Light Amplification

(1) St Emi dominate SP. Emi $\frac{B_{21}}{A_{21}} \Delta \rho(\nu)$

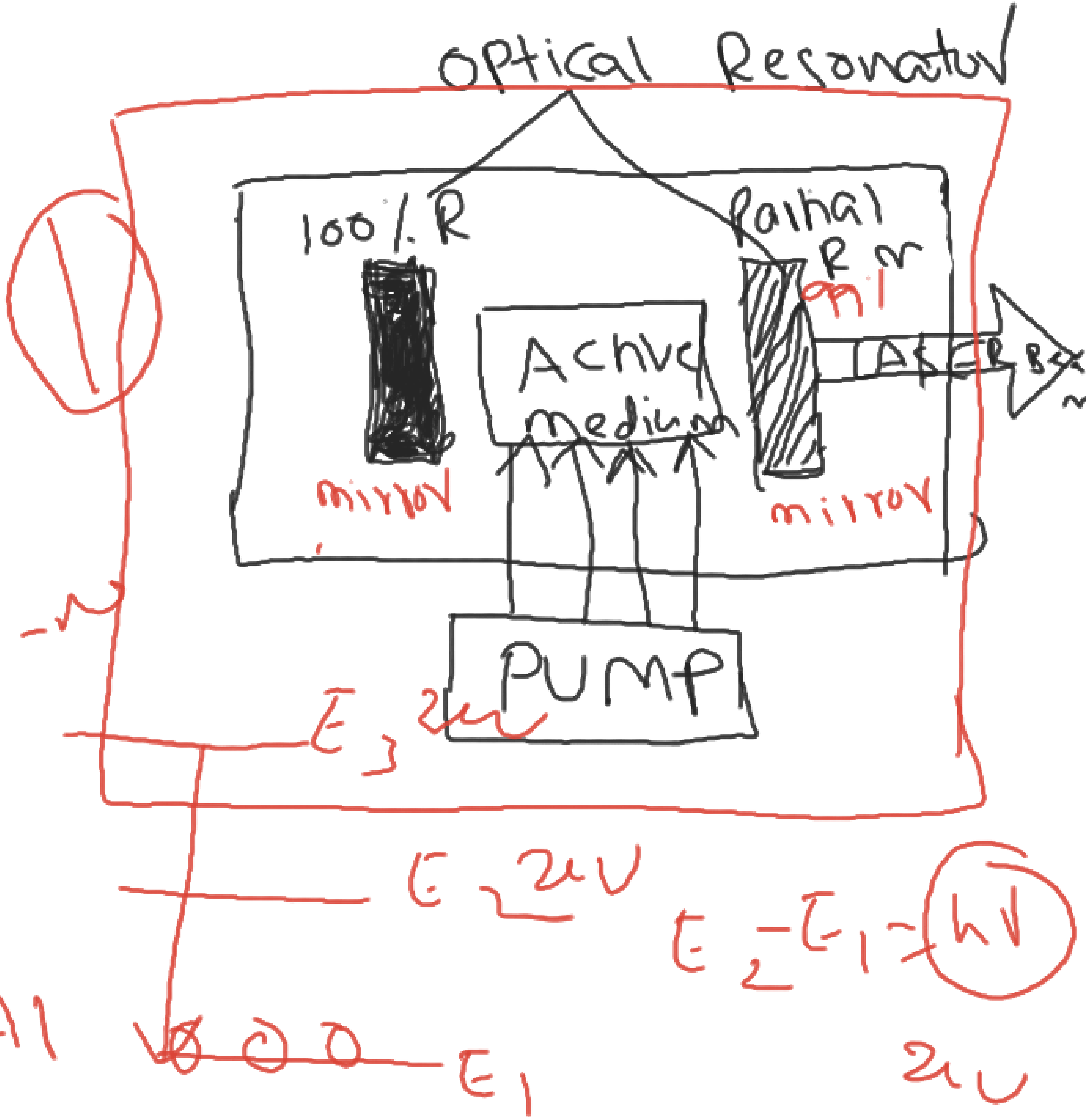
(2) Atoms should stay longer time in the excited state
→ metastable state 10^{-8} s → 10^{-3}–10^{-6}
10^{3}–10^{6} hrs

