

Nd:YAG Lasers (Neodymium: Yttrium aluminium garnet $\text{Y}_3\text{Al}_5\text{O}_{12}$)

First successful working laser belongs to solid-state medium was ruby laser built by T.H. Maiman in 1960

Pure material acts as host and the dopant acts as guest material responsible for the lasing action

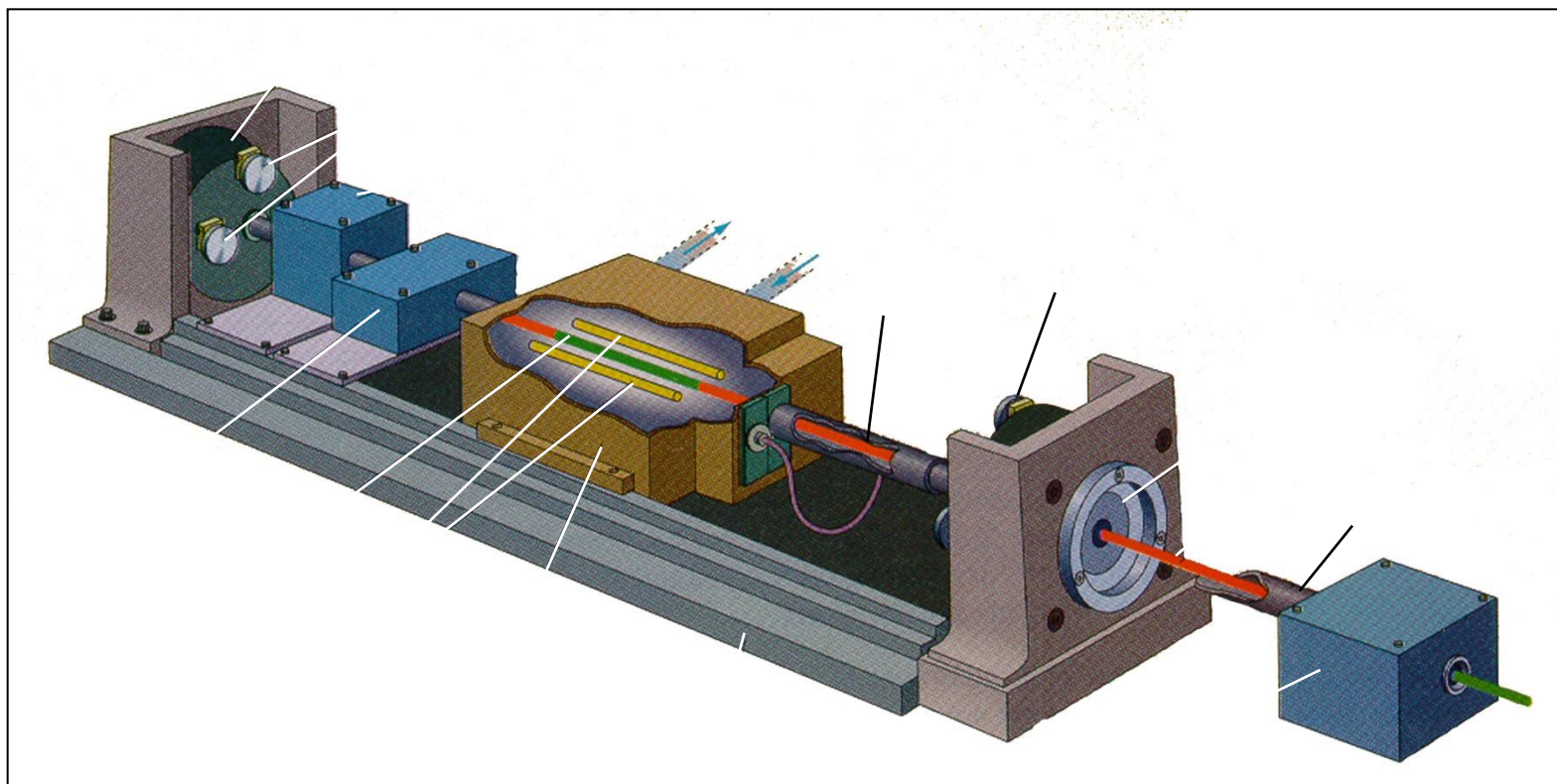
Material

It is a four level laser

$\text{Y}_3\text{Al}_5\text{O}_{12}$ commonly called as YAG is an optical isotropic crystal

