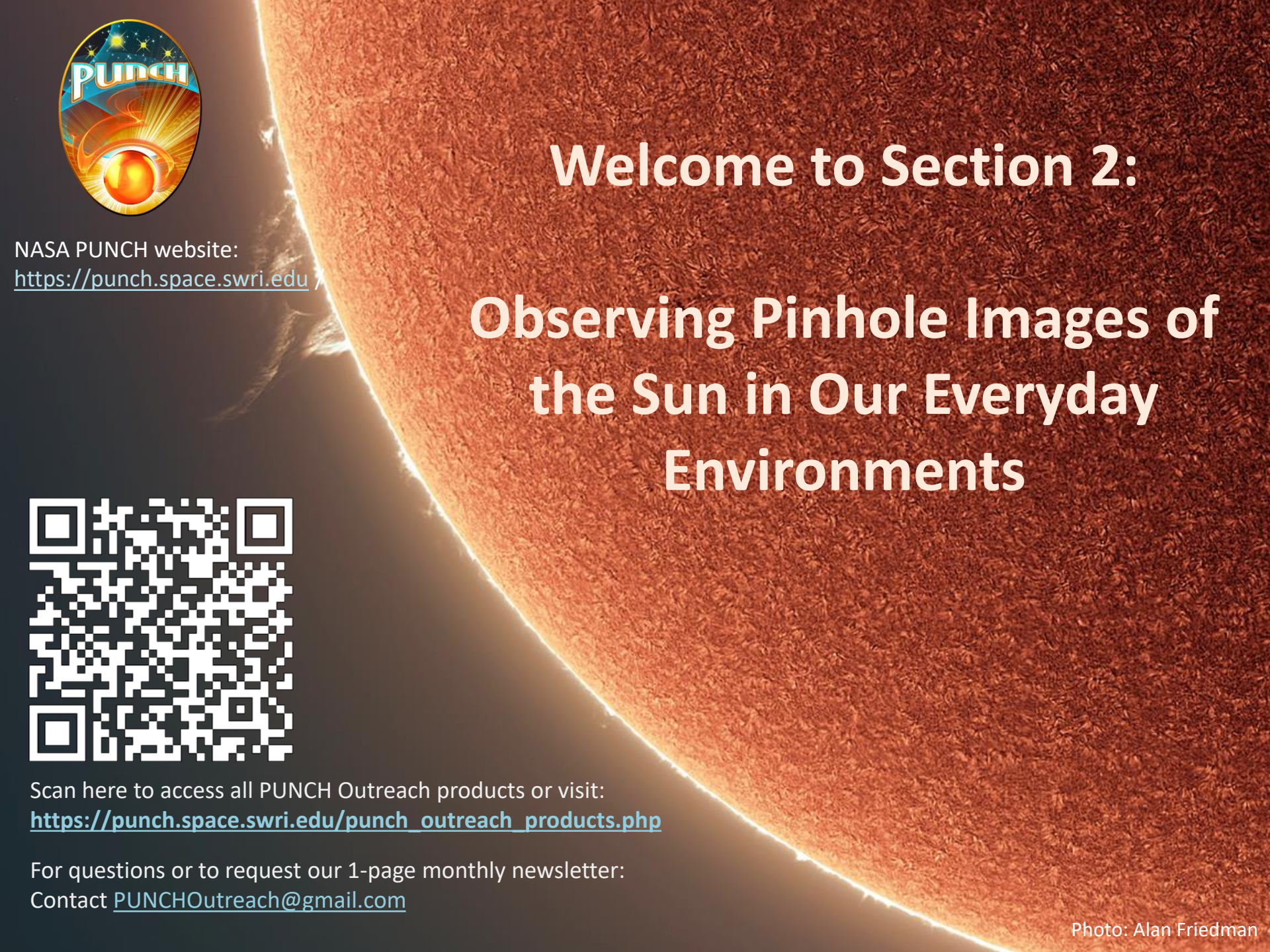

Welcome to Section 2:

Observing Pinhole Images of the Sun in Our Everyday Environments

NASA PUNCH website:
https://punch.space.swri.edu /

Scan here to access all PUNCH Outreach products or visit:
https://punch.space.swri.edu/punch_outreach_products.php

For questions or to request our 1-page monthly newsletter:
Contact PUNCHOutreach@gmail.com

Photo: Alan Friedman

[*Really*] Understanding Pinhole Projection of the Sun

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FRONT

And **PLEASE** give us feedback on these questions at the link below:

