

2.9 Concept of Laser

The photon emitted during stimulated emission has the same energy, phase, frequency and direction as that of the incident photon.

Thus, we have two coherent photons. Now, these two photons are incident on two other atoms in the state E_2 . This results in induced emission of two more photons.

Now, there are four coherent photons of same energy. These four photons induce further transitions with four other atoms in the energy state E_2 . This gives stimulated emission of eight coherent photons of same energy.

If the process continues in a chain, ultimately enable to increase the intensity of coherent radiation enormously.

Stimulated emission is multiplied through a chain reaction. This multiplication of photons through stimulated emission leads to coherent, powerful, monochromatic, collimated beam of light. The light is known as laser light.

Thus for laser action, stimulated emission is most important. It is achieved by population inversion.

OPTICAL RESONATOR

An optical resonator consists of a pair of reflecting surfaces in which one is fully reflecting (R_1) and the other is partially reflecting (R_2). The active material is placed in between these two reflecting surfaces.

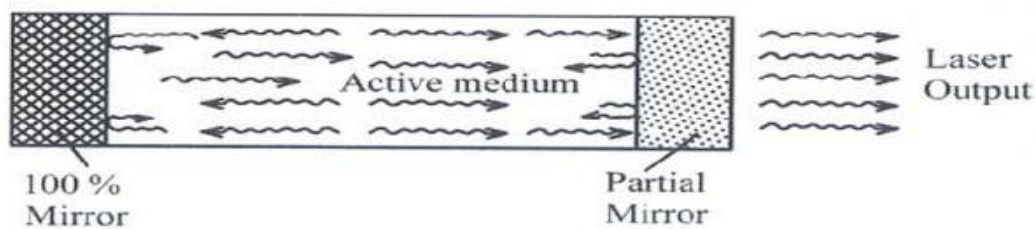


fig:2.9.1-Optical Resonator

The photons generated due to transitions between the energy states of active material are bounced back and forth between two reflecting surfaces. This will induce more and more stimulated transition leading to laser action.

Optical Resonator

The optical resonator constitutes an active medium kept between a fully reflecting mirror and a partially reflecting mirror as shown in figure.

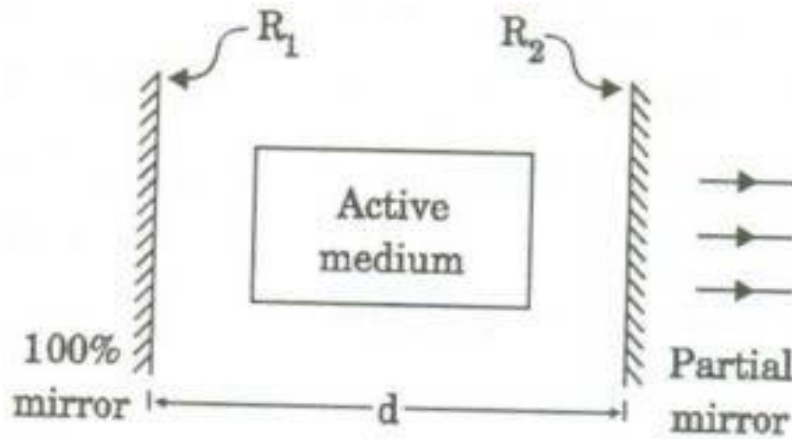


fig:2.9.2 Mirrors in laser action

This optical resonator acts as a feedback system in amplifying the light emitted from the active medium, by making it to undergo multiple reflections between the 100% mirror and the partial mirror. Here the light bounces back and forth between the two mirrors and hence the intensity of the light is increased enormously. Finally, the intense, amplified beam called LASER is allowed to come out through the partial mirror as shown in figure.