



LASERS AND ITS APPLICATIONS

Contents

- 1) Introduction of laser
- 2) Principle of laser
- 3) Kinds of lasers
- 4) Construction and working of Ruby laser
- 5) Construction and working of He-Ne laser
- 6) Applications of lasers
 - a) Communication
 - b) Industry
 - c) Medicine
 - d) Military operation



7) Advantages of lasers

8) Disadvantages of lasers

9) Conclusion

Introduction

- The word laser is an acronym that stands for “light amplification by the stimulated emission of radiation”.
- Lasers are essentially highly directional, highly intense, highly monochromatic and highly coherent optical sources.
- Stimulated emission was postulated by einstein as early as in 1917.

- In 1960 , a solid state ruby laser is developed by maiman on this principle.
- In 1961, a gas state He-Ne laser is developed by Ali javan and others in Bell telephone laboratory.

Principle of laser



Absorption

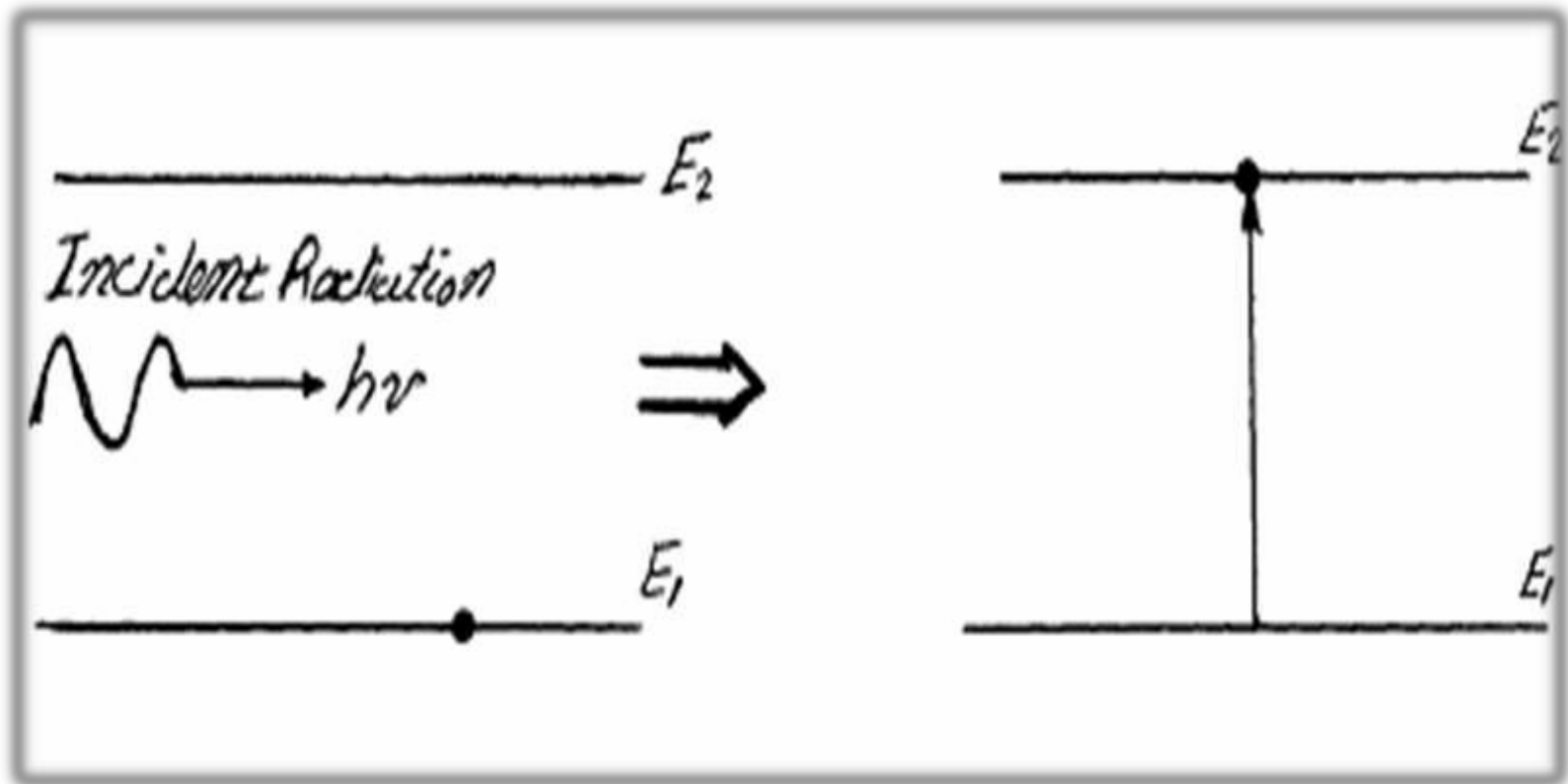


Spontaneous
Emission

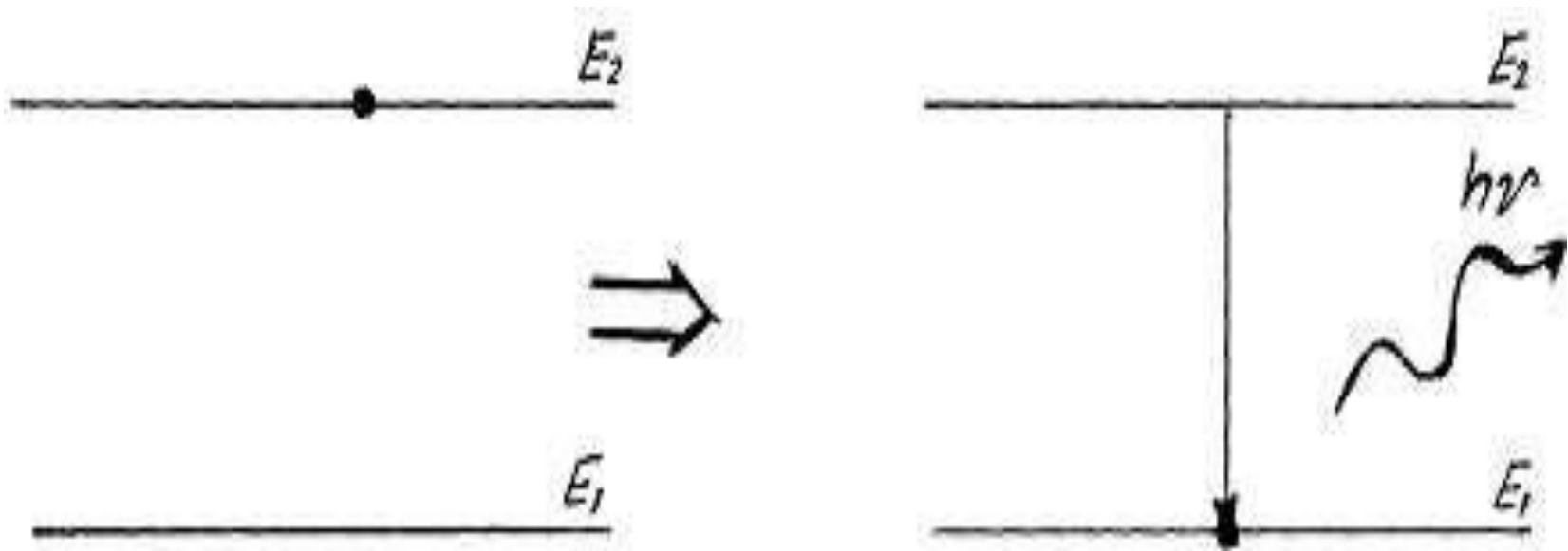


Stimulated
Emission

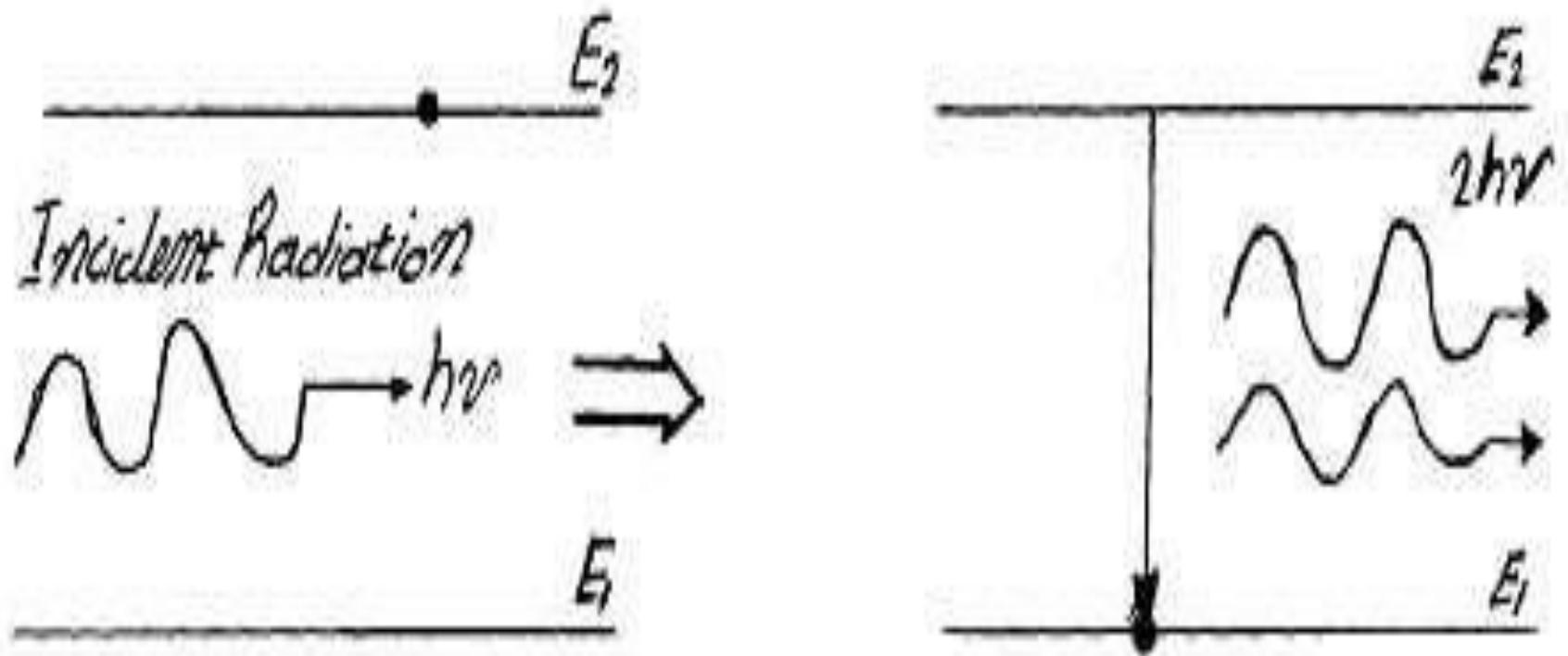
- The process of exciting the atom to higher energy level by absorbing the stimulating incident photon is known as stimulated absorption of radiation.



- The transition of an excited atom by itself to lower energy level is known as spontaneous emission of radiation.



- The excited atom after getting stimulated by the incident photon transits to lower energy level by emitting photons is known as stimulated emission of radiation.



