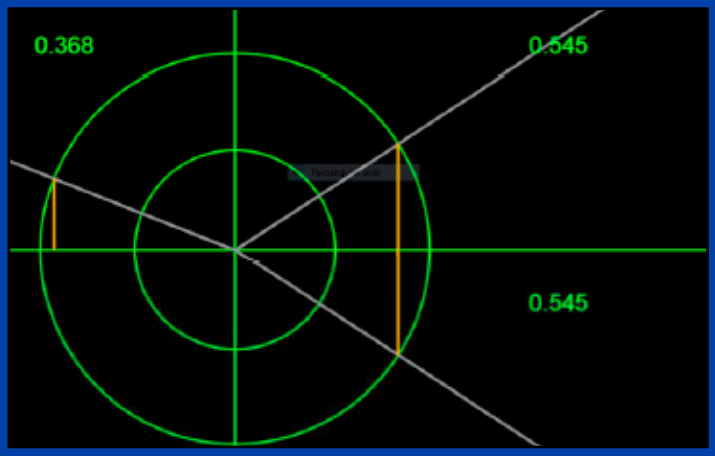
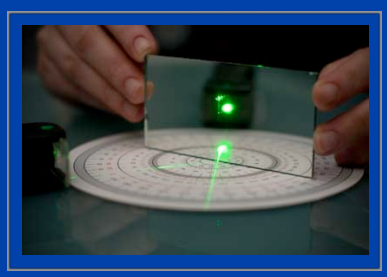
LASER CLASSROOM

Uncovering the Laws of Reflection and Refraction





A web based app is used to collect data with real lasers so that students can uncover the laws of reflection and refraction by observing patterns.

CREATED BY:

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Laws of Reflection and Refraction

Overview

Using a web based App, students collect data to uncover patterns that reveal the laws of reflection and refraction.

Time: 30-45 minutes
Grades: 9-12

Materials

- Laptop or tablet computer with Internet
- Green Laser Blox with line generating lens
- A semi-circular acrylic lens
- A piece of tracing paper
- Screen safe re-stickable glue - available at Amazon - **http://tinyurl.com/prayzof**

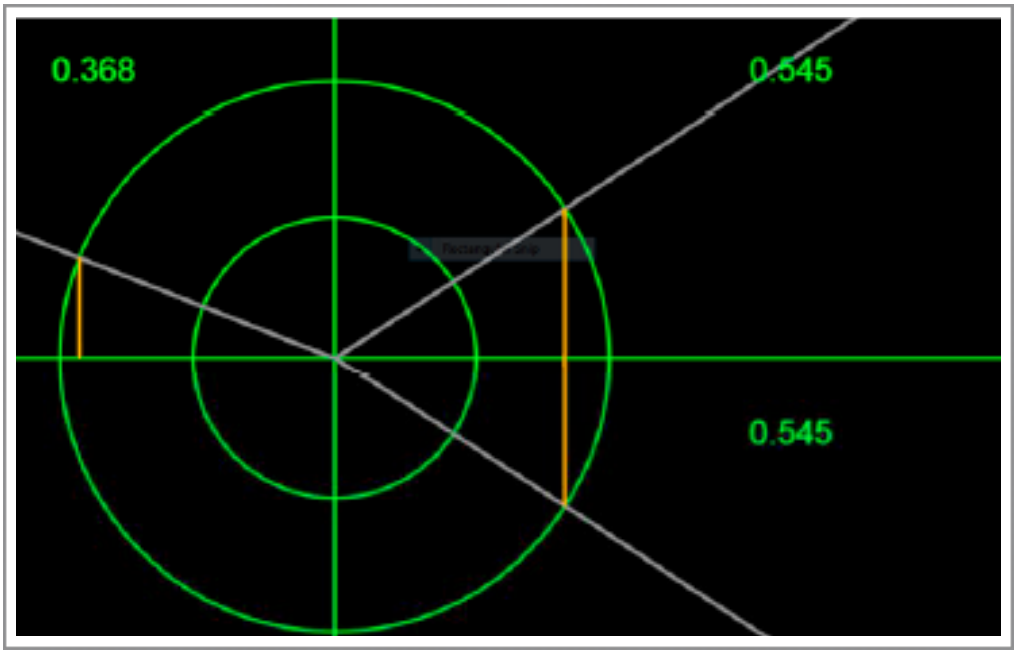
Discussion and Background

Once data are collected, students will see that the semicord of the reflected beam is always equal in length to the semicord of the incident beam. This is the law of reflection.

But the 10th−century Persian mathematician and physicist Ibn Sahl also found a relationship between the lengths of the incident and transmitted semicords. As students search for this relationship, have them keep in mind that thier measurements might not be perfect, and some might need to be repeated - this is an excellent lesson in accuracy and precision. The relationship students will discover is called the law of refraction.

