Research Journal of Physical Sciences _____ ISSN 2320–4796
Vol. **2(6),** 9-10, October **(2014)** *Res. J. Physical Sci.*

Short Communication

Theoretical Approach of Laser

Kale H.G.
Department of Physics, Lalbahadur Shastri Senior College, Partur Tq. Partur Dist. Jalna-431501 MS, INDIA

Available online at: www.isca.in
Received 17th August 2014, revised 16th September 2014, accepted 3rd October 2014

Abstract

Laser works on basis of absorption, spontaneous emission, stimulated emission of radiation by emitting photon of frequency hν when atom jump from higher energy state to lower energy state.

Keywords: Theoretical, Laser, spontaneous and stimulated emission.

Introduction

The world "Laser" is a "Light Amplification by stimulated emission of radiation". This concept was introduced by Einstein in 1917. Laser light, the light from an ordinary light like bulb emitted when atom jump from one quantum state of higher energy to quantum state of low energy. The primary laser solid interaction process is excitation of electrons from their equilibrium state to some excited state by absorption of photon.

Characteristic of Laser: Monochromaticity of laser: Light from ordinary source spread in all direction with possible velocity is not monochromatic light. ex. The radiation from florescent neon is monochromatic light. Monochromaticity is characteristics property of laser having single wavelength.

Coherence: The term coherence means the two source of light vibrate in the same plane/phase there is constant phase difference or zero phase difference.

Unidirectional: The light from laser travel in straight line in one direction light from laser spreads very little.

Methodology

Consider and isolated system having its lowest energy state (ground state) whose energy E_0 and higher energy state (excited state) whose energy E_n. The process takes place in which atom move from one energy state to other state as given by.

Absorption: in figure-1 Initially the atoms are present in its ground state if the atom has provided external electromagnetic field atom can absorb amount of energy $h\nu$ from the external source and move to higher energy state. This process is called absorption.

$h\nu = E_n - E_0$

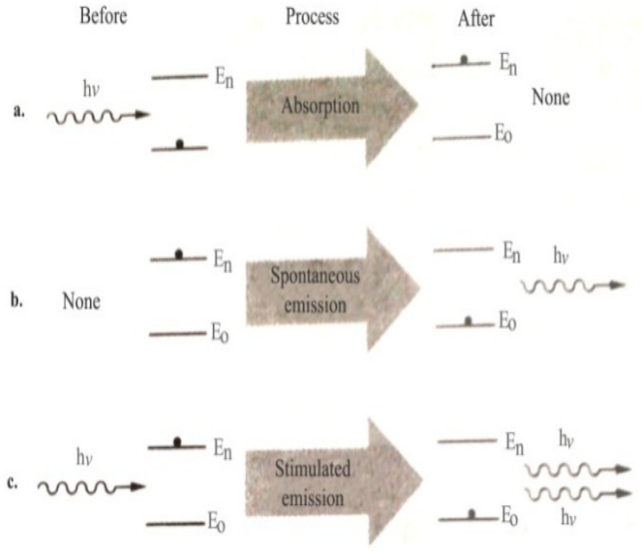

Figure-1
Shows an isolated system of stimulated emission for single atom

Spontaneous emission: in figure-1 now atom is in excited state and remain there for very short time period called life time ie.10^{-8} sec. after that atom will move to ground state. In the ground state atom can remain for unlimited time but in excited state it can remain for limited time called its lifetime. In spontaneous emission atom passes from higher energy state to lower energy state by emitting photon spontaneously.

Stimulated emission: in figure the transition from higher energy state to lower energy state emission of photon with some frequency $h\nu$ implies that atom can passes from excited state to ground state emitting photon not only spontaneously but when we supply external field. During this process atom emitted additional photon having energy $h\nu$

Application: i. It is used for voice and data transmission over optical fiber. ii. It is used for nuclear fusion research and

astronomical purposes. iii. It is used for reading bar codes, manufacturing and reading compact discs. iv. It is used for military purpose. v. It is used in medical field (for performing surgery of many kinds).

Conclusion

Laser light produces by stimulated emission of radiation having frequency hν as follow.

$h\nu = E_n - E_0$

When atom undergoes a transition from higher energy state to lower energy state with a photon of frequency ν emitted. The stimulated and emitted photons are identical in all respect and combine to form laser light.

Reference

1. Halliday, Resnick, Walker. (2008). 6th ed., *Fundamentals of Physics*, Wiley India (P) Ltd., 1026 **(2008)**

2. Gaur R.K. and Gupta S.L., Rept. *Engineering Physics.* Dhanpat Rai Publication (P). Ltd., 31 **(2011)**