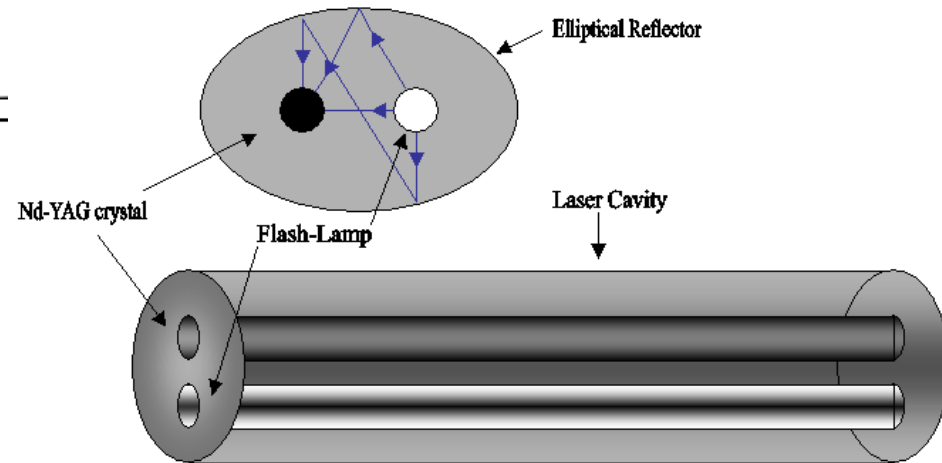
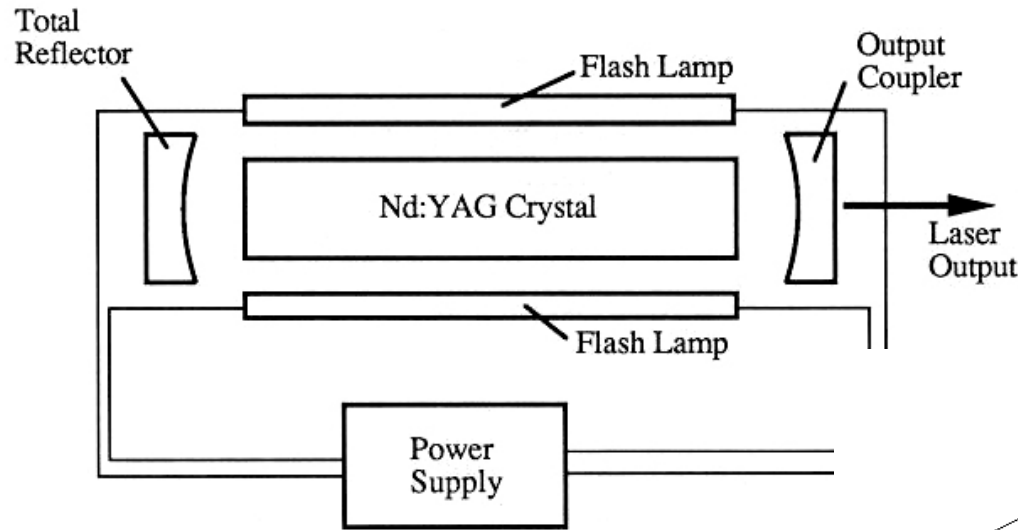
Some of Y^{3+} ions in the crystal is replaced by neodymium ions, Nd^{3+}

Crystal atoms do not participate in lasing action-but as host for active centers where Nd^{3+} resides

