

# FULL STEAM AHEAD

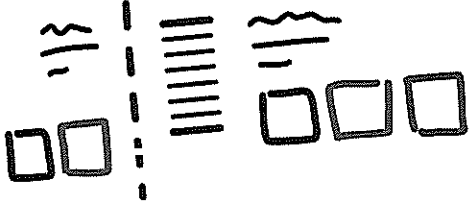
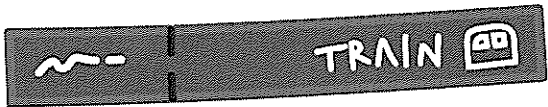
Par Excellence STEM Academy  
STEM Program Monthly Newsletter

# 1.

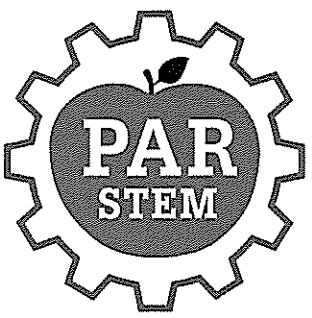
## PROJECT LEAD THE WAY: WHAT ARE WE LEARNING?

For the fourth 9 weeks, Par students are designing solutions to authentic real-world problems with the following themes:

Kindergarten: Living Things  
 1st grade: Light and Sound  
 2nd grade: Prototyping & Design  
 3rd & 4th grades: Earth's Past, Present, & Future  
 5th grade: Ecosystems & Life Cycles  
 6th grade: Cells  
 Dr. Shardell's class: Ecosystems & Life Cycles



**NEXT →**



# 2.

## STEM CLUB NEWS!

At Par Excellence STEM Academy, we believe that:

- STEM is for all
- Barriers to learning are meant to be smashed
- There is a scientist and mathematician in every person.
- STEM and PBL provide essential skills necessary for 21st century careers
- Your race, culture, disability status, gender, socio-economic status, or zip code shouldn't determine your access to a high-quality STEM education

A huge congratulations to Par's very first STEMest! team on their 2nd place award. The team, led by Mr. Blaney, presented at The Works' STEMest! on their research & prototype emphasizing the importance of composting in schools. We are so proud of you Blair, Isaac, & Justin!



# 3.

## SOLAR ECLIPSE FAMILY ACTIVITIES

April 8, 2024 marks a momentous event in Ohio--much of the state will be in the path of totality or near-totality for the solar eclipse. We are all very excited for this once-in-a-lifetime opportunity. How can you enjoy this event as a family?

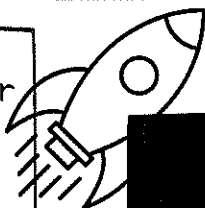
- Students will receive a pair of eclipse glasses the first week in April (more can be obtained from local libraries)
- Attend a local Eclipse event (see attached fliers) or find an outdoor area away from the city.
- Be safe! Be sure to use eclipse glasses or make a pinhole viewer. Sunglasses don't offer enough protection!

## STEM SPOTLIGHT ON DR. SHARDELL'S CLASS

Dr. Shardell's class is focusing on life cycles and species survival. For the month of February, students learned about two types of bees: group bees (i.e. honeybees) and solitary bees (i.e. carpenter bees). Then, they compared advantages and disadvantages of group and solitary life.

Students did independent research on what bees need at each stage of their life cycle, as well as potential dangers to the bee population. Ask your child to make a prediction about what might happen to tonight's dinner if bees were extinct!

Finally, the students created prototypes of bee sanctuaries that protect bees at each stage of their life cycle: egg, larva, & adult.



# 5.

## FOCUS ON PBL: WHAT ARE TEAM & INDIVIDUAL PROJECTS?

PROJECT-BASED LEARNING IS A FORM OF LEARNING WHERE STUDENTS ARE ENGAGED IN DESIGNING SOLUTIONS TO REAL-WORLD PROBLEMS. PBL HAS SEVERAL KEY FEATURES: A DRIVING QUESTION, AN AUTHENTIC PROBLEM, USE OF THE ENGINEERING DESIGN CYCLE, 21ST CENTURY SKILLS, TEAM & INDIVIDUAL PRODUCTS, CROSS-CURRICULAR INSTRUCTION, & PUBLIC PRESENTATION.

To be successful in school, in the community, and in their future careers, students must be able to cooperate in a group, in addition to demonstrating independence and critical thinking skills.

