

Nd-YAG LASER

→ Nd-YAG stands for Neodymium - Yttrium Aluminium Garnet. Nd is a rare earth metal when doped with solid state crystals produce emission of $1 \mu\text{m}$.

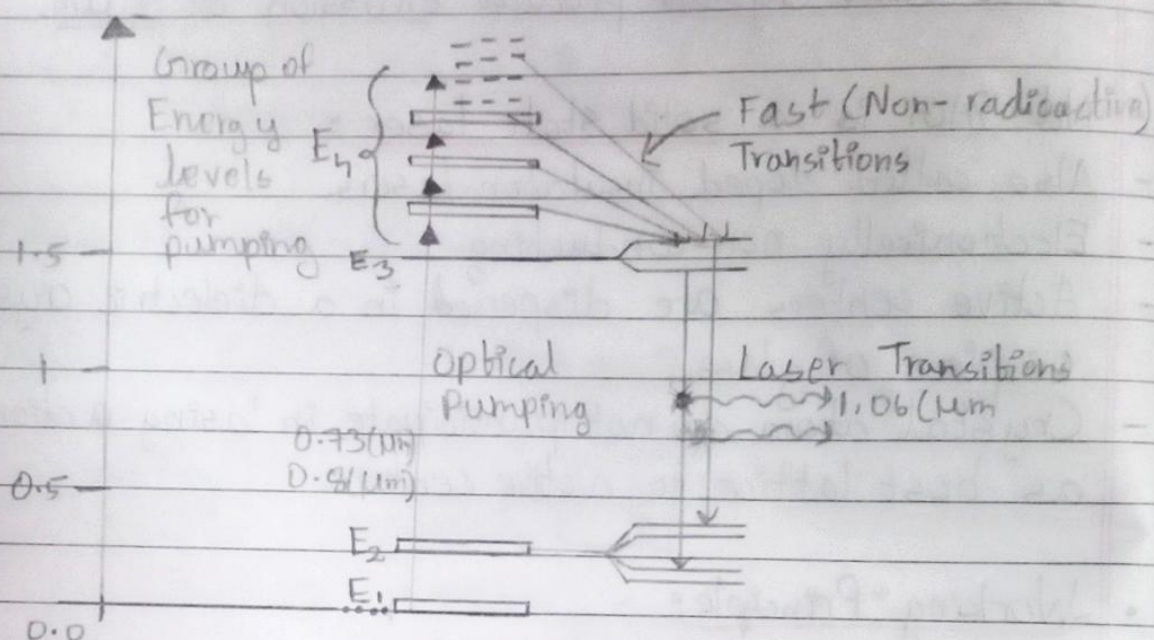
- Nd-YAG is a solid state laser :
- Also called doped insulator lasers.
- Electronically non-conducting.
- Active centers are dispersed in a dielectric crystal or piece of glass.
- Crystal atom do not participate in lasing action but act as host lattice to active centers.

• Working Principle:

- It is a four level laser - pumping achieved by xenon flash lamp.
- Nd^{3+} ions take place of yttrium ions. Doping concentration is of 0.725% by weight - 1.4×10^{26} atoms per m^3 .
- Two primary pump bands are in energy 7000-8500 Å
- It excites Nd^{3+} ions from the ground state to multiple energy states of E_4 . Nd^{3+} ions are active medium.
- The excited Nd^{3+} ions quickly decays to the metastable upper state laser level E_3 by releasing excess energy to lattice.
- E_1 cannot be populated by Nd^{3+} ions since it is 0.25eV above ground state. Therefore sparsely populated at normal operating temperature.
- Population inversion achieved between E_3 and E_2 levels.
- In E_3 state Nd^{3+} ions emit $1.06 \mu\text{m}$ wavelength and drop

