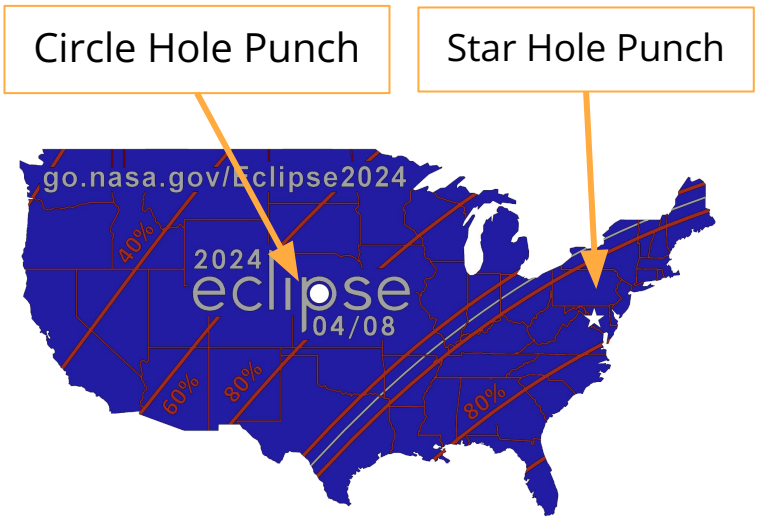
2024 Total Solar Eclipse US Map Pinhole Projector Activity

Your back should always be to the Sun when using a pinhole projector. Do NOT look at the Sun through the pinhole!

Steps:

1. Choose the **square**, **triangle** or **heart** hole puncher to punch a hole on the map where you live.
2. **Make a prediction!** What shape will the Sun be when it shines through each hole (3 different shapes)?
3. **Standing with your back toward the Sun,** hold the map approximately three feet above the ground, out in front of you, to allow sunlight to shine through the holes in the map onto the ground. Project the image on a piece of paper for a better image.
4. **Experiment!** What happens when you move the map closer or farther away from the ground?



2024 Total Solar Eclipse U.S. Map Pinhole Projector
Credit: NASA HEAT/J. Patrick Haas



Place a piece of paper on the ground to see the projection more clearly.

Access the 3D Print Files:

https://nasa3d.arc.nasa.gov/detail/usa-eclipse-2024

This product is supported by the NASA Heliophysics Education Activation Team (NASA HEAT), part of NASA's Science Activation portfolio.

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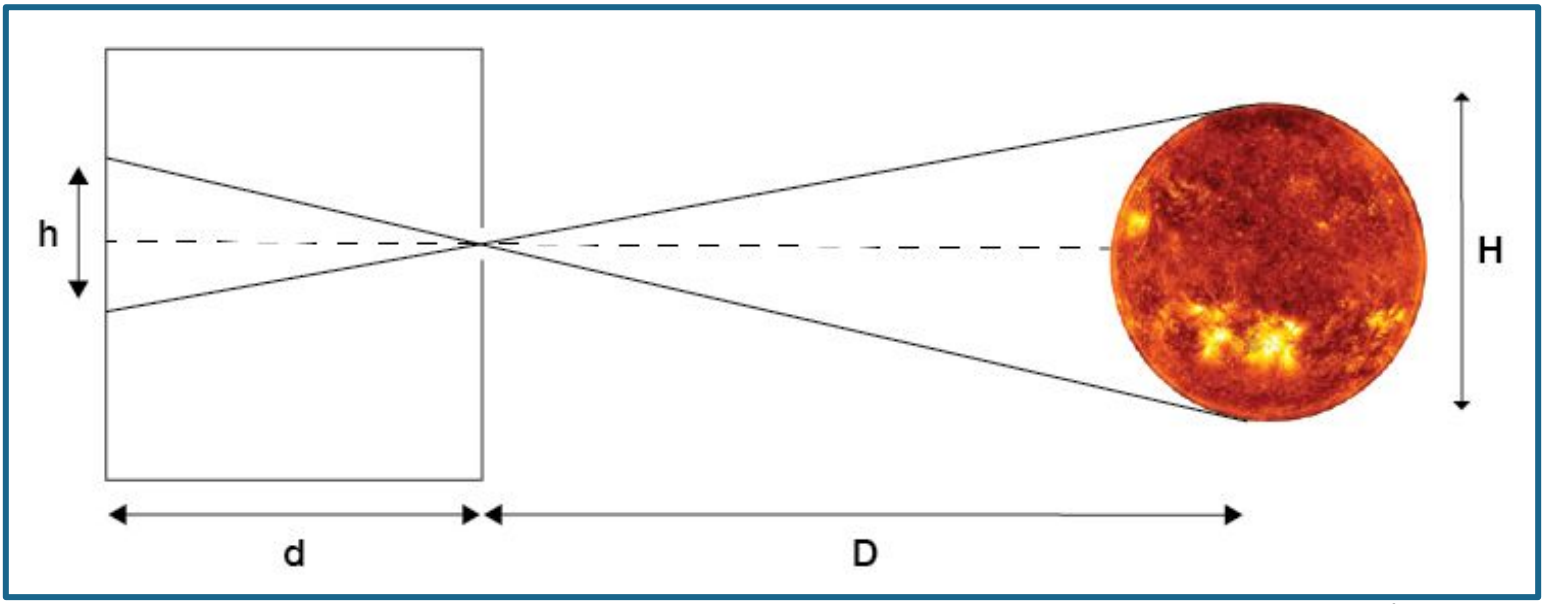
2024 Total Solar Eclipse US Map Pinhole Projector Activity