Observing and Investigating

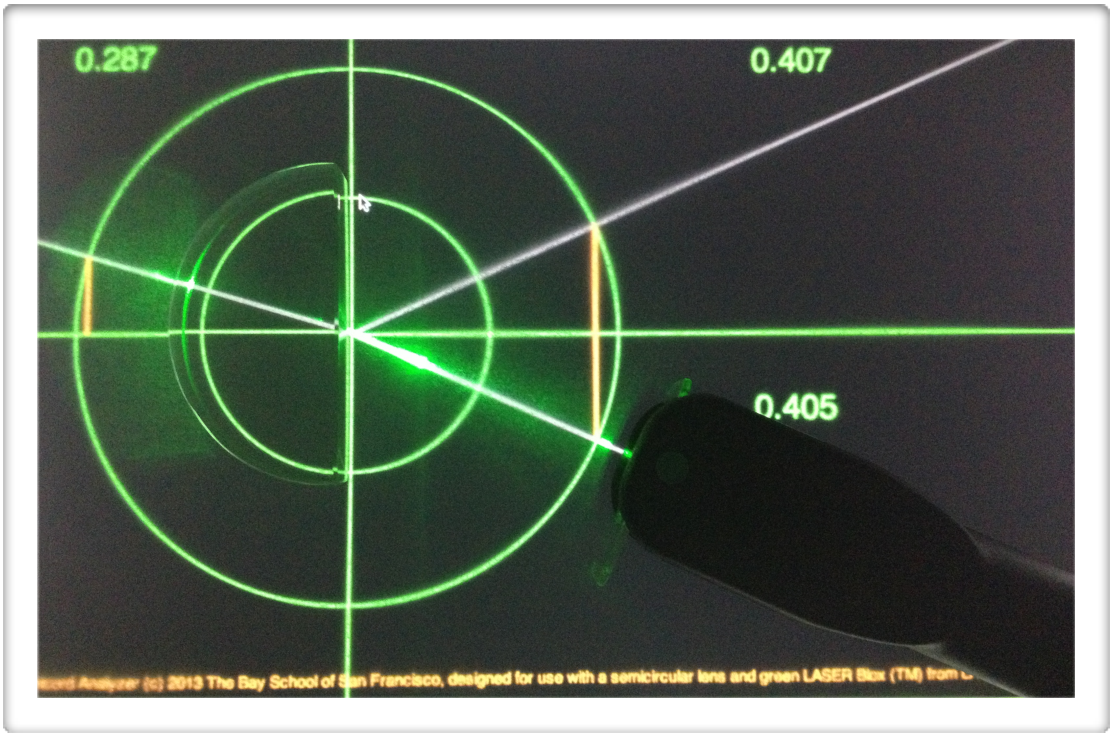
1. Launch the computer's web browser and enter the url http://tdev.ly/ddmj There you will find the image below.



2. Spot the corners of the tracing paper with a very small amount of "re-stickable" glue (available at Amazon - **http://tinyurl.com/prayzof)**. If you are using a tablet, place the computer on a level surface. If you are using a laptop, open the lid so the screen is horizontal. Carefully place the tracing paper on the computer screen and adjust the paper until it covers the webpage - NO WRINKLES PLEASE!

3. Spot a bit of re-stickable glue on the frosted side of the acrylic lens and place the lens on the tracing paper so the flat side of the lens lies just slightly to the left of the vertical green line, the lens sliced very nearly in half by the horizontal green line.

4. Insert the line generating lens into the *LaserBlox*™ and direct the beam line at the center of the flat side of the semicircular lens, starting from somewhere in the lower right-hand quadrant of the coordinate system. By dragging, move the gray line so it lies directly below the beam line (**the incident beam**) If you are using a touch-screen device, move the gray line by touching the tracing paper and sliding your finger gently across the surface of the paper.



5.If the room lights are low enough, you should be able to see the reflected beam quite easily in the upper right hand quadrant. Move the gray line in that quadrant so it is directly below the reflected beam. Finally, move the gray line in the upper-left hand quadrant so it is directly below the beam that passes through the lens (**the transmitted beam**).

NOTE: if you are having difficulty making aligning the gray lines with all three beams, check to make sure the semicircular lens is positioned properly.

6. Record the three numbers that appear on the screen. The program calculates these numbers by dividing the length of each of the three orange line segments (***the three semicords***) by the radius of the outer circle.

Student Data Sheet

Aim the incident beam at the origin of the coordinate system from as many different locations in the lower right quadrant as you have time for. Tabulate your data as follows.

Incident Semicord	Reflected Semicord	Transmitted Semicord

Looking at your data, can you see that the semicord of the reflected beam is always equal in length to the semicord of the incident beam? This is the law of reflection. But the 10th−century Persian mathematician and physicist Ibn Sahl also found a relationship between the lengths of the incident and transmitted semicords. As you search for this relationship, keep in mind your measurements might not be perfect, and some might need to be repeated. The relationship you are trying to discover is called the law of refraction.