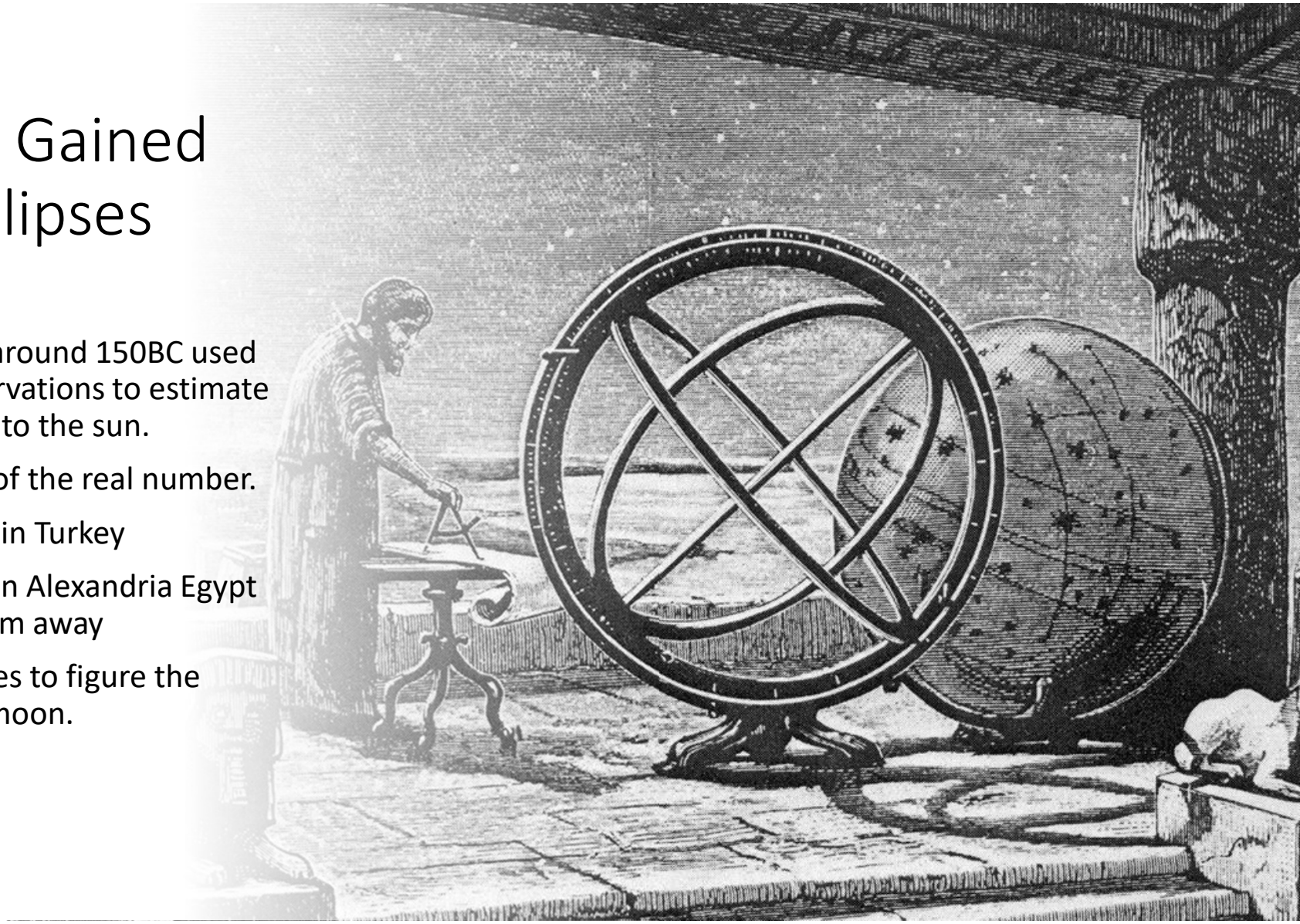


Eclipse Projection below trees

- Tree leaves crossing also leave small gaps that also act as pinhole cameras.
- Look for eclipse images on the ground.