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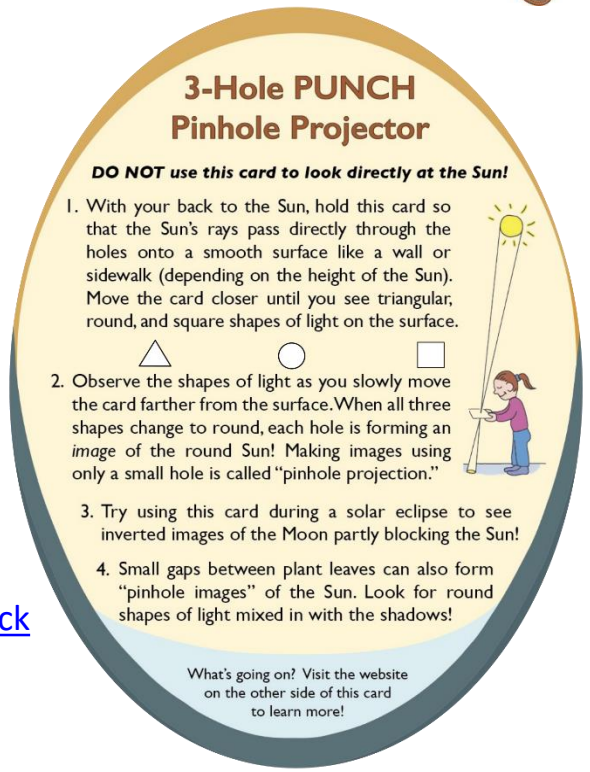
Remaining questions?

Ideas for improvements?

https://tinyurl.com/PinholeFeedback



BACK

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Final Release for use up to and including the Annular Eclipse on 14 Oct 2023

Essential viewing:

6-minute “how-to-facilitate” video

[https://punch.space.swri.edu/punch_outreach_pinholeprojector.php]

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Polarimeter to UNify the Corona and Heliosphere

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3-HOLE PUNCH PINHOLE PROJECTOR

The PUNCH Outreach team designed the 3-Hole PUNCH Pinhole Projector (3HPPP) so that everyone can experience and explore the wonder of how a small, lens-less hole of any shape works to create real images of the Sun or other bright light sources, both indoors and outdoors.

Image credit: Vivian White

Our projector allows you to observe the Sun safely during eclipses or on any sunny day!

The 3HPPP is NOT your ordinary pinhole projector nor a simple give-away like a sticker or button, but a powerful learning tool when safely and effectively facilitated.

This **6-minute “how-to” video** shares what we’ve learned about how to facilitate use of the 3HPPP to excite a lifetime of curiosity and wonder in learners of all ages.

[*Really*] Understanding Pinhole Projection of the Sun

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Introducing Bhanu

[BAH-noo]

Bhanu means "ray of light" in Sanskrit

Bhanu helps guide our way through these Sections. You are in Section 2 of 5.

Section	Title of Section	Description of Section
1	How to Use the 3-Hole PUNCH Pinhole Projector	introduces the 3-Hole PUNCH Pinhole Projector, demonstrates how to use it both outdoors and indoors, and describes its differences from a pinhole camera/viewer.
2	**Observing Pinhole Images of the Sun in Our Everyday Environments**	**teaches you how to observe the phenomenon of pinhole images of the Sun in our everyday world, both indoors and outdoors.**
3	Exploring Pinhole Projection Using Your Own Hands	invites you to explore the behavior of pinhole projection by experimenting with your own hands (try both palms up!)
4	Explaining and Understanding How Pinhole Imaging Happens	interactively guides your quest for explanations and deeper understanding of how pinhole imaging happens. After this, you will *really* understand why small, lens-less holes can create images.
5	APPENDICES A-E: More Insights & Fun Resources	offers more insights & resources (e.g., explaining the relationship between pinhole images and the view through "eclipse" glasses)

CONTACT:
Dr. Cherilynn Morrow, Outreach Director for the NASA PUNCH mission [cherilynn.morrow@gmail.com]

Pinhole Projection of the Sun

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2. Observing Pinhole Images of the Sun in Our Everyday Environments

Bahnu says: Be alert to seeing pinhole images of the Sun every sunny day! The leaves in bushes and trees are like Nature's camera but almost nobody notices. Learn to see this wonder hiding in plain sight and help others to see it too!