In project-based learning, students not only conduct independent research and demonstrate mastery of content through solo activities, they work in cooperative learning teams to brainstorm, design, and test solutions to a problem and offer feedback to teammates.

Through project-based learning, students learn that teamwork often means compromising and working through disagreements. Students also practice incorporating everyone's strengths and ensuring everyone in the group is heard and acknowledged as an essential member of the team.



(<https://attheworks.org>)



Welcome! The Works is open Tues-Sat, 9 AM to 4 PM.

([https://attheworks.org/events\\_posts/holiday-homecoming/](https://attheworks.org/events_posts/holiday-homecoming/))

# BUCKEYECLIPSE

Learn the science behind the Eclipse!

**Date:**

2024-03-27

**Time From:**

6:00 pm

**Time To:**

7:00 pm

**Cost:**

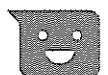
Free

**Ages:**

Teens & Adults

**Location:**

SciDome





Join fellow Buckeyes for a family-friendly evening of planetarium shows to celebrate a once-in-a-lifetime experience: the 2024 total solar eclipse! During this special event, representatives of Ohio State's astronomy department will guide audiences through interactive shows in the SciDome planetarium at The Works. You'll learn what to expect during the eclipse and the science behind what you will see in the path of totality on April 8.

Wednesday, March 27 | 2 shows! 6 PM & 7 PM | Teens & Adults

***Free, Registration required***

Register for the 6 PM Show

(<https://sales.attheworks.org/PatronEducation.aspx?pid=1372&cal=https%3a%2f%2fsales.attheworks.org%3a443%2fcalendar.aspx>)

Register for the 7 PM Show

(<https://sales.attheworks.org/PatronEducation.aspx?pid=1373&cal=https%3a%2f%2fsales.attheworks.org%3a443%2fcalendar.aspx>)