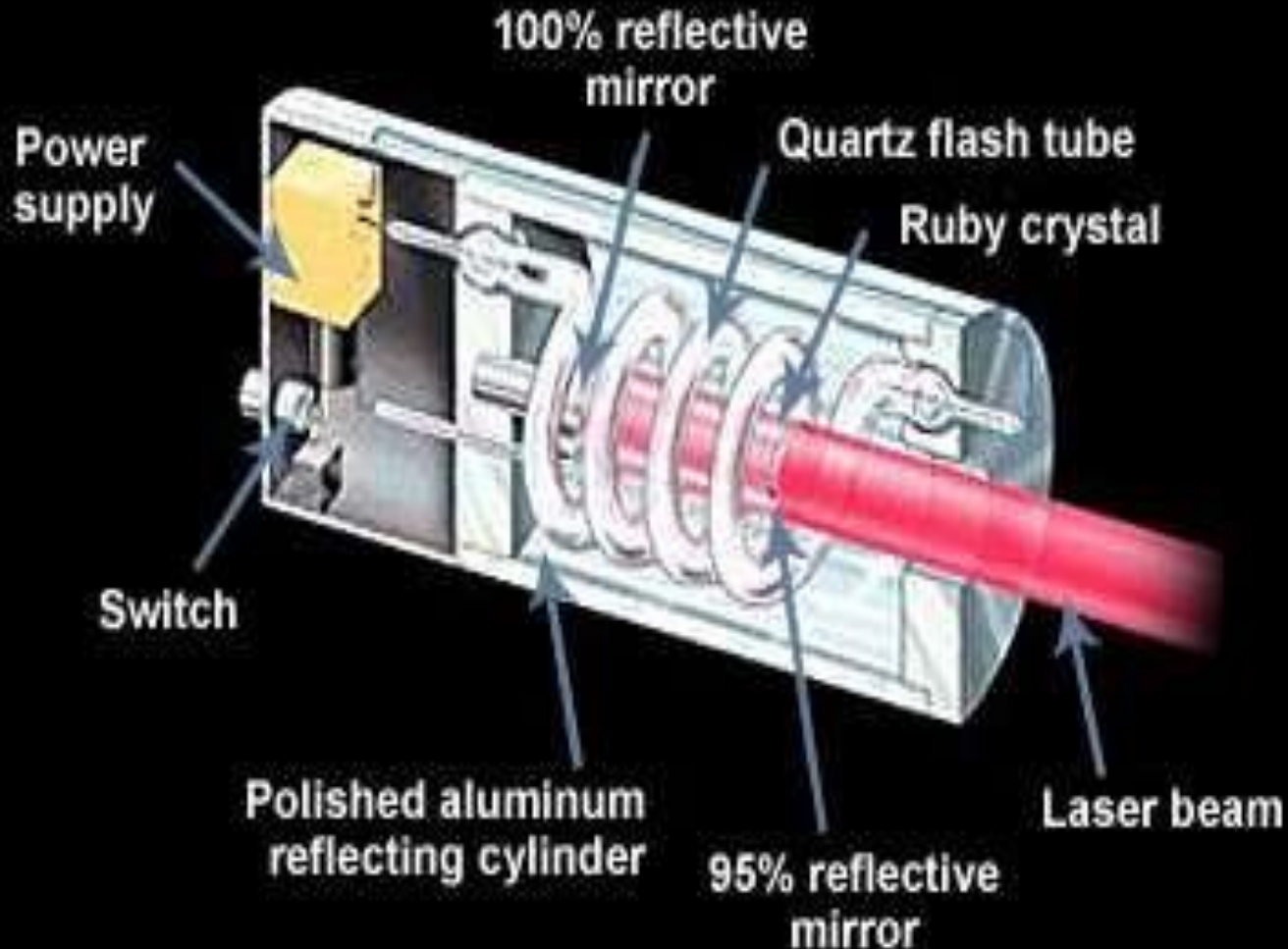
Kinds of lasers

Among the various kinds of lasers some important types of lasers are listed below:

- 1) Solid state laser : Ruby laser
- 2) Gas laser : Co₂ laser, He-Ne laser
- 3) Liquid laser : Europium chelate laser
- 4) Dye laser : Courmarin dye laser
- 5) Semiconductor laser : Inp laser

