

SM Department

English Module

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L2Physics

Lesson 06: Laser and its applications

❖ Definition of Laser:

A **laser** is a device that stimulates atoms or molecules to emit light at particular wavelengths and amplifies that light, typically producing a very narrow beam of radiation. The emission generally covers an extremely limited range of visible, infrared, or ultraviolet wavelengths. The term "laser" originated as an acronym for "**light amplification by stimulated emission of radiation**". The first laser was built in 1960 by Theodore H. Maiman at Hughes Research Laboratories, based on theoretical work by Charles Hard Townes and Arthur Leonard Schawlow.

Laser light is different from an ordinary light. It has various unique properties such as coherence, monochromaticity, directionality, and high intensity. Because of these unique properties, lasers are used in various applications such as; optical disk drives, laser printers, DNA sequencing instruments, fiber-optic, semiconducting chip manufacturing (photolithography), and free-space optical communication, laser surgery and skin treatments, cutting and welding materials, military and law enforcement devices for marking targets and measuring range and speed, and in laser lighting displays for entertainment. They have been used for car headlamps on luxury cars, by using a blue laser and a phosphor to produce highly directional white light.

❖ Types of Laser:

Gas lasers: (helium and helium-neon, HeNe, are the most common gas lasers) have an output of a visible red light.



figure 1: Gas laser

Solid-state lasers: Solid-state lasers use a crystalline or glass rod which is "doped" with ions that provide the required energy states.

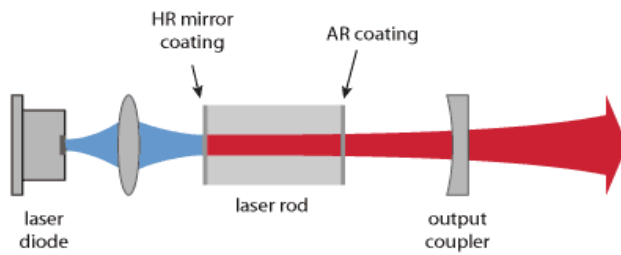


Figure 2. Solid state laser

Semiconductor laser: are not solid-state lasers. These electronic devices are generally very small and use low power.

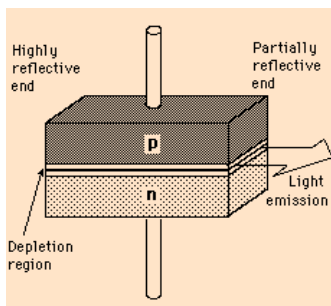


figure 3: semiconductor laser

❖ **Laser Applications:** the most significant applications of laser include

1) Lasers in Medicine:

- Lasers are used for bloodless surgery.
- Lasers are used to destroy kidney stones.
- Lasers are used in cancer diagnosis and therapy.
- The liver and lung diseases could be treated by using lasers.

- Lasers are used to study the internal structure of microorganisms and cells.
- Lasers are used to produce chemical reactions.
- Lasers are used to create plasma.
- Lasers are used to remove tumors successfully.
- Lasers are used to remove the caries or decayed portion of the teeth.
- Lasers are used in cosmetic treatments such as acne treatment, cellulite and hair removal.

2) Lasers in Science and Technology:

- A laser helps in studying the Brownian motion of particles.
- With the help of a helium-neon laser, it was proved that the velocity of light is same in all directions.
- With the help of a laser, it is possible to count the number of atoms in a substance.
- Lasers are used in computers to retrieve stored information from a Compact Disc (CD).
- Lasers are used to store large amount of information or data in CD-ROM.
- Lasers are used to measure the pollutant gases and other contaminants of the atmosphere.
- Lasers help in determining the rate of rotation of the earth accurately.
- Lasers are used in computer printers.
- Lasers are used for producing three-dimensional pictures in space without the use of lens.
- Lasers are used for detecting earthquakes and underwater nuclear blasts.

3) Lasers in Communications:

- Laser light is used in optical fiber communications to send information over large distances with low loss.
- Laser light is used in underwater communication networks.
- Lasers are used in space communication, radars and satellites.

❖ Glossary:

تضخيم الضوء بواسطة الانبعاث المستحث: Light amplification by stimulated emission of radiation
أشعة: beams الأشعة تحت الحمراء: infrared ينبعث: to emit للإشعاع

الاتجاهية: directionality أحادية اللون: monochromaticity التماسك: Coherence

محركات الأقراص الضوئية: optical disk drives كثافة عالية: High intensity

أجهزة تسلسل الحمض النووي: DNA sequencing instruments طابعات الليزر: Laser printers

مواد القطع واللحام: cutting and welding materials الألياف الضوئية: Fiber-optic

تصنيع شرائح أشباه الموصلات: (photolithography) Semiconducting chip manufacturing

اتصال بصري في الفضاء الحر: Free-space optical communication