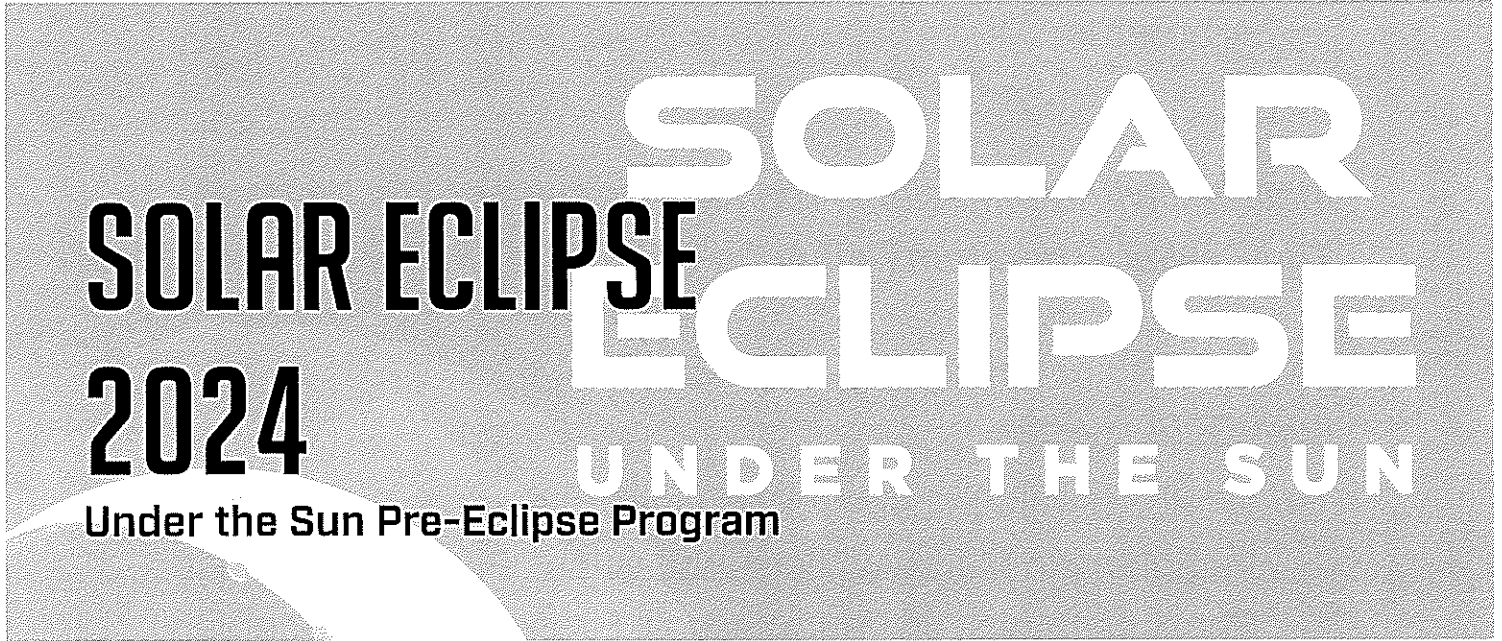


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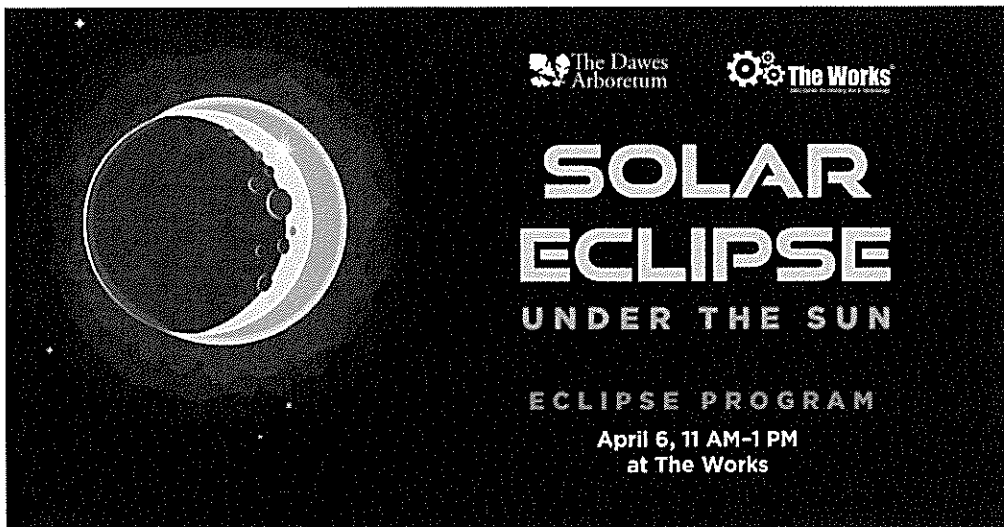
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## An Astronomical Event!

Learn about the eclipse before the big day! Join The Works and The Dawes Arboretum as we explore this awesome astronomical event. Kids and families can enjoy loads of hands-on activities, space programming, and a science kit giveaway. You're sure to feel like an astronomer before the day is over!



The Works and The Dawes Arboretum are partnering to celebrate the solar eclipse!

- April 6 – Program, 11 AM – 1 PM at The Works
- April 8 – Eclipse Viewing, 2 PM – 4 PM, at The Dawes Arboretum

***Included with Admission/Free for Members of The Works & The Dawes Arboretum / All Ages***

**Important Notes:**

- Works members can pick up viewing glasses, 1 per family, beginning in March while supplies last. Please see Guest Services to pick up your glasses. First-come, first-served.
- The Dawes Arboretum will also supply viewing glasses at their event while supplies last.
- **The Works museum will be closed on Monday, April 8.**
- As a reminder, eye protection is required to view the eclipse. Looking at the sun without special protection will likely result in severe eye injury. Eclipse glasses and viewers should meet the ISO 12312-2 international safety standard.

*The Dawes Arboretum is located at 7770 Jacksontown Rd, Newark, OH 43056. Please visit their event page for more about their event on the day of the eclipse, Monday, April 8.*



# Eclipse Pinhole Viewer

Age: 6 +

Activity Time: 5 min

Prep Time: 10 min

Safely Observing a Solar Eclipse

## Summary

Solar eclipses are an amazing sight to witness! However, looking directly at the Sun can cause serious damage to your eyes. Solar eclipse glasses (which are very different from sunglasses) and welding glasses are two ways to be able to safely look at the Sun during a solar eclipse, but these are not always available. Fortunately, anyone can observe a solar eclipse safely by making a pinhole viewer to project the image of the Sun onto a flat surface. This activity outlines how to make a simple pinhole viewer using household items.