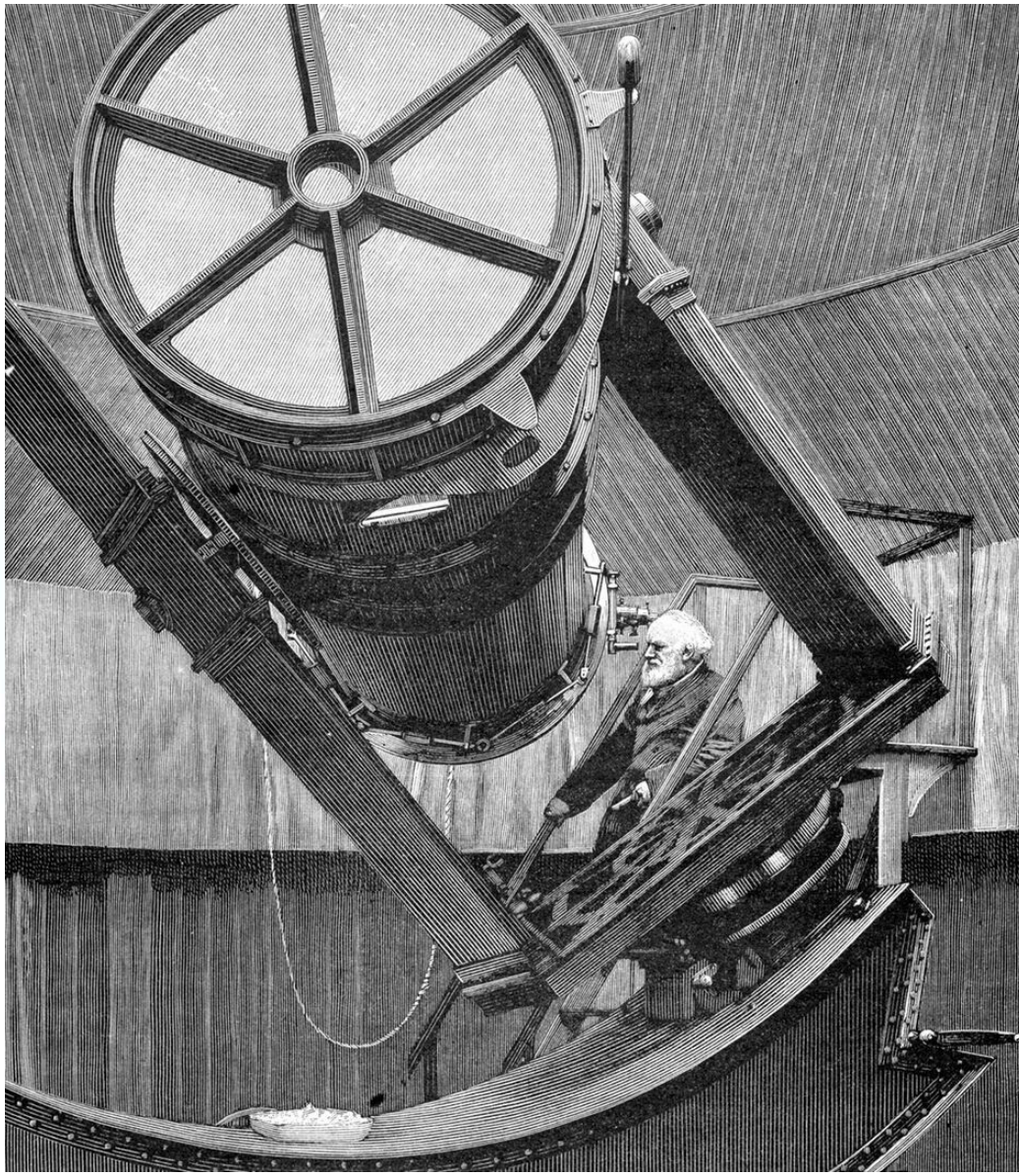
Science Gained from Eclipses

- Hipparchus around 150BC used eclipse observations to estimate the distance to the sun.
- Within 20% of the real number.
- Total Eclipse in Turkey
- 80% Eclipse in Alexandria Egypt about 1000km away
- Used triangles to figure the distance to moon.