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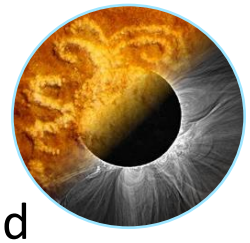
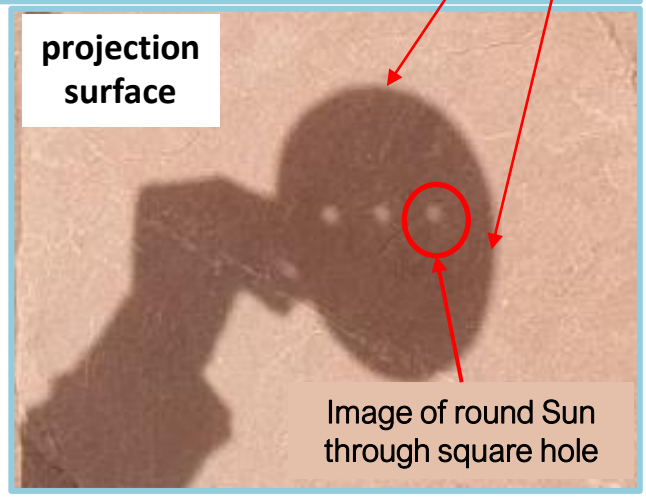
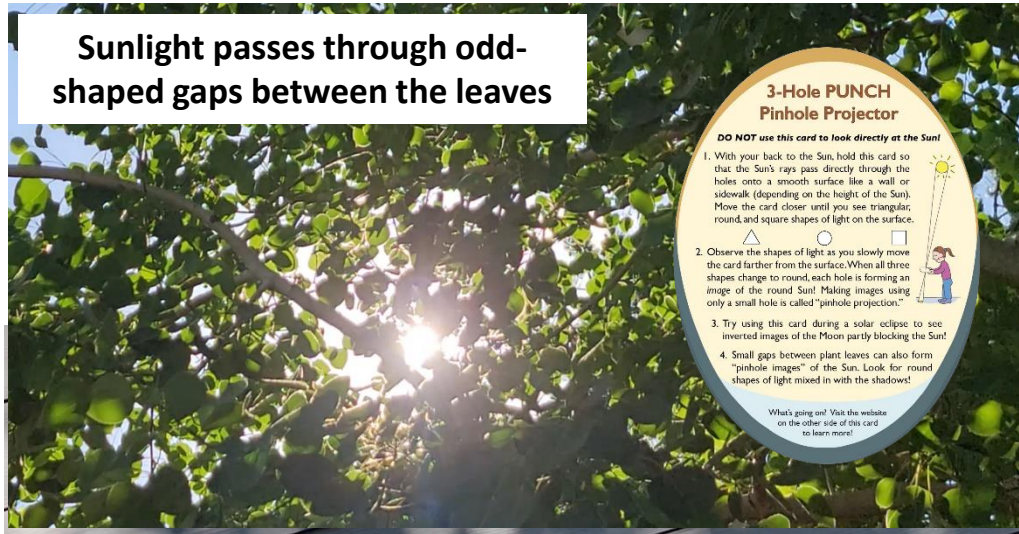
Pinhole Projection of the Sun



Gaps between leaves are like the “pinholes” of our projector, and even these odd-shaped gaps create round images of our sun!

Sunlight comes from this direction





Pinhole Projection of the Sun

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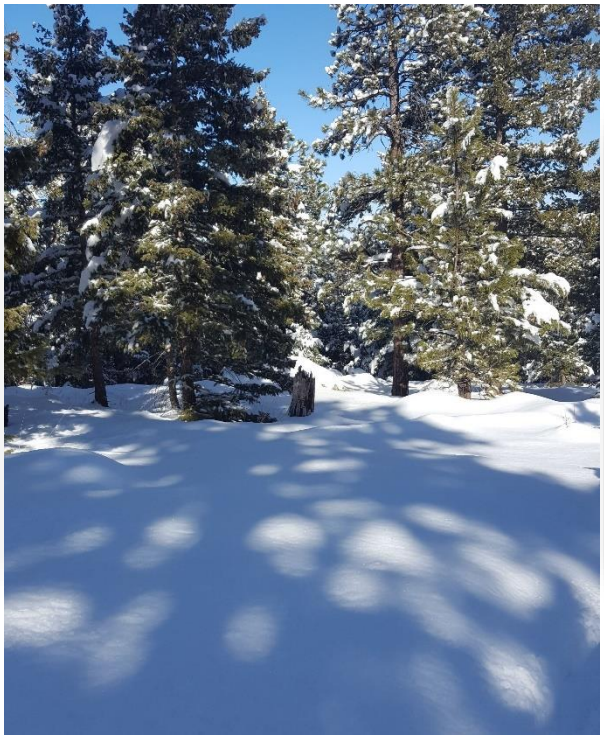
We can find "pinhole images" of the round Sun all around us.