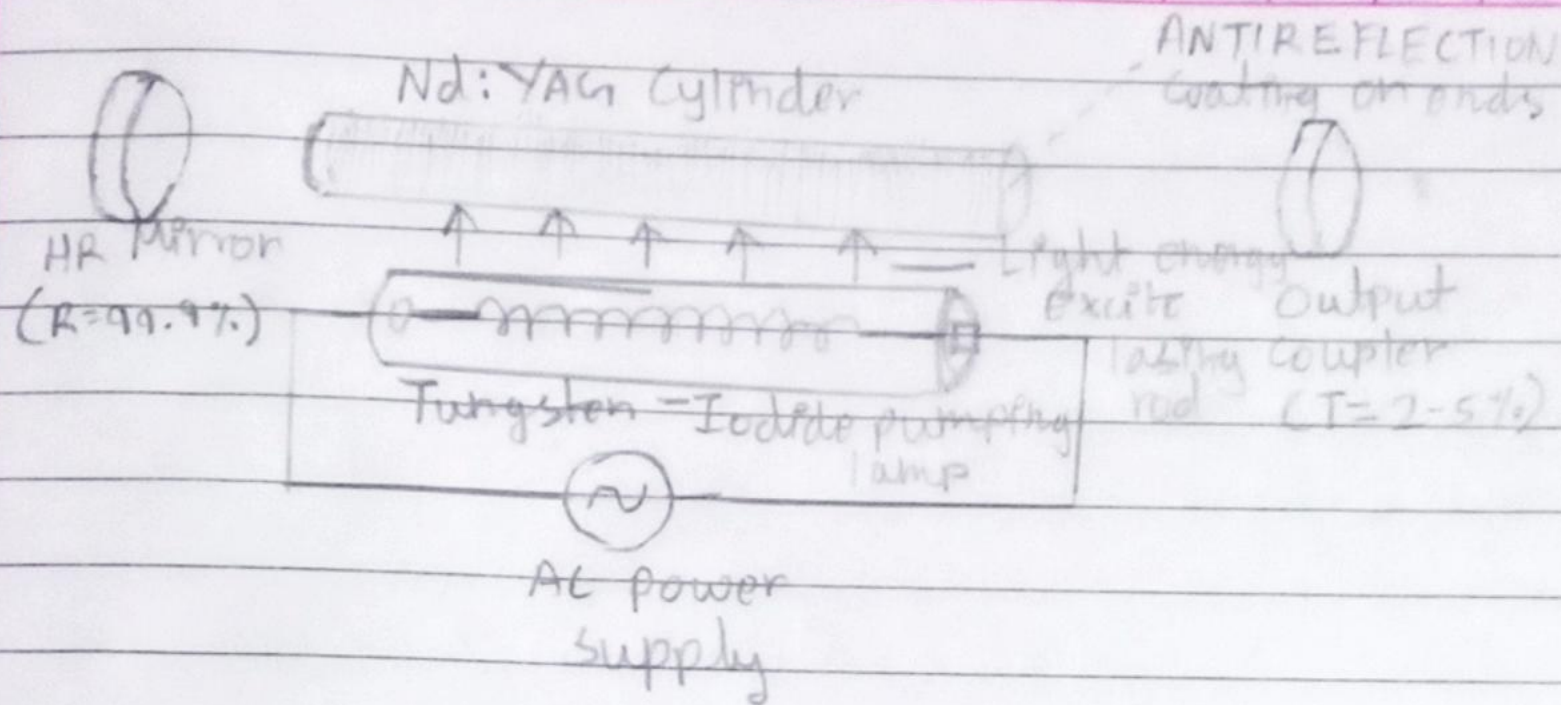
to lower level laser E_2 .

- To get continuous output - tungsten halide incandescent lamps are used.
- It operates in pulsed/continuous mode.



Energy Levels

- Construction:
 - Length of the Nd:YAG laser rod is 5cm to 10cm and diameter is 6-9mm.
 - Laser rod and linear flash lamp - elliptical reflector cavity.
 - Ends of rod are polished and made optically flat and parallel.
 - Optical cavity - silvering two ends or using 2 external mirrors. One is 100% reflecting other is partially reflecting.
 - System cooled by water or air circulation.



CONSTRUCTION OF Nd:YAG LASER