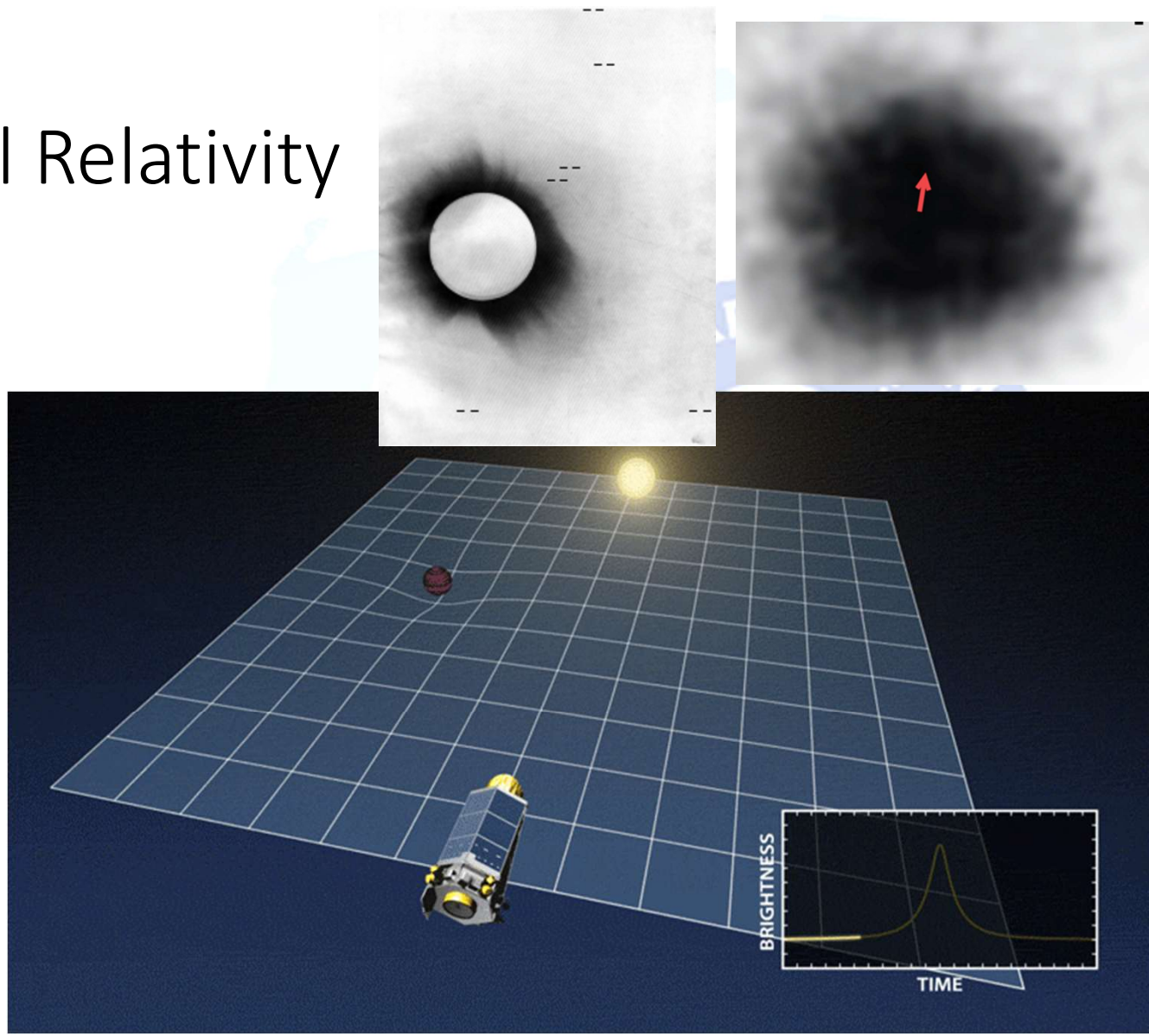
Discovery of Helium

- French Astronomer Pierre Jansson got the idea to view the spectrum of the sun during an eclipse.
- Normally too bright to get spectra.
- 1868 eclipse he found an unknown spectral line not seen before.
- Was the element helium.



Proof of General Relativity

- During an eclipse scientist measured the deflection of stars caused by the sun for stars very close to the sun.
- General relativity exactly predicted their positions in the sky.



Things to Remember

- Safety, Safety, Safety
- Location Matters
- Timing Matters
- Look for Stages we talked about

2024 Total Solar Eclipse Viewing Event

Monday, April 8, 2024

Get ready for a once-in-a-lifetime event! The Colony is in a prime location to catch the total solar eclipse on Monday, April 8. Come out to Stewart Creek Park for a FREE, family friendly watch party. The partial eclipse will begin at approximately 12:23 PM and continue until totality at approximately 1:41 PM. Enjoy themed crafts and activities, giveaways, food vendors and expert insight at multiple viewing stations.

Date:	April 8, 2024
Time:	12:30 PM - 2:30 PM
Time Details:	Partial eclipse begins: 12:23 PM Totality: 1:41 PM.
Location:	Stewart Creek Park View Facility
Address:	3700 Sparks Road The Colony, TX 75056
Cost:	FREE
Link:	More Info