Curiosity Guide #302
Sound Resonance

Accompanies Curious Crew, Season 3, Episode 2 (#302)

Resonant Imaging Tubes

Investigation #9

Description

Use sound waves to make light patterns!

Materials per Imaging Tube

- Laser pointer
- 11-inch balloon
- 2 rubber bands
- Two-sided tape
- Small mirror, plastic preferred
- 6-foot length of one-half-inch PVC pipe
- Two 90-degree, one-half-inch PVC
- Three PVC T-joints in one-half-inch size
- 3-inch diameter PVC
- Hacksaw
- Metal file
- Pliers
- Goggles
- Electrical tape
- Measuring tape
- Marker

Procedure

1) Cut the neck of the balloon and discard.
2) Cut the 3-inch-diameter pipe to 4 inches in length, using the saw.

3) Use a metal file to get off the burrs.
4) Stretch the balloon over one end of the pipe. Secure with a rubber band. This is the membrane.
5) Using the pliers, snip off a 1-centimeter square piece of mirror. Tape the mirror on the membrane, using double-sided tape. The mirror should be positioned between the center of the membrane and the edge of the pipe.
6) Cut the following lengths from the one-half-inch PVC pipe:
    a. Two pieces that are 3 centimeters
    b. 1 piece that is 5 centimeters
    c. 3 pieces that are 12 centimeters
    d. 2 pieces that are 50 centimeters
7) Arrange the parts so that the 12-centimeter parts feed into a T joint, continue to the 50 centimeter parts, to an elbow, to a 3-centimeter part.
8) Connect the two halves with a 5-centimeter length between the two T joints, and place a third T joint between the two 3-centimeter parts.
9) Add the last 12-centimeter part in the open remaining T joint.
10) The joints should fit snugly.
11) Place the 3-inch pipe in the space on the open end. The membrane should face the rest of the pipes. The mirror should be positioned toward the top of the membrane.
12) Wrap the three rubber bands around the PVC outside pipes and the large 3-inch pipe.
13) Slide the end of the laser pointer in the 12-centimeter tube. Make sure the laser pointer is snug. You may have to wrap electrical tape around it to keep it snug.
14) Turn on the laser. Never point it in someone's eyes.
15) Adjust the laser so that it hits the piece of mirror on the membrane.
16) Hold the Imaging Tube so that it faces the wall. Make noises in the open part of the tube.

17) What patterns do you notice on the wall? Try the same thing with the lights off. What do you see?

My Results

Explanation

The Resonant Imaging Tube makes patterns as a result of the vibrating balloon membrane. Sound is produced in the large tube. The sound causes the air molecules in the tube to vibrate and collide with the membranes, causing the membrane to wiggle, too. As the membrane moves, it also moves the mirror, which reflects the laser light in side-to-side and up-and-down patterns. You may possibly be able to see how the different resonant frequencies appear as standing waves, or dancing peaks and valleys. If you move further away from the wall, the image will also appear larger. Hold it up to a radio speaker and see what resonant patterns you can observe.

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