

Laser Maze

Overview: Did you know that the word LASER stands for Light Amplification by Stimulated Emission of Radiation? Most lasers fire a monochromatic (one color) narrow, focused beam of light, but more complex lasers emit a broad range of wavelengths at the same time. By using lenses and mirrors, you can bounce, shift, reflect, shatter, and split a laser beam. Since the laser beam is so narrow and focused, you'll be able to see several reflections before it fades away from scatter.

What to Learn: Light has a source and travels in a direction. The angle of reflection of a light beam is equal to the angle of incidence.

Materials

- laser (A key-chain laser works great. Do NOT use green lasers, which can only be used outdoors.)
- large paper clips
- brass fasteners
- index cards
- small mirrors (mosaic-type work well)
- hot glue gun (optional)
- tape
- dry ice (optional)

Experiment

1. Open each paperclip into an "L" shape.
2. Insert a brass fastener into one U-shape leg and punch it through the card.
3. Hot glue (or tape) one square mirror onto the other end of the L-bracket.
4. Your mirror should be able to rotate. Do this with each mirror.
5. Turn down the lights.
6. Turn on the laser and adjust the mirrors to aim the beam from one mirror on to the next.
7. Take your laser with you into a steamy bathroom (which has mirrors!) after a hot shower. The tiny droplets of water in the steam will illuminate your beam. (*Psst! Don't get the laser wet!*)
8. If you have carpet, shine your laser under the bed while stomping the floor with your hand. The small particles (dust bunnies?) float up so you can see the beam. Some parents aren't going to like this idea, sooo....
9. Have an adult drop a chunk of dry ice (using gloves!) into a bowl of water and use the fog to illuminate the beam. The drawback to this is that you need to keep adding more dry ice as it sublimates (goes from solid to gas) and replacing the water (when it gets too cold to produce fog).

10. Draw a diagram of your laser maze and label all the different parts. How many mirrors can you get it to reflect off of?

Reading

In 1917, Einstein figured out the basic principles for the LASER and MASER (a laser beam with wavelengths in the microwave part of the spectrum) by building on Max Planck's work on light. It wasn't until 1960, though when the first laser actually emitted light at Hughes Research Lab. Today, there are several different kinds of lasers, including gas lasers, chemical lasers, semiconductor lasers, and solid state lasers. Some of the most powerful lasers ever conceived are gamma ray lasers (which can replace hundreds of lasers with only one) and the space-based X-ray lasers (which use the energy from a nuclear explosion) – neither of these have been built yet!

Gas lasers pump different types of gases to get different laser colors such as the red HeNe (Helium-Neon laser), the high-powered CO₂ lasers that they can melt through metal, the blue-green argon-ion, the UV lasers that use nitrogen, and the metallic-gas combination such as He-Ag lasers (helium and silver) and Ne-Cu (neon and copper) which emit a deep violet beam.

But what about lasers used every day? The lasers we're going to be using are semiconductor lasers that use a small laser diode to emit a beam. They are the same lasers that are in the grocery store scanners, pen laser pointers and key chain lasers. Usually a class I or II laser, these pose minimal safety risk and are safe to use in our experiments.

Exercises

1. The word LASER is actually an acronym. What does it stand for?
2. What type of laser did we use in our experiment?
3. Why can't we see the laser beams without the help of steam, dirty carpet, etc.?

Answers to Exercises: Laser Maze

1. The word LASER is actually an acronym. What does it stand for? (Light Amplification by Stimulated Emission of Radiation)
2. What type of laser did we use in our experiment? (semiconductor laser)
3. Why can't we see the laser beams without the help of steam, dirty carpet, etc.? (Our eyes are tuned for green light, not red.)