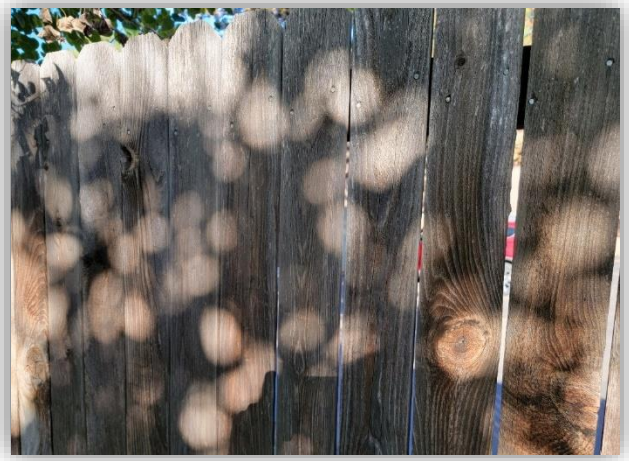
These are REAL images of the actual Sun – our star!

We can find them at all times of the day and all times of the year.

We find them amid the shadows of trees with leaves or needles.

We find them on sidewalks, on snow, on fences, and buildings.



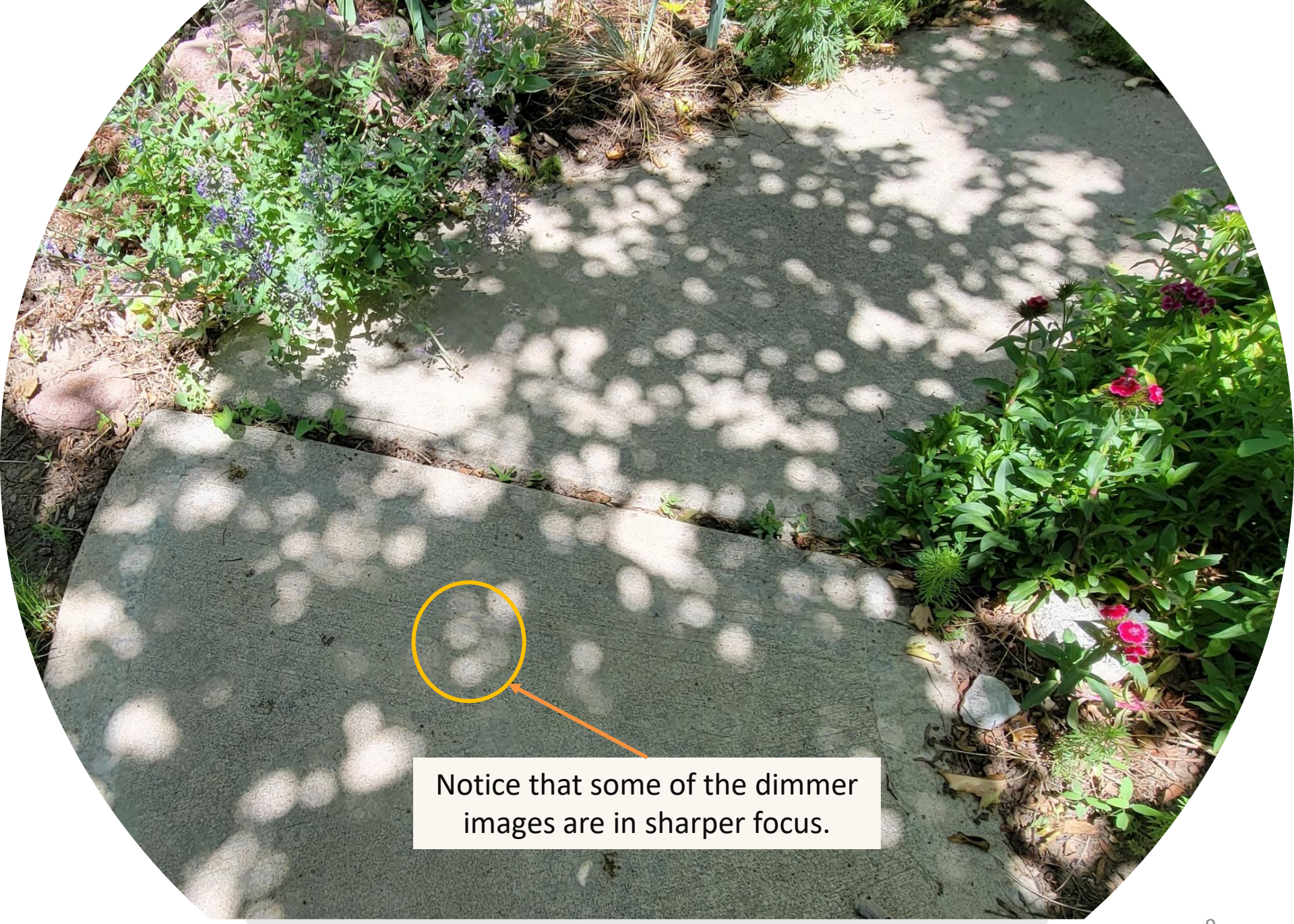


The images of the Sun come in all sizes and may be more round or more oval-like depending on the angle between the incoming sunlight and the projection surface.

