LASER

The term "**laser**" originated as an **acronym** for **"light amplification by stimulated emission of radiation".**

History of LASER

When it was first discovered, the laser gave rise to some foolish hopes and was heralded as the answer to all the world's problems: it could be used to melt dangerous icebergs, replace the existing telephone network or carry millions of volts from one place to another. Leaving aside the more far-fetched (or premature in the case of telecommunications) applications, by 1965 some people envisaged using lasers as scalpels in surgical operations, or to facilitate nuclear fission, or as a precision cutting tool for metals or as a means to store information (CDs) or to produce 3D images (holography).

Nevertheless, all these applications were initially impossible to put into practice so people began to wonder what was the use of this device. Strangely

enough, contrary to most other 20th century inventions, the laser was not invented in response to an industrial, scientific or social need. For example, nuclear power was developed to meet the growing need for energy, computers were invented to carry out increasingly complex calculations, and quantum mechanics were formulated to solve some theoretical problems such as black body radiation or the photoelectric effect. The laser seemed to come out of nowhere, or almost. Of course, some famous theoreticians (Townes, Schawlow, Basov, Prokhorov and others) worked on the subject in order to transpose microwave amplifiers, called **masers,** into the optical domain. Other scientists were interested by Einstein's prediction of stimulated emission and tried to observe this effect experimentally. Nobody, however, actually "needed" the laser. Nobody was desperately waiting for it to be invented so they could put it to some use. The best example comes from Arthur Schawlow, one of the illustrious inventors of the laser: "One day all typewriters will be equipped with a laser to erase typing errors. The laser beam will vaporise the ink on the page in a fraction of a second without leaving the slightest trace." So, the laser was destined to become just a "super-corrector

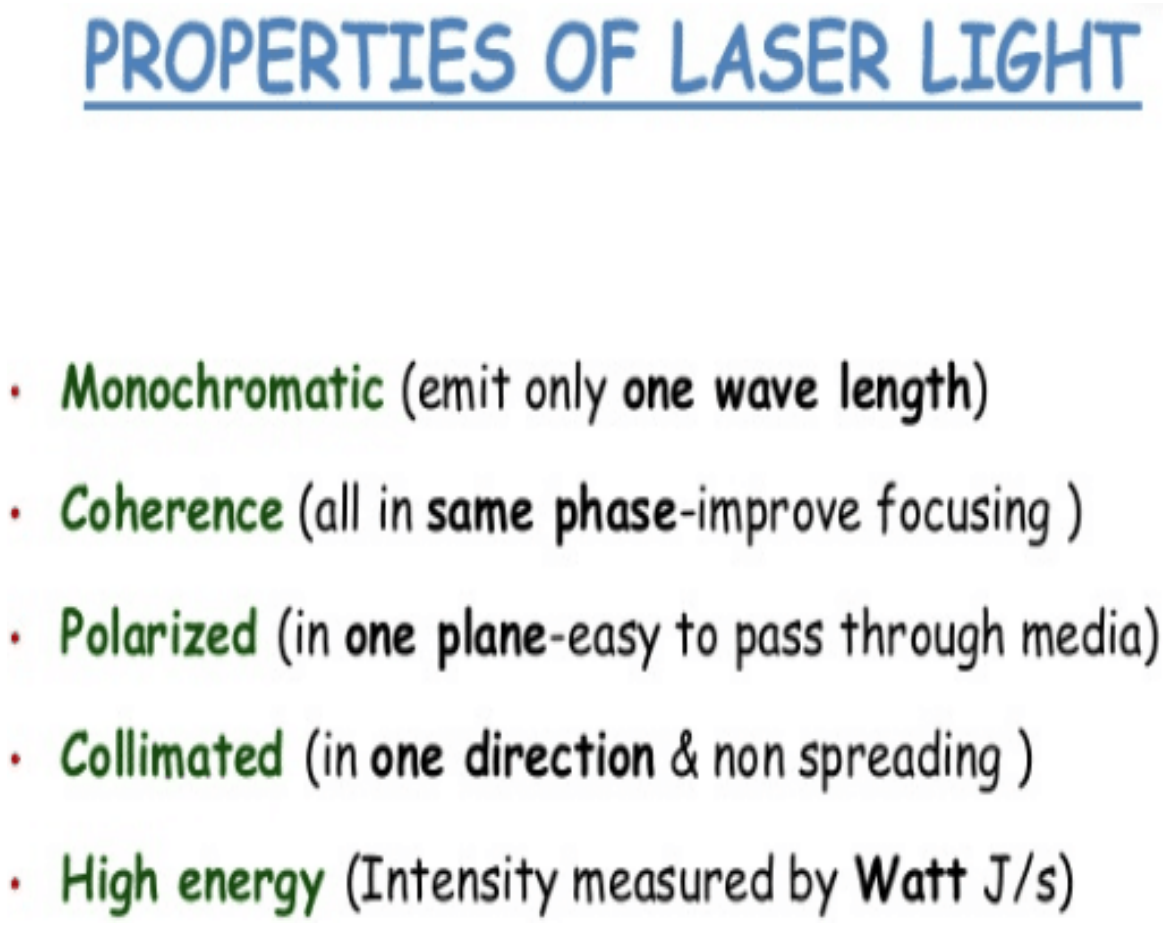
for absent-minded typists"? In the early years following its invention, it was mocked by a good number of industrialists. Even high-ranking scientists got involved. Pierre Aigran (Secretary of State for Research, researcher and member of the Academy of Sciences at the time of the discovery of the laser) stated: "We are used to having a problem and looking for a solution. In the case of the laser, we already have the solution, we just have to find the problem."

