



# How to Turn a Cheap Laser into Hours of Hands-On Science Activities

by Aurora Lipper, *Supercharged Science*

*This article teaches kids about lasers and gives a handful of totally fun (and safe) experiments to do with lasers. It's also good for boy scouts working on a badge, or for any kids that love science experiments. These experiments are part of a Light & Laser science workshop that I teach during our summer Supercharged Science Camp in San Luis Obispo.*

**What is light?** Imagine tossing a rock into a still pond and watching the circles of ripples form and spread out into rings. Now look at the ripples in the water... notice how they spread out. What makes the ripples move outward is *energy*, and there are different kinds of energy, such as electrical (like the stuff from your wall socket), mechanical (when you shove someone), and others.

**Light is like the ripples.** Notice the waves are not really moving the water from one side of the pond to the other, but rather move energy across the surface of the water. To put it another way, energy travels across the pond in a wave. Light works the same way – light travels as energy waves. Only light doesn't need water to travel through the way the water waves do... it can travel through a vacuum (like space).

**Depending on the material, light can change speeds**, just like sound vibrations can. Think of how your voice changes when you inhale helium and then try to talk. The "speed limit" of light is 186,000 miles per second – that's fast enough to circle the Earth seven times every second, but that's also inside a vacuum. You can get light going slower than you can walk by aiming it through different gases. In our own atmosphere, light travels slower than it does in outer space.

**What is a LASER?** The word "LASER" stands for **Light Amplification by Stimulated Emission of Radiation**. A laser is an optical light source that emits a concentrated beam of photons. Lasers are usually monochromatic – the light that shoots out is usually one wavelength and color, and is in a narrow beam. By contrast, light from a regular incandescent light bulb covers the entire spectrum as well as scatters all over the room. (Which is good, because could you light up a room with a narrow beam of light?)

**There are over a hundred different types of atoms** on the planet, and they are always vibrating, moving, and rotating. When you add energy to these atoms (think of giving sugar to kids), they really get excited and bounce all over the place. When the atoms relax back down to their "normal" state, they emit a photon (a packet of light). A laser controls the way energized atoms release photons. Lasers "charge" the atoms inside the gas medium.

**Light from an incandescent light bulb emits high energy photons** that bounce all over the place. When you focus the energy into a narrow beam, it's much more powerful than having it scattered all over the place... and that's just what a laser is...a high-energy, highly-focused beam of light...similar to the 'sprinkle' versus the 'jet' setting on a garden hose.

## Laser Experiments



**CDs** Shine your beam over the surface of an old CD or DVD. Does it work better with a scratched or smoother surface?

**Reflection** Shine the laser beam through a flat piece of glass, such as a microscope slide or single-paned window. Can you find the pass-through as well as a reflected beam? Try a clear water bottle with a few drops of milk added in.

**Lenses** If you have an old pair of eyeglasses, pop out the lenses and try one or both in the beam to see the various effects. Try one lens, and then try two in line with each other to see if you can change the beam.

*There's more!* This article is six pages long, so we've put the rest online on our website. Visit this link to read the rest:

[www.SuperchargedScience.com/laser](http://www.SuperchargedScience.com/laser)

As a mechanical engineer, university instructor, private pilot, astronomer, and educator, Aurora Lipper has been helping kids learn science for over a decade. She can teach you how to transform toilet paper tubes into working radios and build laser light shows from tupperware.