Construction and working of ruby laser

Components of the first ruby laser

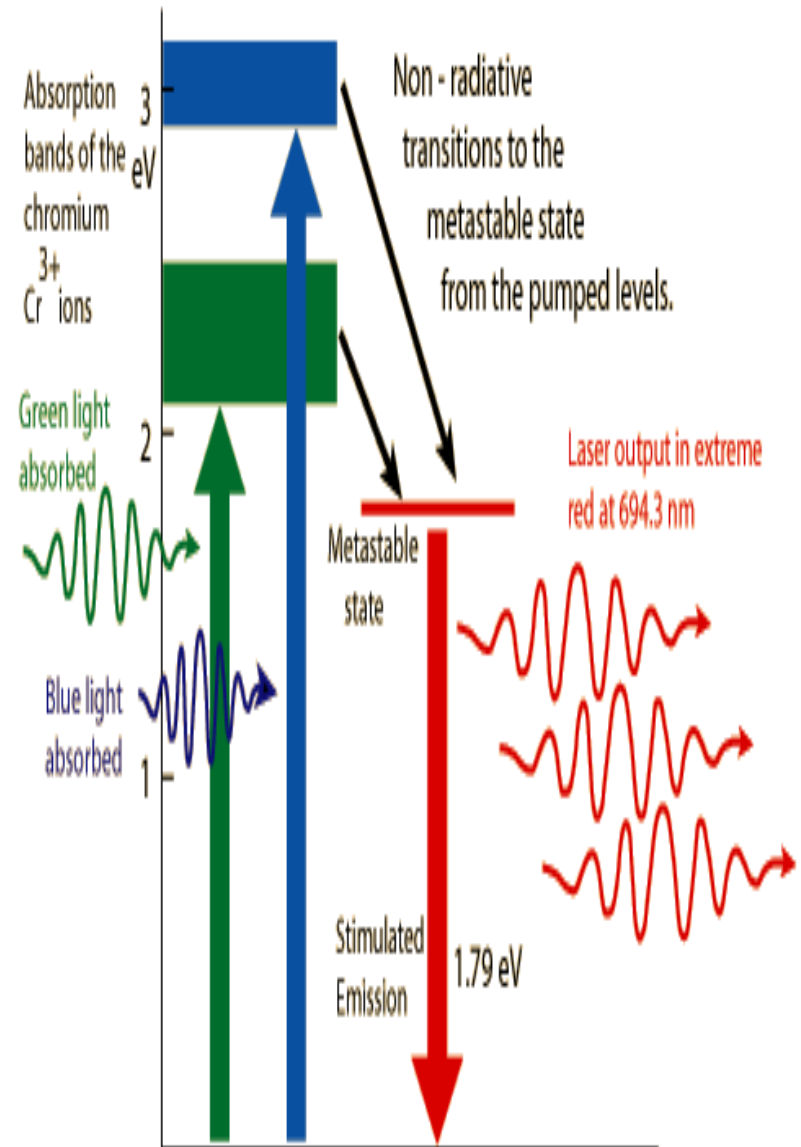


Construction :

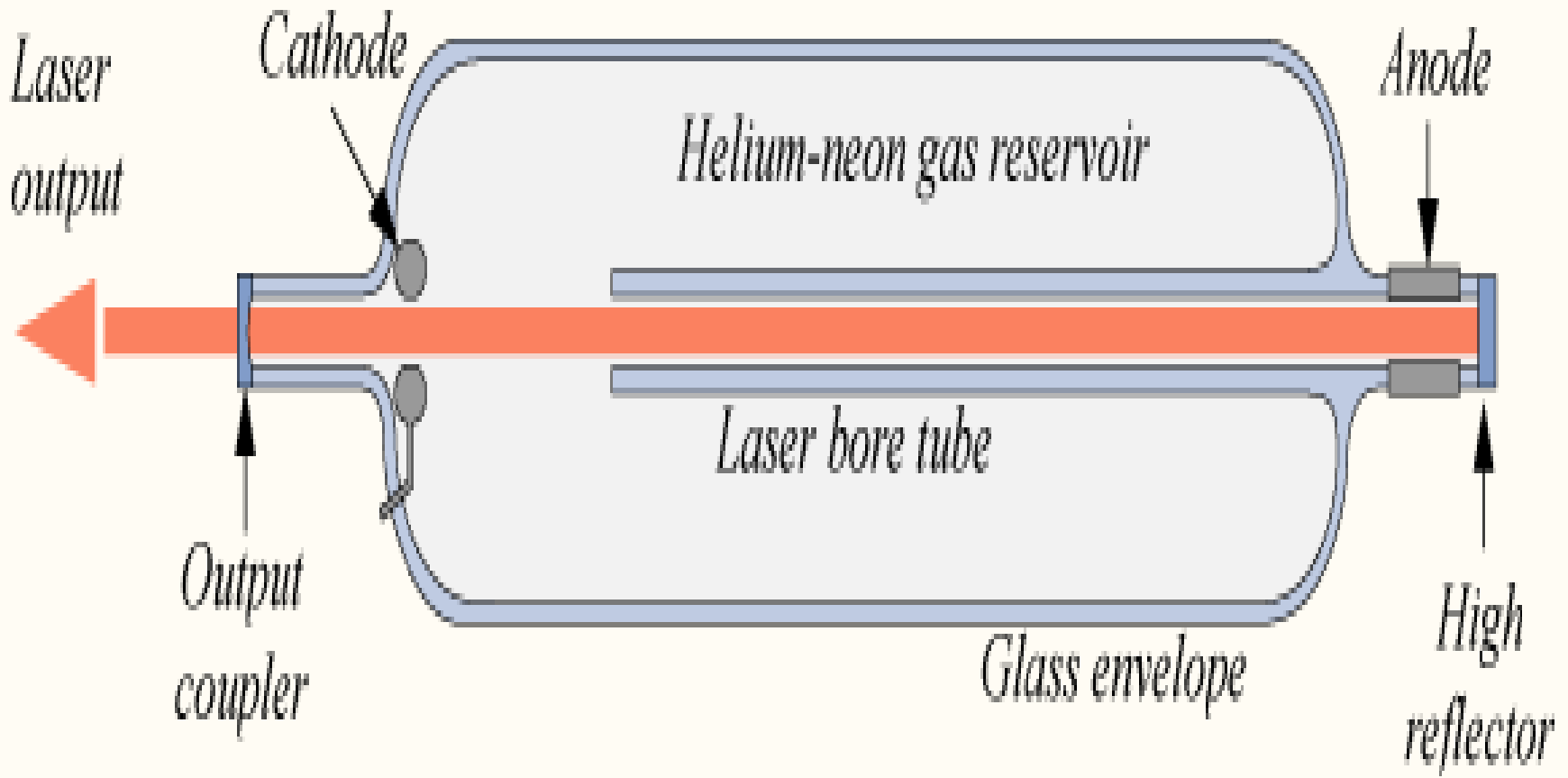
- In ruby laser a cylindrical ruby rod made up of aluminum oxide which is doped with 0.05% weight of chromium oxide.
- One end of rod is fully silvered and the other one partially silvered so it act as optical resonator.
- The rod is surrounded by a glass tube which in turn is surrounded by the helical flash lamp filled with xenon gas.