Of course, with the passage of time, numerous problems have been solved thanks to the laser and some of those early dreams have come true (telecommunications, laser weapons, fusion by laser, laser scalpels). What seemed to be just a cumbersome "toy" for researchers is today universally hailed as one of the most important inventions of the 20th century, both in terms of physics and its applications. The laser is now used in an ever widening range of sectors: treatment of materials, biomedical, instrumentation and measurement, laser shows.

Introduction

Properties of LASER

A **laser** is a device that projects a highly concentrated narrow beam of light which is amplified using stimulated radiation. **Lasers** have three **properties**: coherency, collimation and monochromatic **properties**. These three **properties of lasers** produce a small focus point of intense power.



Q What are the main components of Laser?

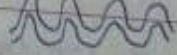
1) Active medium → actively response
2) Pumping source → laser pointers (when pressure exert, photons release, excite the comp.)
3) Optical resonance compound.
   ↳ when rays strike the comp., laser emitted.

Lasers → Emission spectroscopy → The sources required are:-

1) Highly energetic photons
2) Electric current
3) Temprature / Electric discharge

Q Is laser involved in fluorescence phenomena?
Yes laser is involved. Laser is used for the excitation of electrons and gives intense beam. Laser diodes are most efficient.

Q How we can compare lasers light with other sources? Directional, narrow spectrum

1) Monochromatic nature: Laser is mono-chromatic in nature while other light source is of d/f wavelength.
2) Intensified beam: Laser beam is intense than other light source
3) Well collimated: Lasers focus at single point while light is not well-collimated eg, laser cutting, ethogy
4) Polarization: Laser shows more polarization than light source.
5) Coherent nature: →  → crest over the crest while trough over trough, it is constructive interference. Amplitude ↑ Both waves are coherent.

LASER

⇒ In toys, guns, on motorway → red light is laser which is used for navigation (to measure speed)

L A S E R

Light Amplification Stimulated Emission Radiations

laser is acronym for "Light Amplification by stimulated emission of Radiations"

Q Which type of light is used?

All the electromagnetic radiations (EMR) which are all available on spectra are used as light source. starting from radio waves till onward.

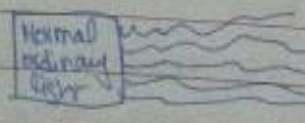
Cosmic rays are also used but require special arrangement. (low energy)

EMR → Radio lasers, Micro-lasers, IR lasers, Visible UV lasers.

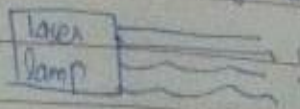
Q Why laser are so imp?

Laser is intense, monochromatic in nature, less band width, interference ↓, coherent in nature, Narrow beam. It can polarize as well as depolarize

(cost & tough alignment)



It is in short time upto femto sec (10^{-15}). d/f λ of light, no phenomena is there



It can travel to longer distance.