



### **Bending Light Description:**

Explore how engineers “bend light” to make computer chips! Photolithography is a process used to put a specific pattern on a chip before etching. Photo means light and lithography means printing, so in photolithography you are printing with light. It is easy to see how this process works with a pair scissors, a paper plate, and flashlight. Engineers use a special mask, which is like a stencil with some dark areas and clear areas, to properly print a pattern onto the chip. The light shines only through the clear areas of the mask onto a wafer or chip.

**Lesson Plan.** Bending Light! Exploring the science behind photolithography

**Grade Level:** 6<sup>th</sup>-8<sup>th</sup>

**Subject:** Science and Technology

### **Materials:**

- Paper plate
- Scissors
- Flashlight
- Magnifying glass (optional)

### **Essential Question:**

1. How is light used in manufacturing semiconductors?

### **Before viewing:**

### **Introduction:**

1. Explain to students that they will be exploring an engineering process called photolithography. Photolithography is used to manufacture semiconductors by using light to print onto a wafer or chip.

- a. Ask students if they have ever made hand animals in a dark room with just a flashlight. This is similar to photolithography. Let's see how!

## **Bending Light Experiment**

**Materials needed:** paper plate, scissors, flashlight, magnifying glass (optional)

Set- up Instructions:

1. Distribute materials: paper plate, scissors, flashlight, magnifying glass



## **Conduct Experiment:**

1. Draw a block letter "E" (about as long as your finger) in the middle of a paper plate, and cut it out (you will need to make a straight cut from the edge of the plate to get to the E, that's ok).
2. Shine a flashlight through the paper plate onto the wall or floor and observe the resulting stencil. Is the "E" bigger or smaller than what you cut out of the plate? Can you change the size of the "E" by moving the flashlight?
3. (Optional) If you have a magnifying glass, place it in the pathway of the paper plate and flashlight. You will need an extra person to hold the magnifying glass for you. Now experiment with the position of the flashlight and magnifying glass.
  1. How big can you make the "E"?
  2. How small can you make it?
  3. Could you get the "E" to flip?

## **Reflective Discussion:**

1. Ask students to explain what happened when the light went through the magnifying glass?
2. Explain to them that the lenses are curved (convex) and made of glass. When light travels through the air, and then travels through the glass, the rays of light bend to create a much smaller image on the chip. This is known as refraction.
3. Using the magnifying glass in the activity shows how the rays of light bent to create a smaller image.
4. How does this experiment relate to making hand puppets in the dark with a flashlight?