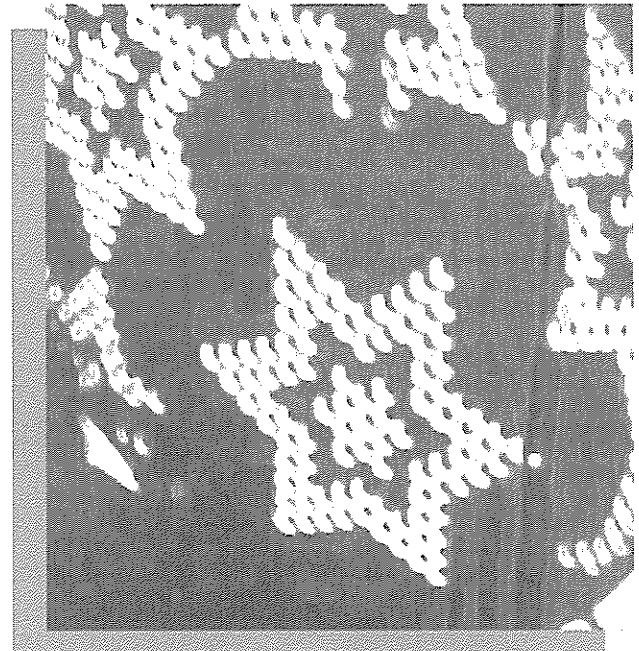
## Objectives

- Participants learn the importance of Sun safety! Never look directly at the Sun without the aid of solar eclipse glasses or similar apparatus and how to identify those.
- Participants learn about simple optics and the path of light.
- Participants learn the basics of solar eclipses.
- Participants can use their creativity to make a working pin hole viewer to use on eclipse day.

## Materials

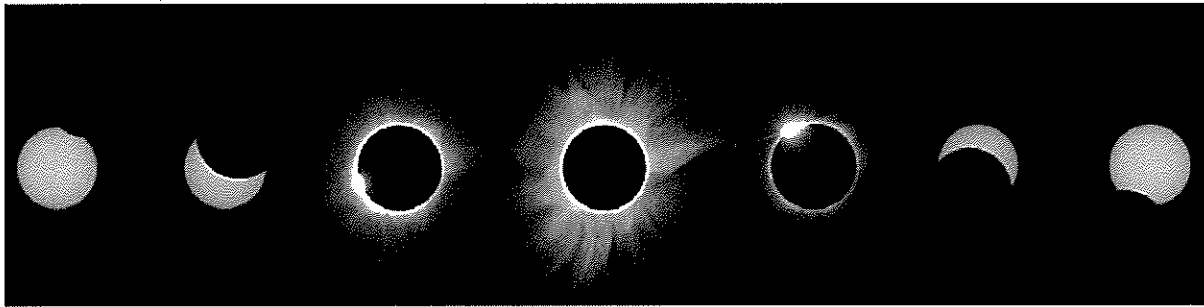
### Materials Needed (per student)

- 1 sheet construction paper or cardstock
- Aluminum foil
- Scissors
- Push pin
- Tape
- Optional: white paper



**WARNING:** Never look directly at the Sun through the pin hole viewer! To avoid damaging your eyes, look at the image of the Sun projected onto a flat surface (facing away from the Sun) and never directly through the hole at the Sun.

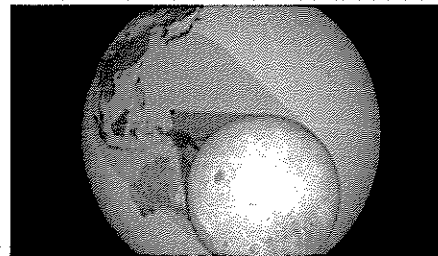
## SCIENCE BACKGROUND



Phases of a total solar eclipse, Credit: Justin Ng

A solar eclipse happens at a specific location on the Earth's surface when the Moon passes in front of the Sun, obscuring it. It is an amazing fact that while the Sun is 400 times bigger than the Moon, the Sun also happens to be about 400 times further away from us than the Moon. This means that the Sun and the Moon appear about the same size to us in the sky.