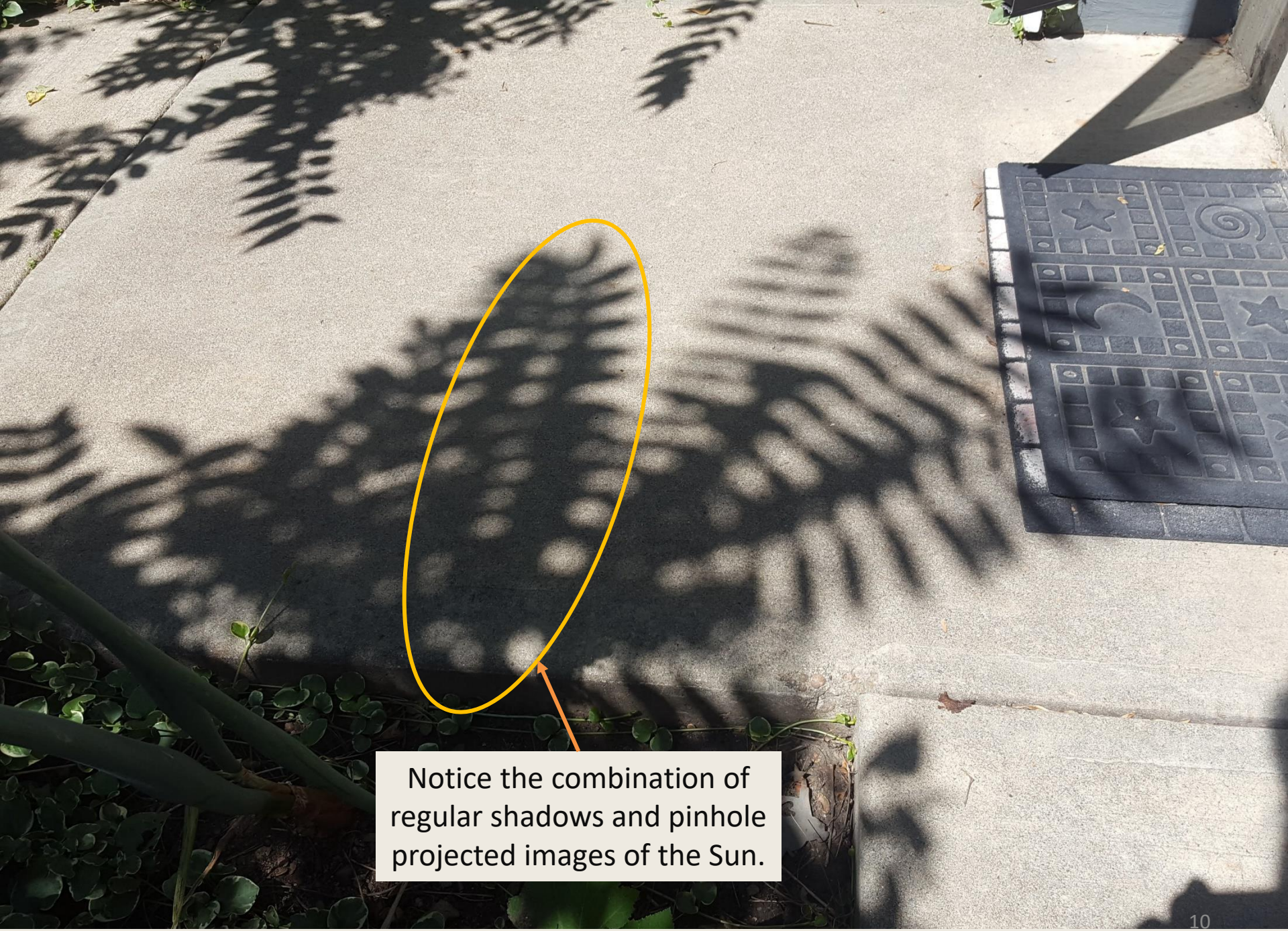
During solar eclipses it is easier to tell that we are seeing real images of the Sun.

Gaps between tree leaves make wonderful pinhole image displays as the Moon eclipses the Sun.

Upper left image by Cantavestrella. See Credits & Acknowledgements for other photo credits.



