Lasers

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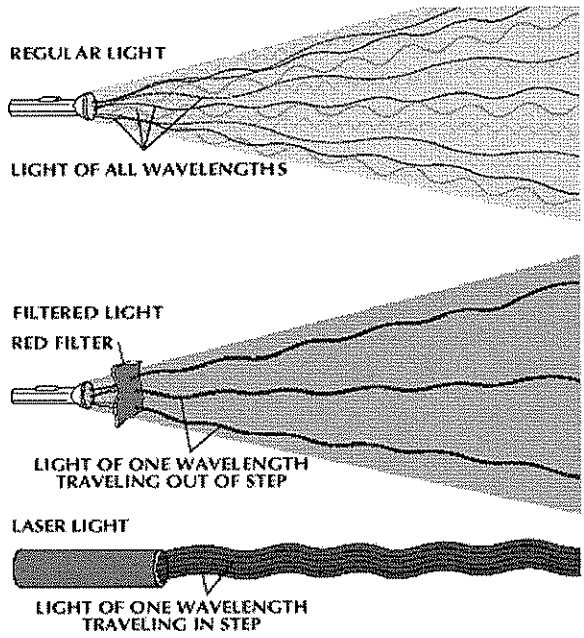
To start, Laser is an acronym that stands for "Light Amplification by the Stimulated Emission of Radiation". The following will give you a good history of the laser, as well as how it works and some of it's standard applications since it's invention just about 50 years ago.

History of the Laser

The laser was first thought up as a concept in the H.G. Wells' famous "War of the Worlds." It was used as a weapon by the invading aliens as a weapon, but no theory was put behind it at this time. A few years later in 1917, Albert Einstein theorized about the concept of "stimulated emission", which would eventually lead to the development of the Laser. After a long period of not much happening in the field of lasers, Charles Townes and Arthur Schawlow created the MASER, which stands for "Microwave amplification by the stimulated emission of radiation." In 1958, these two had theorized about a visible MASER, but had not done any research on it. This same year, Gordon Gould, a graduate student working under the aforementioned, had begun research on this visible MASER. After many failed attempts he had given up, forgetting to patent his idea. This caused many of his ideas to be exploited by other interested in the field. In 1960, Theodore Maiman invented what many called the first optical laser. This had caused many controversies as he was not the original inventor of it per se, Gould was. After years of legal battles, in 1977 Gould had won the patent for the Laser.

Principles Behind the Laser

The idea that makes Lasers different from other light sources is how the photons are produced. In Semi-Conductor Lasers, compounds with a direct band-gap are the most commonly used. In most cases GaAs is used as the lasing material for such lasers. This is because the majority of the electrons are resting in the valence band. When energy equal to the band gap is pumped into the material, the electrons get excited and jump up to the conduction band. When most of the electrons jump to the conduction band, this is known as population inversion. When they come back down to the conduction band, they release a photon. These photons are then reflected back and forth between the mirrors placed at



The reason Lasers are dangerous to look at is because of a parameter of them known as Radiance. Radiance is calculated as:

$$\Re = \frac{\text{Power(watts)}}{A*SDA*\Delta\lambda}$$

Where A is the area of the Laser output, SDA is the solid divergence angle measured in stradians, and $\Delta\lambda$ is the wavelength range of the laser, measured in nanometers. Lasers have a high radiance compared to any light source, which is why they should not be shined into peoples eyes.

Different Types of Lasers

There are four main types of lasers, the major difference being the type of lasing material that is used in the cavity.

1) **Solid State**- There are many types of solid state media that could be used for lasers, however the most commonly found in them is neodymium doped YAG (Yttrium Aluminum Garnet). This type of laser (the YAG) lases in the mid infrared range.
2) **Gas** – This type of laser uses a combination of gasses in the lasing cavity. The most common combination is He-Ne, which emits at a wavelength of 633 nm. Carbon Dioxide lasers are also used and emit a

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