	Diameter	Distance from Earth
<b>Sun</b>	1.4 million kilometers 864,600 miles	150 million kilometers 93 million miles
<b>Moon</b>	3,500 kilometers 2,200 miles	384,400 kilometers 238,900 miles
<b>Ratio</b>	~400:1	~400:1



Penumbral and umbral shadows on Earth  
Credit: Ernie Wright, NASA Visualization Studio

Because the Sun is so large in diameter, the light emitted from one edge of the disk of the Sun arrives at Earth at a slightly different angle than the light coming from the other edge. This difference in angles means that some sunlight is able to leak into the shadow of the Moon. This partially darkened part of the shadow is called the **penumbra**. This light does not leak into a small region in the center of the shadow, which is called the **umbra**. Locations in the penumbral shadow of the Moon experience a partial solar eclipse and places in the umbral shadow experience a total solar eclipse. During a total solar eclipse, the Moon's shadow sweeps across the face of the Earth and everywhere on the **path of totality** will experience a partial solar eclipse leading up to and winding down from the total solar eclipse.

A pinhole viewer is one of the oldest and simplest optical devices, and can be used to observe an eclipse. The image of the sun is projected onto a surface behind the small hole as light rays from the top of the eclipse are relayed to the bottom of the

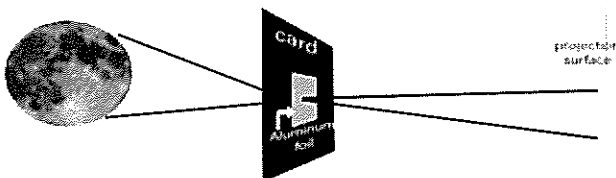
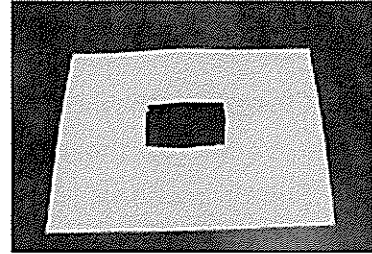


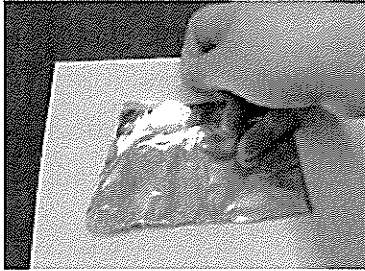
image and light from the bottom of the eclipse creates the top of the image. So the eclipse you see projected is actually upside-down, but because the crescent of the Sun is vertically symmetrical, this effect is not noticeable.



1. Starting with either a full or half-sheet of cardstock, cut a ~1 inch rectangular hole in the center. This will form the window for the aluminum foil.

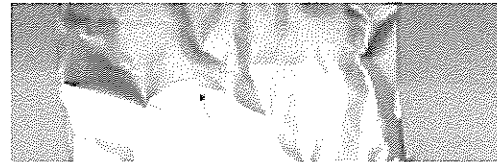
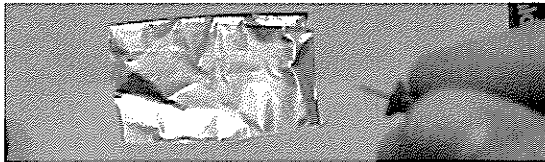


2. Cut out a rectangle of aluminum foil that is a little bit larger than the window you just cut out.

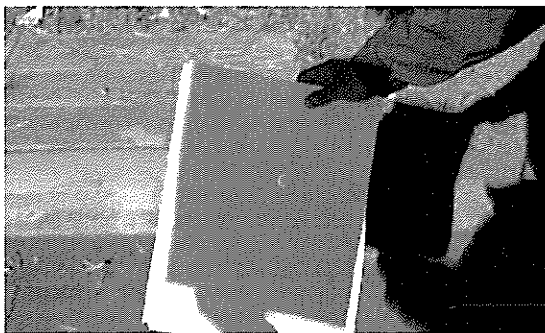


3. Use four pieces of tape to secure each edge of the aluminum foil onto the cardstock. This will become the "back" of the pinhole viewer.

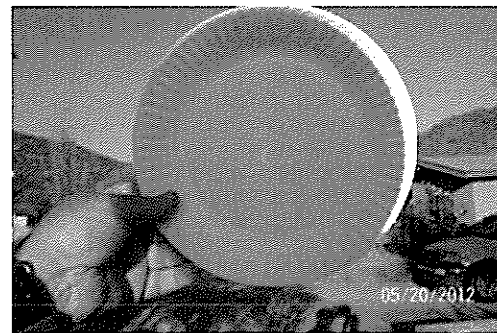
4. Using a pushpin or tack, make a small hole in the center of the aluminum foil. Aluminum foil is used here because it tends to form a very circular hole with smooth edges, so try not to move the pin around too much as you make the hole.