Images of the round Sun projected on a sidewalk as midday sunlight passes through the small gaps between leaves of a tree



Images of the round Sun projected on a sidewalk as sunlight passes through the small gaps near the base of fern-like leaves.

Notice how much larger these images are beneath the tall Ponderosa Pine trees.

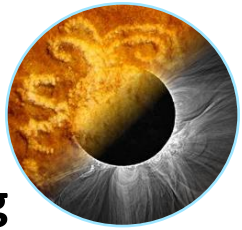
Images of the Sun projected on the snow as low-angle sunlight streams through gaps among the pine needles

Morning & evening are great times to see pinhole images of the Sun on vertical surfaces. Why?

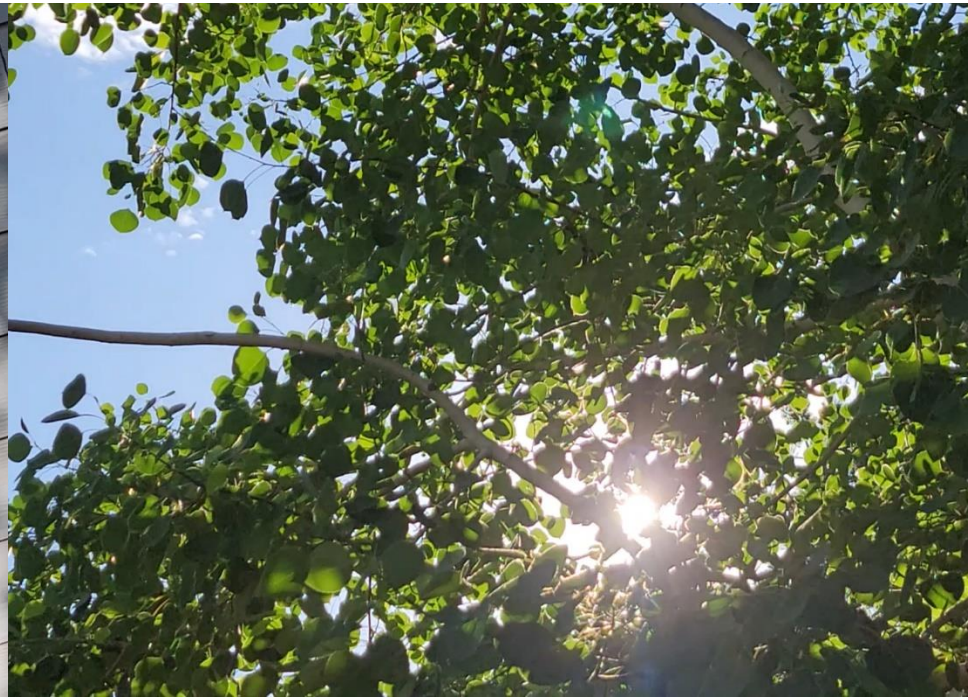
Images of the round Sun projected on a fence as morning sunlight passes through the small gaps between leaves of a tree

Images of the round Sun projected on a building as morning sunlight streams through small gaps between leaves of a tree

Pinhole Projection of the Sun



Pinhole images of the Sun projected on a building as morning sunlight streams through gaps between the leaves of an Aspen tree.



When the Sun is lower in the sky (early morning and late afternoon) it is easier to see pinhole images of the Sun on a vertical surface.

Pinhole Projection of the Sun

We can also find pinhole images of the Sun INSIDE when sunlight shines through the leaves of a tree or bush outside a window

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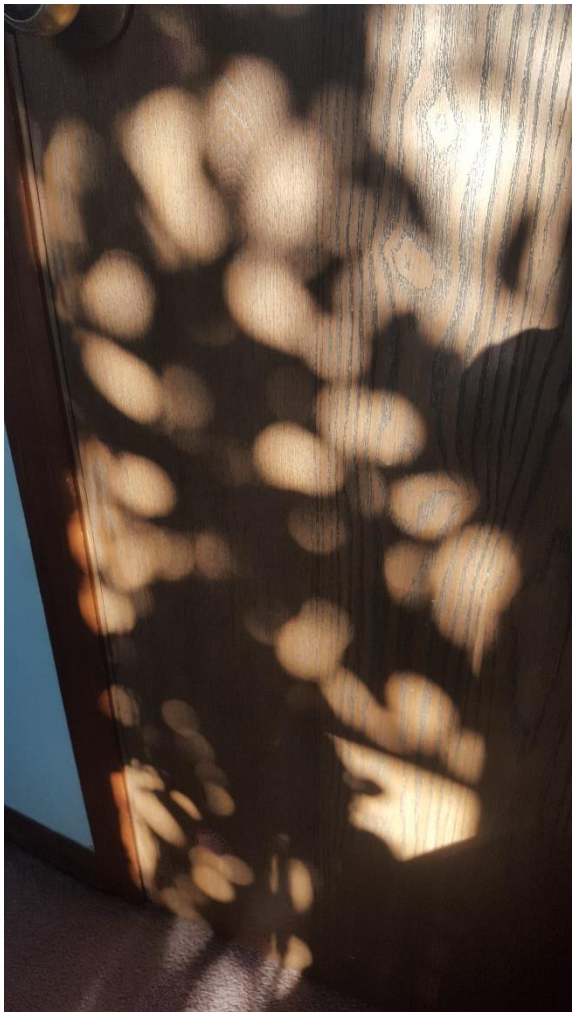

