The History of the Laser

A crowd attending a soccer game in Istanbul, Turkey, watches a laser light show.

Welcome to EXPLORATIONS in VOA Special English. I'm Mario Ritter. This week, we tell about one of the most recognizable objects in science fiction — the laser. It is one of the best examples of how technology can go from the science of the future to everyday use in a short period of time. Faith Lapidus and Steve Ember tell us about the history and many uses for the laser.

Laser is short for Light Amplification by Stimulated Emission of Radiation. The idea behind lasers is complex. Just how complex? Consider that it took the mind of Albert Einstein to discover the physics behind the laser.

Figure 1Theodore Maiman with parts of the first laser at Hughes Research Laboratories

Theodore Maiman succeed in building the first working laser in nineteen sixty. Mr. Maiman worked at Hughes Research Laboratories in Malibu, California.

A laser fires a light beam. Before the laser, scientists developed a similar device: a maser which stands for Microwave Amplification by Stimulated Emission of Radiation. A maser is basically

a microwave version of the laser. Microwaves are a form of electromagnetic radiation similar to, but shorter than, radio waves. The best-known use of masers is in highly accurate clocks.

In the nineteen fifties, researchers in the United States and Russia independently developed the technology that made both masers and lasers possible. Charles Townes was a professor at the Massachusetts Institute of Technology in Cambridge, Massachusetts. He and his students developed the first maser.

Russians Nicolay Basov and Aleksandr Prokhorov did their research in Moscow. Their work led to technology important to lasers and masers. The three men received the Nobel Prize in Physics in nineteen sixty-four.

The idea of a thin beam of light with deadly power came much earlier. By the end of the eighteen hundreds, the industrial revolution had shown that science could invent machines with almost magical powers. And some writers of the time were the first to imagine something like a laser.

In eighteen ninety-eighty, H.G. Wells published a science fiction novel called "The War of the Worlds." In it, he described creatures from the planet Mars that had technology far beyond anything on Earth. Among their weapons was what Wells called a "heat ray." Listen to actor Orson Welles describe the weapon in a famous radio broadcast of "The War of the Worlds" from nineteen thirty-eight.

"I shall refer to the mysterious weapon as a heat ray… It's my guess that in some way they are able to generate an intense heat in a chamber of practically absolute non-conductivity. This intense heat they project in a parallel beam against any object they choose, by means of a polished parabolic mirror of unknown composition, much as the mirror of a lighthouse projects a beam of light. That -- That is my conjecture of the origin of the heat ray."

H.G. Wells' description is not too far from the truth. All lasers have several things in common. They have a material that supplies electrons and a power source that lifts the energy level of those electrons. And, as Wells guessed, many lasers have mirrors that direct light.

Laser light is different from daylight or electric lights. It has one wavelength or color. Laser light is also highly organized. Light behaves like a wave and laser light launches in one orderly wave at a time from its source.

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The physics of the laser may be complex. Still, it is just a story of how electrons interact with light. When a light particle, or photon, hits an electron, the electron jumps to a higher energy state. If another photon strikes one of these high-energy electrons, the electron releases two photons that travel together at the same wavelength. When this process is repeated enough, lots of organized, or coherent, photons are produced.

In Theodore Maiman's first laser, a rod of man-made ruby supplied the electrons. A more powerful version of the flash on a common camera was used to lift the energy state of the electrons. Mirrors on either end of the ruby rod reflected and increased the light. And an opening at one end of the rod let the laser light shoot out — just like the flash ray of science fiction hero Buck Rogers.

Industry put lasers to work almost immediately after they were invented in nineteen sixty. But weapons were not first on the list.

The first medical operation using a laser took place the year following its invention. Doctors Charles Campbell and Charles Koester used a laser to remove a tumor from a patient's eye at Columbia-Presbyterian Hospital in New York City. Since then, doctors have used lasers to cut and remove tissue safely with little risk of infections.

Other health uses include medical imaging and vision correction surgery. Eye surgeons use lasers in LASIK operations to reshape the cornea, which covers the lens of the eye. The reshaped cornea corrects the patient's bad eyesight so he or she does not have to wear glasses or other corrective lenses.

Lasers have made measurement an exact science. Astronomers have used lasers to measure the moon's distance from Earth to within a few centimeters. Mappers and builders use laser technology every day. For example, drawing a perfectly level straight line on a construction site is easy using a laser.

Energy researchers are using lasers in an attempt to develop fusion, the same energy process that powers the sun. Scientists hope fusion can supply almost limitless amounts of clean energy in the future.

Lasers have also changed the way we communicate. It is likely that laser light on a fiber optic network carried this EXPLORATIONS program at least part of the way to you if you are reading or listening online. Super-fast

Internet connections let people watch movies and send huge amounts of information at the speed of light.

Manufacturers have used lasers for years to cut and join metal parts. And the jewelry industry uses lasers to write on the surface of the world's hardest substance, diamonds.

Since nineteen seventy-four, the public has had direct experience with lasers — at the grocery store checkout line.

Laser barcode scanners have changed how stores record almost everything. They help businesses keep track of products. They help in storage and every detail of the supply process.

Experts say no company has put barcode technology to better use than Wal-Mart, based in Bentonville, Arkansas. By nineteen eighty-eight, all Wal-Mart stores used laser bar code scanners. Highly detailed records on its products, and how they were selling, helped Wal-Mart keep costs down. Today, Wal-Mart is the world's biggest corporation.

Lasers are found in many products used almost everywhere. Laser printers can print out forms and documents quickly and are relatively low in cost. They are required equipment for offices around the world.

If you have a CD or DVD player, you own a laser. Laser disc players use lasers to accurately read or write marks on a reflective, coated plastic disc. A device turns these optical signals into digital information that becomes music, computer software or a full-length movie.

Over one hundred years ago, writers imagined that beams of light could be powerful weapons. Today, lasers guide missiles and bombs.

For example, pilots can mark a target invisibly with a laser. Bombs or missiles then track the target with deadly results.

And, yes, American defense companies are working on giant laser guns recognizable to science fiction fans everywhere. But there are technological difficulties. Scientific American magazine says huge lasers turn only about twenty to thirty percent of the energy they use into a laser beam. The rest is lost as heat.

That has not stopped scientists from working to perfect powerful lasers that, one day, may be able to shoot missiles out of the sky.