5. Go outside during bright daylight and practice lining up the Sun with the pinhole viewer. You will want to put a white piece of paper a few feet behind the viewer, or project the Sun's image onto a smooth surface like concrete. *Be sure not to look at the Sun!* When looking at the image of the Sun, the Sun will be behind you. When you use the pin hole viewer during an eclipse, you will see a crescent of the Sun like the ones below.



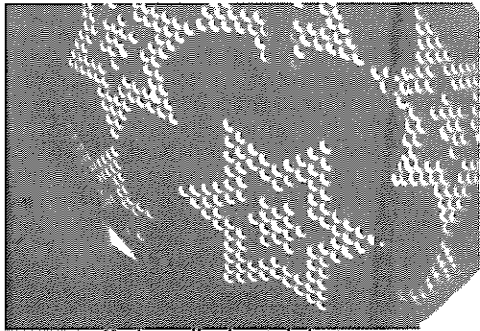
Credit: Eugene Kim



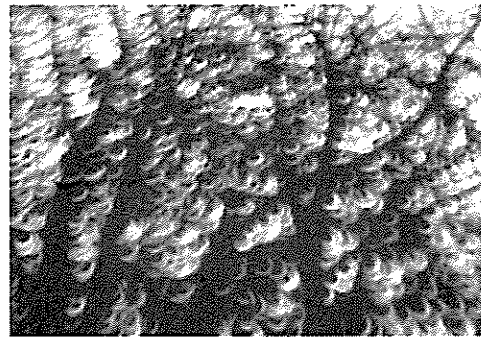
Credit: Dave Pool

More Fun Options:

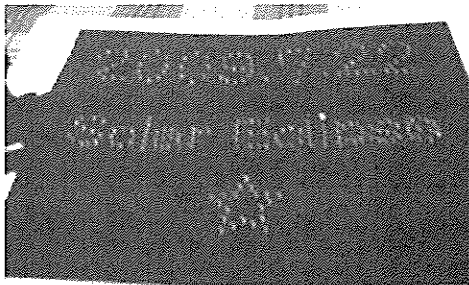
One pin hole will give you one perfect projected image of the Sun, but you don't have to stop there! You are free to make more pinholes, creating a series of little Sun projections. Make a design, write your name - the possibilities are limited only by your imagination! In fact, any object with small holes can be used as a pin hole viewer. Collanders can make great pin hole viewers! In fact, the small regions of light that pass between the leaves of a deciduous tree can make a slew of solar projections - that's why those little dappled bits of light are circular (like the disk of the Sun). The next time you're lounging under a tree - see for yourself! During a partial solar eclipse, those circles turn to crescents. Finally, the ultimate DIY pinhole viewer is just your two hands overlapping so that small amounts of light pass through your fingers.



Kitchen collander pin hole viewer,  
Credit: John Louie



Leaves creating pin hole projections



Message written in pin holes  
Credit: National Astronomical Observatory of Japan



Making a pin hole viewer with your fingers,  
Credit: Ellie's Enormous Elevator



Image credit: Lisa Kunze

Watch a video tutorial of this activity on YouTube:

**<http://bit.ly/MakingAPinHoleViewer>**

Find out more by watching our solar magnetism webcast:

**<http://bit.ly/Webcast5-ObservingTheEclipse>**

 [www.nso.edu/eclipse2017](http://www.nso.edu/eclipse2017)

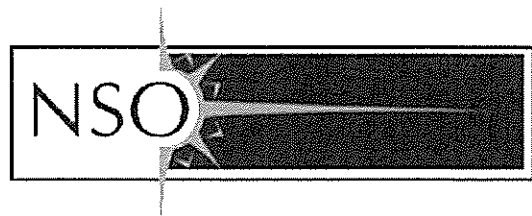
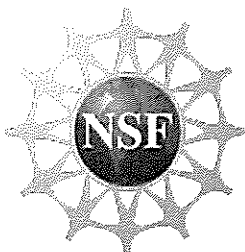
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