Talking Points

- **Another tool you can use to observe a solar eclipse is a pinhole projector.**
  - Even if you have solar viewing glasses, a pinhole projector is a different and interesting way to observe a solar eclipse. You should try both tools during the duration of the solar eclipse.
  - A pinhole projector is an indirect method of observing a solar eclipse.
- **The map shows the percentage of the Sun that is covered by the Moon's shadow at different locations across the country.**
  - Observers on the "100% line" of the map will experience a TOTAL solar eclipse.
  - All other locations will experience a partial solar eclipse.
- **No matter what shape you project the Sun through, it will project the shape of the Sun, not the shape of the hole.**
  - The Sun is normally round. Try the projection before the solar eclipse starts.
  - During the solar eclipse, you can observe how the shape of the Sun changes as the Moon’s shadow covers more and more of the Sun as the solar eclipse progresses.

How does a Pinhole Projector Work?

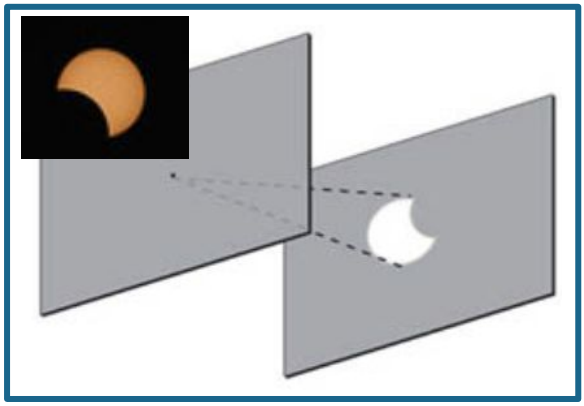
Your back should always be to the Sun when using a pinhole projector. Do NOT look at the Sun through the pinhole!



Credit: NASA

A pinhole projector is a very basic camera.

The above diagram shows the relationship between the height of the projected image (h), projection distance (d), distance to the object (D), and the height (diameter) of the object (H), in this case the Sun.



The shape of the Sun during the partial phase of a solar eclipse through a simple pinhole projector.

Access full activity, math extension and all files:

https://science.nasa.gov/learn/heat/resource/2024-total-solar-eclipse-usa-map-nasa-pinhole-projector/

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How does a Pinhole Projector Work?

Talking Points

- **Pinhole projectors allowed early scientists and artists to view the shapes of illuminated objects, like the Sun, by shining the light from the object through a very small hole, projecting the image onto the ground or a wall.**
  - Projecting an image of the Sun can be as simple as punching a hole in a piece of paper.
  - You can also use a cereal box to make a more advanced version.
- **A pinhole projector works similarly to a camera, although instead of how a camera projects an image onto film (or a digital light detector), we are projecting the image of the Sun onto the ground.**
  - Simple cameras consist of a light-proof box (the camera body), a small hole that allows light to pass through (the aperture), and a lens inside the box to focus the light.
  - The hole in the paper functions similarly to the aperture of a camera, and the ground is the film/light detector.
  - The size of the aperture can be adjusted to increase or decrease the amount of light captured. A bigger opening allows more light in, making the image brighter, but less clear. A smaller opening allows less light in, making the image dimmer, but crisper.
  - A 5 mm hole is the optimal size for creating a crisp projection of the Sun from approximately 1 meter off the ground.
  - You can adjust the focus by changing the height of the pinhole projector from the ground.
- **Do not attempt to take a picture of the Sun with a film or digital camera, without using a solar filter over the lens.**
  - If you want to take a picture of the solar eclipse with your camera using solar viewing glasses, place the glasses flush against the lens and you can view the Sun on your screen. You need to lower the exposure on your camera as low as it will go. ***(Refer to Photographing a Solar Eclipse Tabletop.)***