

Who invented the laser?

- [Arthur Schawlow biography](#)
- [Charles Townes biography](#)
- [Bell Labs Historical Contributions](#)

What Is a Laser?

The word laser is an acronym for light amplification by stimulated emission of radiation, although common usage today is to use the word as a noun -- laser -- rather than as an acronym -- LASER.

A laser is a device that creates and amplifies a narrow, intense beam of coherent light.

What is a laser?

Atoms emit radiation. We see it every day when the "excited" neon atoms in a neon sign emit light. Normally, they radiate their light in random directions at random times. The result is incoherent light -- a technical term for what you would consider a jumble of photons going in all directions.

Why are lasers important?

The trick in generating coherent light -- of a single or just a few frequencies going in one precise direction -- is to find the right atoms with the right internal storage mechanisms and create an environment in which they can all cooperate -- to give up their light at the right time and all in the same direction.

What's happening today?

- [Lucent Threw a Party and Everyone Came](#)
- [Bell Labs and Lucent's Contributions to Laser Research](#)

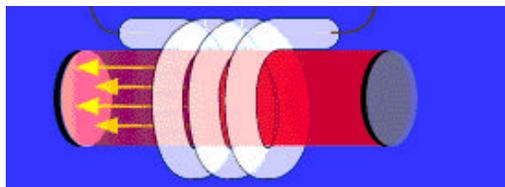
Exciting atoms or molecules

In a laser, the atoms or molecules of a crystal, such as ruby or garnet -- or of a gas, liquid, or other substance -- are excited in what is called the *laser cavity* so that more of them are at higher energy levels than are at lower energy levels. Reflective surfaces at both ends of the cavity permit energy to reflect back and forth, building up in each passage. (See figure below)

Where can I learn more?



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In a ruby laser, light from the flash lamp, in what is called "optical pumping", excites the molecules in the ruby rod, and they bounce back and forth between two mirrors until coherent light escapes from the cavity.

If a photon whose frequency corresponds to the energy difference between the excited and ground states strikes an excited atom, the atom is stimulated as it falls back to a lower energy state to emit a second photon of the same (or a proportional) frequency, in phase with and in the same direction as the bombarding photon.

This process is called *stimulated emission* . The bombarding

photon and the emitted photon may then each strike other excited atoms, stimulating further emission of photons, all of the same frequency and phase. This process produces a sudden burst of coherent radiation as all the atoms discharge in a rapid chain reaction.

Wide range of sizes and uses

First built in 1960, lasers now range in size from semiconductor lasers as small as a grain of salt to solid-state and gas lasers as large as a storage building. The light beam produced by most lasers is pencil-thin and maintains its size and direction over very large distances.

Lasers are widely used in industry for cutting and boring metals and other materials, in medicine for surgery, and in communications, scientific research, and holography. They are an integral part of such familiar devices as bar-code scanners used in supermarkets, scanners, laser printers, and compact disk players.

Bell Labs has made [historical contributions](#) to the development of lasers and that research [continues today](#) at Lucent Technologies and Bell Labs on a variety of communications applications, where lasers are powering commercial lightwave fiber optic communication systems operating at gigabit data rates and experimental systems at terabit data rates.

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