Working:

- When the flash lamp light will be flashed on ruby rod the chromium ions excited to higher energy states.
- After staying for up to 10^{-8} second ions get transmitted to the metastable state.
- The laser radiation of a wavelength of 6943\AA and laser emission is pulsed one.



Construction and working of He-Ne laser

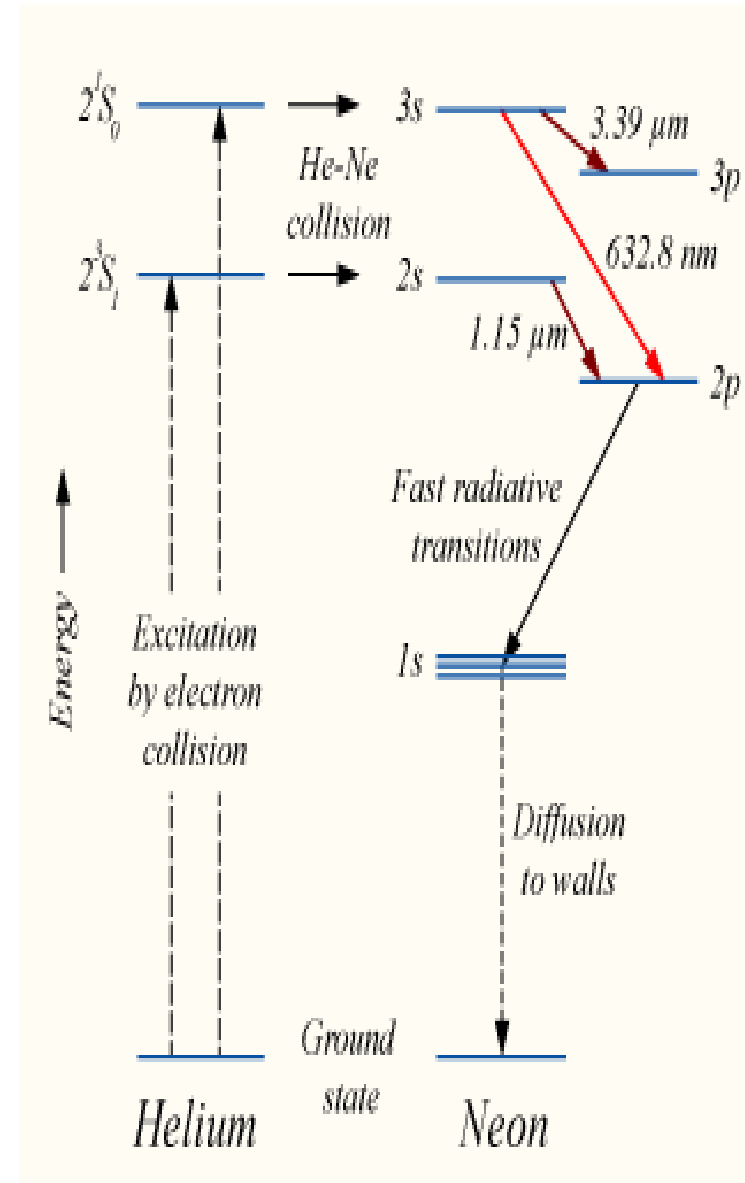


Construction:

- **A He-Ne laser consists of large and narrow discharge tube filled with helium and neon gases in the ratio 10:1.**
- **The tube is enclosed between fully and partially reflective mirrors which serve as optical cavity.**
- **The two end windows are set at Brewster's angle, so reflected radiations enter into the tube become polarized.**

Working

- Helium atoms after transferring their energies to neon atoms are excited to 2s and 3s.
- The population in these levels is more than those in lower levels 2p and 3p.
- The emission of radiation having wavelength 6328\AA is red in colour and it gives continuous emission of radiation.



Applications of lasers

Lasers in communication:

In optical fiber communication laser bandwidth is very high compared to the radio and microwave communications.

- As it has large bandwidth, more amount of data can be sent.
- More channels can be simultaneously transmitted.
- Lasers are also used in other communication



ers.