Images of the round Sun projected on a wall as late afternoon sunlight passes through leaves outside a window.

Pinhole Projection of the Sun

Look for pinhole images of the Sun when sunlight passes through the narrow gaps at the edges of window blinds.

These small gaps at the edges of the blinds are long, thin rectangles

But see how perfectly round are the images of the Sun they project on the wall!

Images of the Sun projected on a hotel room wall as morning sunlight passes through gaps at the sides of window blinds.

Pinhole Projection of the Sun

You can also find pinhole images of the Sun as sunlight passes through the tight weave of a straw hat

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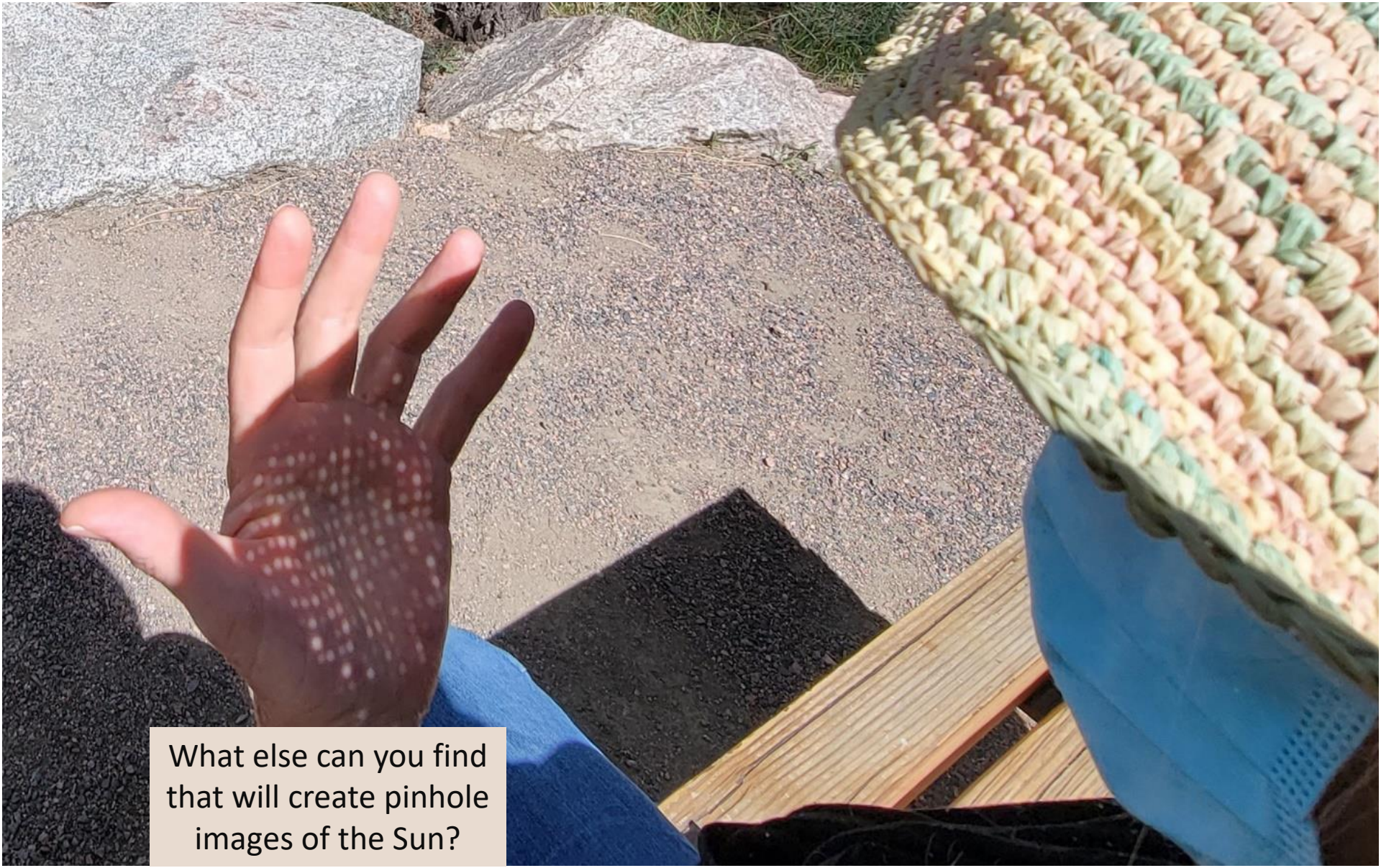
The size and clarity of pinhole images depend on the size of the hole and the distance between the hole and the surface on which the images are projected (in this case CM's hand).



