5. Applications of lasers:

Lasers in Medicine

- For Bloodless surgery
- For Eye lens curvature corrections
- For producing chemical reactions
- To create plasma
- To remove tumors

Lasers in Communications

- used in underwater communication networks
- used in space communication, radars and satellites

Lasers in industries

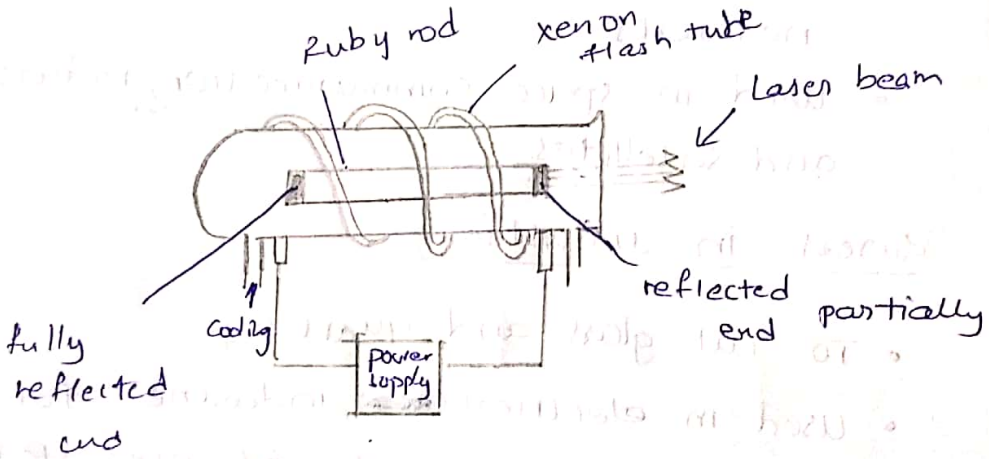
- To cut glass and quartz
- Used in electrical industries for trimming the components of integrated circuit.

Ruby Lasers

It is a three level solid state laser and was constructed by Maimann in 1960. Ruby ($Al_2O_3 + Cr_2O_3$) is a crystal of Aluminium oxide, in which 0.05% of Al^{+3} ions are replaced by Cr^{+3} ions. The color of rod is pink. The active medium in the ruby rod is Cr^{+3} ions.

Construction

In ruby laser 4 cm length and 5 mm diameter rod is generally used. Both the ends of rods are highly polished and made strictly parallel. The ends are silvered in such a way, one became partially reflected and the other end fully reflected. The ruby rod is surrounded by xenon flash tube which provides the pumping light to excite the chromium ions to upper energy levels.

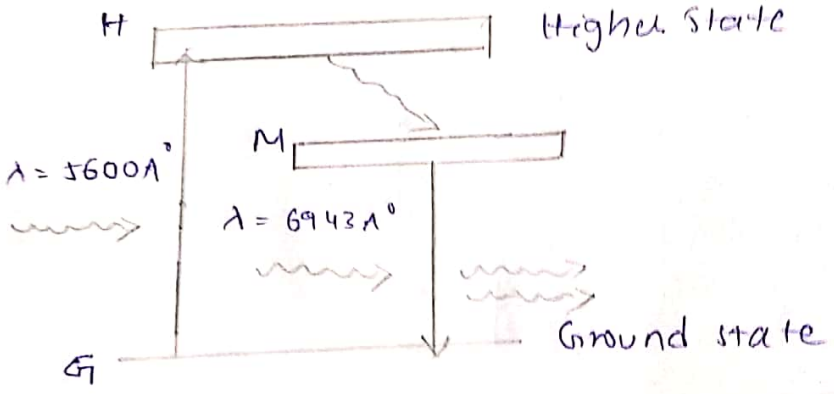


Xenon flash tube emits thousands joules of energy in few milli seconds, but only a part of that energy is utilized by chromium ions while the rest energy heats up the apparatus. A cooling temperature is provised to keep the experimental set up at normal temperatures.

Working

The energy level diagram of chromium ions shown in figure

The chromium ions get excitation into higher energy levels by absorbing of 5600 A^0 of wavelength radiation. The excited chromium ions stay in the level H for short interval of time. After their life time most of the chromium ions are de-excited from H to G and a few chromium ions are deexcited from H to M



The transistion b/w H & M is non-radiative transition i.e the chromium ions gives their energy to the lattice in form of heat. In the meta stable the life time of chromium ions is 10^{-3} sec. The life time of chromium ions in meta stable state is 10^5 times greater than life time of chromiom ions in Higher state.

Uses

1. In Optical photography
2. To remove melanin of the skin
3. For recording of holograms

Drawbacks

→ Laser requires high pumping power
→ A pulse laser
→ efficiency is very small