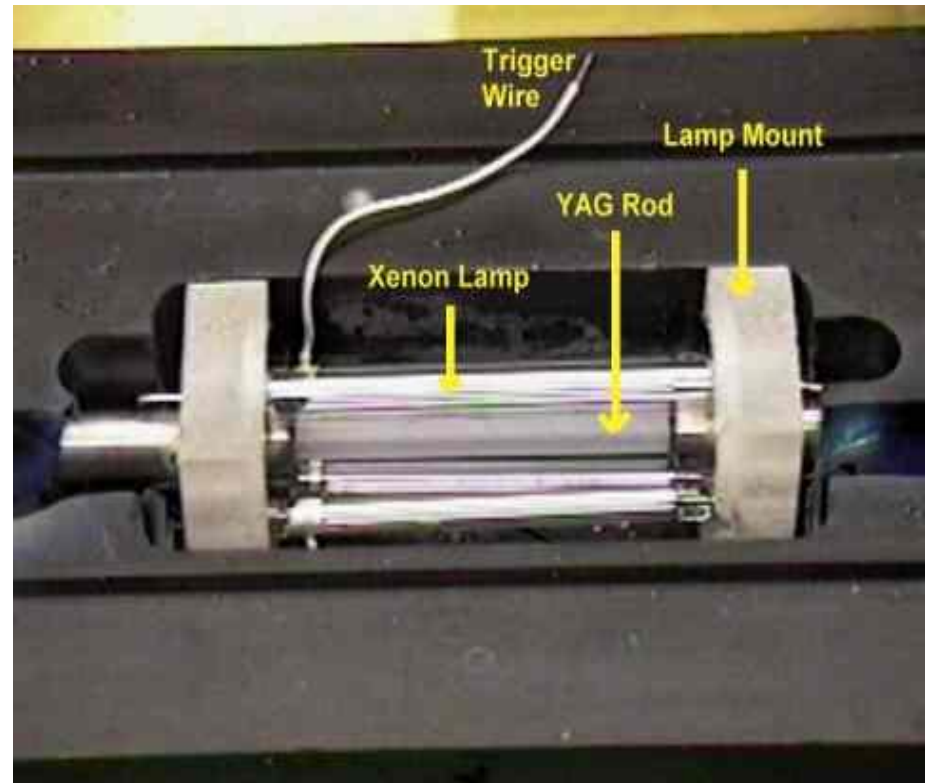
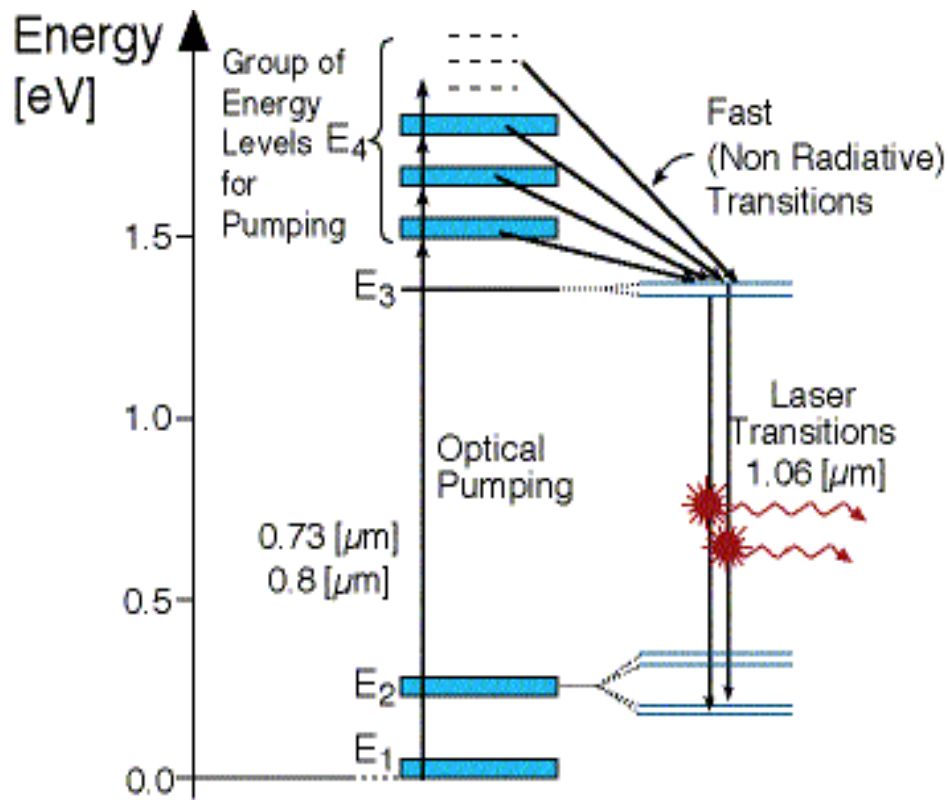


- Construction

- Nd: YAG laser is made up of elliptical cylindrical reflector



- One end is fixed with focus krypton lamp acting as pumping device
- Other focus is silvered – flash from the krypton lamp after reflection concentrate at YAG rod placed at the other end
- Ends of the laser rod is polished with silver to achieve the resonance mechanism of lasing action



- Nd ion has two absorption band – the excitation is done by optical pumping
- Nd ions transfer to upper laser level by non-radiative transition – then stimulated emission to its lower level – from the lower level it is by non-radiative transition to ground level.

Some important features of Nd:YAG laser are:

- It is a four-level laser
- RE like Nd, Er, Dy can be used
- Nd ion concentration corresponds to ground state population of 6×10^{19} ions/cc
- The metastable level $4F_{3/2}$ has a lifetime of 0.23×10^{-3} s
- The Nd:YAG laser is a quasi-continuous wave laser
- Cr ions can be dopped in addition to Nd ions. Xenon flash lamp can be used for pumping