Dozens of pinhole images of the Sun are projected on CM's hand as the Sun shines through the tiny gaps in her straw hat.

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ADDITIONAL INFORMATION

Link for Feedback

Valuable References

Credits & Acknowledgements

Links to PUNCH & PUNCH Outreach Products

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[*Really*] Understanding Pinhole Projection of the Sun

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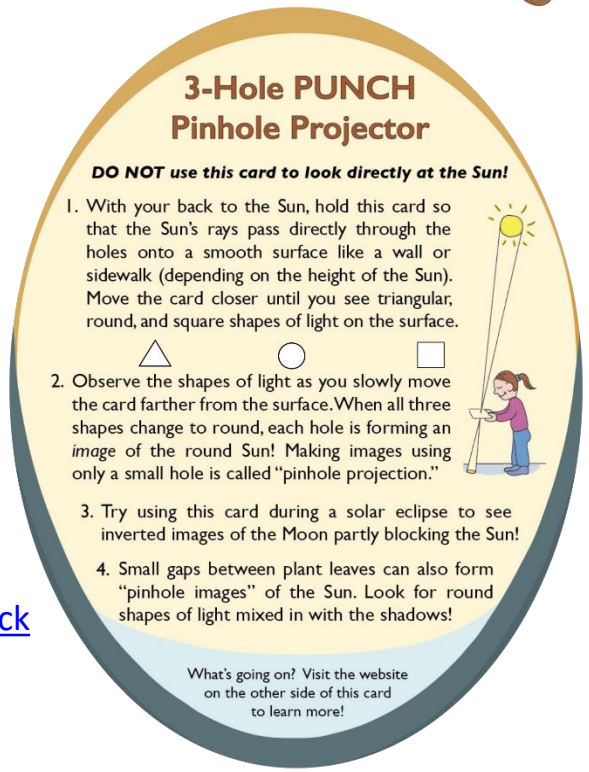

BACK

Valuable References

1. Lenses and Pinholes: What Does “In Focus” Mean?

A brief and clear explanation about what it means to be “in focus”:

https://www.physicsforums.com/insights/lenses-pinholes-focus-mean/

2. How a Pinhole Camera Works (Part 1)

Excellent diagrams:

https://www.scratchapixel.com/lessons/3d-basic-rendering/3d-viewing-pinhole-camera

3. Real image: Collection of focus points made by converging light rays

We love the simple but insightful stick-figure:

https://www.wikiwand.com/en/Real_image

4. Your Eyes See Upside Down and Reversed

Lucid explanation by an eye doctor (MD) relating human eye to a pinhole camera:

https://bceye.com/retinal-image-inverted-reversed/

5. Camera Obscura

The history of this wondrous effect, including reference to a possible paleo-camera:

https://en.wikipedia.org/wiki/Camera_obscura http://paleo-camera.com/archeo-optics/

6. Making, Measuring and Testing the “Optimal” Pinhole

A thorough and playful journey through the technical details of pinhole photography:

https://www.35mmc.com/26/10/2020/making-measuring-and-testing-the-optimal-pinhole-pinhole-adventures-part-3-by-sroyon/

Credits & Acknowledgements

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Briana Ingermann (graphic design, text developer, field testing, procurement of printing, photos)

Mike Zawaski (reviewer/consultant on explanatory presentation, graphic support, photos)

Sanlyn Buxner (head of field testing and evaluation, photos)

Jason Trump, Nina Byers, Geoff Skelton (text reviewer, field testing, reviewer of explanatory presentations)

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Gilly Gilbert (PUNCH Associate Investigator, field tester)

Countless others (who participated in field testing events and gave us their feedback)

Thank you also to our web developer Don Kolinski for posting and updating our work on the PUNCH website.

Please proceed to Section 3:

Exploring Pinhole Projection with Your Own Hands

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