Lasers in industry:

- Lasers can be used to blast holes in diamonds and hard steel.
- Lasers can cut, drill, weld, remove metal from surfaces and perform these operations even at surfaces inaccessible by mechanical methods.
- Lasers range finder is used to measure distance to making maps by surveyors.



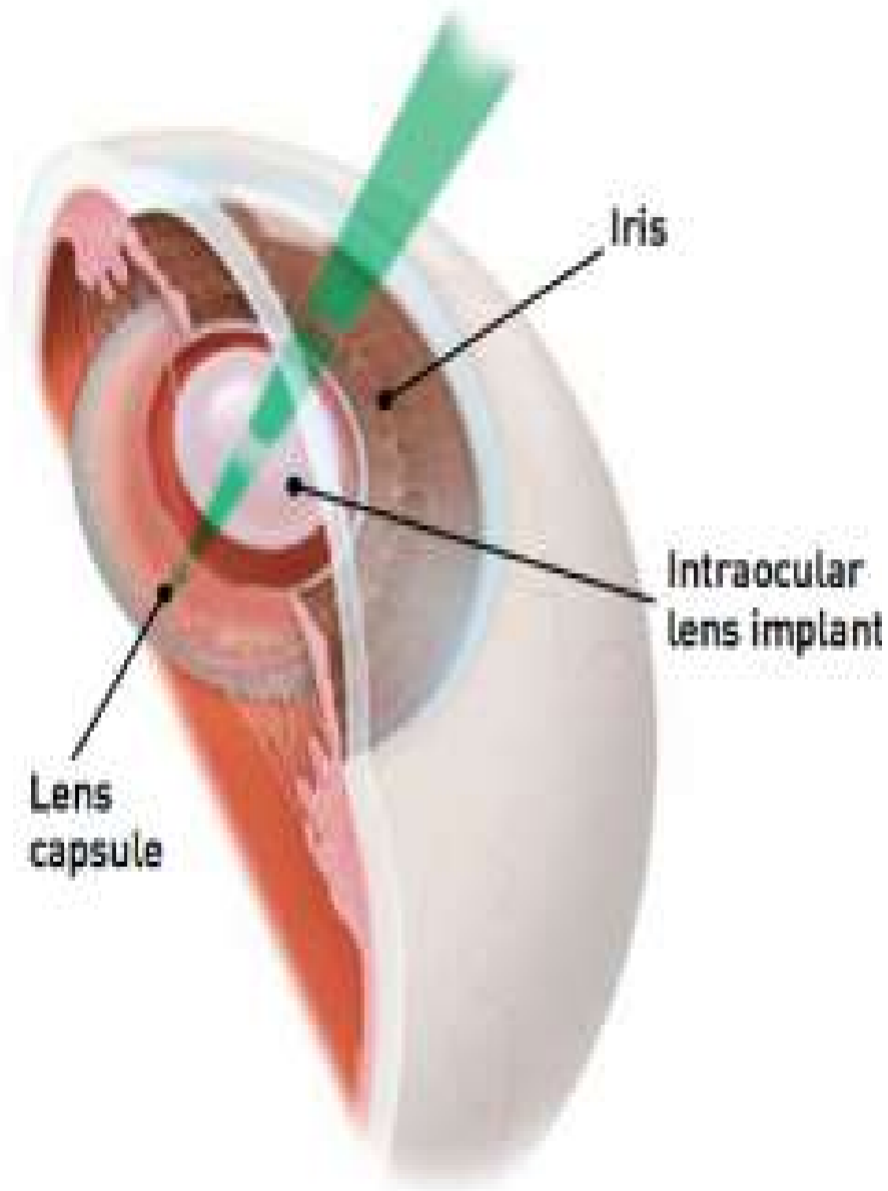


- Argon and Co2 lasers are used in treatment of liver and lungs .
- New kind of laser surgery that uses molecules to stitch together wounds .
- Co2 laser is particularly used in spinal and brain tumour excision and kidney stone extrusion.
- Lasers are used in the treatment of Glaucoma.

