

Laser Light Show

Overview: What happens when you shine a laser beam onto a spinning mirror? In the Laser Maze experiment (#30), the mirrors stayed put. What happens if you took one of those mirrors and moved it really fast?

What to Learn: Light is reflected from mirrors and other surfaces.

Materials (per lab group)

- AA battery pack with AA batteries
- 1.5-3V DC motor
- keychain laser pointer
- clothespin
- round mirror
- two alligator clip leads
- gear that fits onto the motor and has a flat side to attach to the mirror
- 5-minute epoxy (don't use hot glue – it's not strong enough and you'll have sharp mirrors flying off a high-speed motor)

Experiment

1. Insert the batteries into their case.
2. Make sure the wire leads do not touch each other!
3. Attach the alligator clips to the wires by grabbing the metal tip of the wires with the teeth of the matching alligator clip.
4. Use hot glue or epoxy to secure the gear onto the round mirror.
5. Press-fit the gear-mirror onto the shaft when the glue is dry.
6. Make the motor spin using the alligator clips and the battery case. Do this by attaching the remaining ends of the clips to the metal tabs on the back of the motor – one on each tab.
7. Turn down the lights and fire up the laser, aiming the beam onto the motor.
8. You can use the clothespin to keep the laser turned on. It also acts as a stand for the laser to free your hands even more.
9. Shine the reflection somewhere easy to see, like the ceiling.
Once you've got this working, add a second mirror like you did in the Laser Maze experiment. Work with another lab group and put your setup next to each other so you can utilize their motor-mirror assembly with your laser.

Laser Light Show Data Table

Motor Configuration <i>(Is the mirror spinning clockwise or counter-clockwise? Are you pulsing the motor on and off? Is the motor going fast or slow?)</i>	What did the laser beam do (or look like) when reflected off the motor's mirror?

Reading

It turns out that a slightly off-set spinning mirror will make the laser dot on the wall spin in a circle. Or ellipse. Or oval. And the more mirrors you add, the more spiral-graphic-looking your projected laser dot gets.

This experiment works because of imperfections: The mirrors are mounted off-center, the motors wobble, the shafts do not spin true, and a hundred other reasons why our mechanics and optics are not dead-on straight. And that's exactly what we want – the wobbling mirrors and shaky motors make the pretty pictures on the wall! If everything were absolutely perfectly aligned, all you would see is a dot.

Exercises

1. How does the mirror turn a laser dot into an image?
2. What happens when you add a second motor? Third?

Answers to Exercises: Laser Light Show

1. How does the mirror turn a laser dot into an image? (Refer to Background Reading.)
2. What happens when you add a second motor? Third? (You increase the wobble and get spiral-graphic images.)