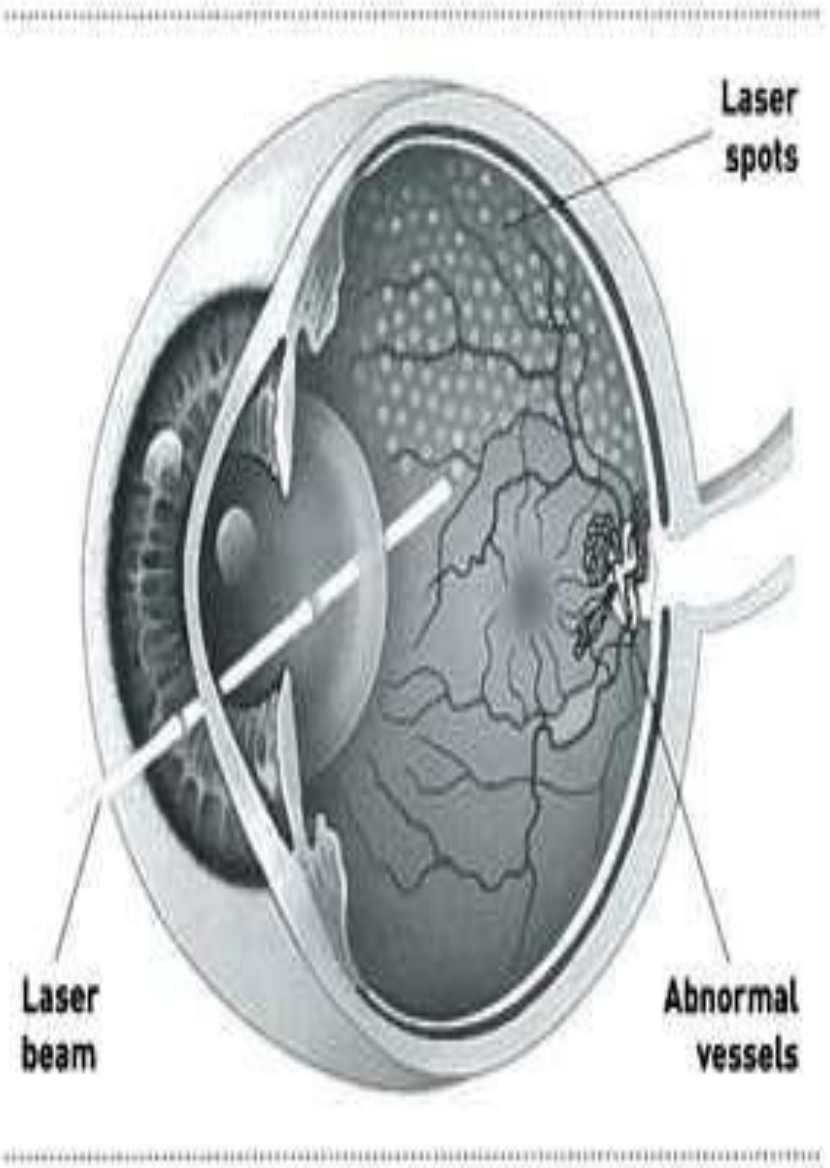
Laser used in eye treatment

- The laser can also repair a detached retina—one that has broken loose from the rear part of the eyeball
- The laser is very useful in removing extraneous blood vessels that can form on the retina—the thin, light-sensitive membrane at the back of the eyeball





A laser can make an opening in a cloudy lens capsule to restore normal sight.



LASER SURGERY CAN SLOW OR STOP THE GROWTH OF ABNORMAL BLOOD VESSELS IN THE RETINA CAUSED BY DIABETIC RETINOPATHY.

Lasers in military:

- A laser beam can be bounced off a target such as enemy air plane or ship, to determine its distance and speed.
- Laser can serve as a war weapon.
- High energy lasers are being employed to destroy enemy air crafts and missiles.



Advantages of lasers

- ❑ Lasers are used to cut glass and drill holes in ceramics.
- ❑ Lasers are used for bloodless surgery and in destroying kidney stones and gallstones.
- ❑ Lasers are used to study the internal structure of microorganisms and cells.
- ❑ Lasers are used in air pollution, to estimate the size of dust particles.

Disadvantages of lasers


- ❑ **Lasers are known to be dangerous to the atmosphere and health.**
- ❑ **Laser printers are very costly when compared to other printers.**
- ❑ **When running the laser machine small amount of ozone are generated, which can damage the ozone layer.**
- ❑ **Some laser particles are also known to emit particles that may cause respiratory disease.**

CONCLUSION

- Finally I conclude that laser plays a crucial role in the modern world.
- Therefore laser play an pivotal role in the present technical world.

ANY QUERIES?



A close-up photograph of two hands, palms up, holding a small, rectangular piece of white paper with deckled edges. The paper is held horizontally across the center of the hands. On the paper, the words "Thank You" are written in a black, elegant cursive script. The background is dark and out of focus.

Thank You