(3) St Em → in ab $\frac{N_2}{N_1} \Rightarrow N_2 > N_1$ – PT

—— N_2
—— N_1 10^{30} → $N_1 > N_2$ → $N_2 > N_1$

Components of LASER

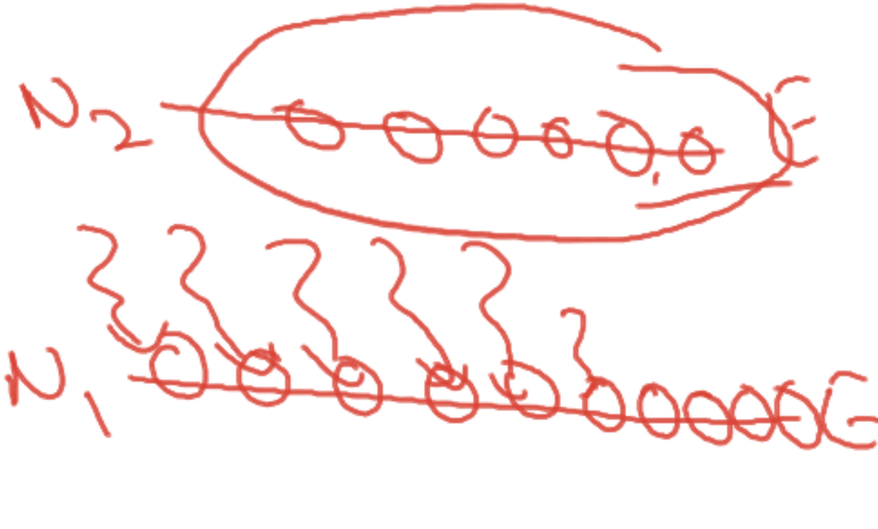
1. An active medium
2. Pumping Agent
3. an optical Resonator

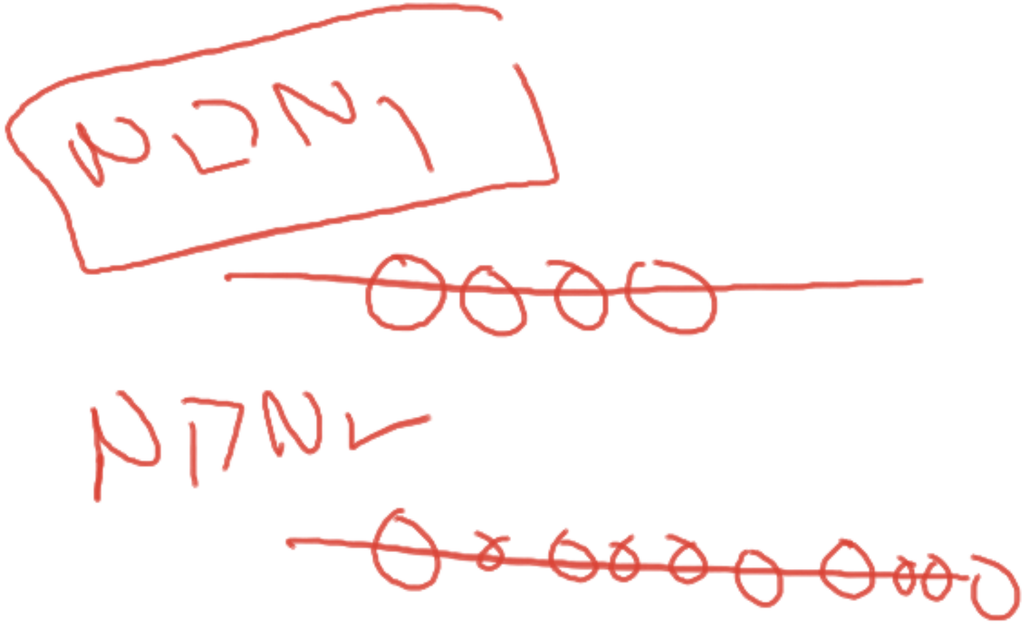


LASING ACTION:-

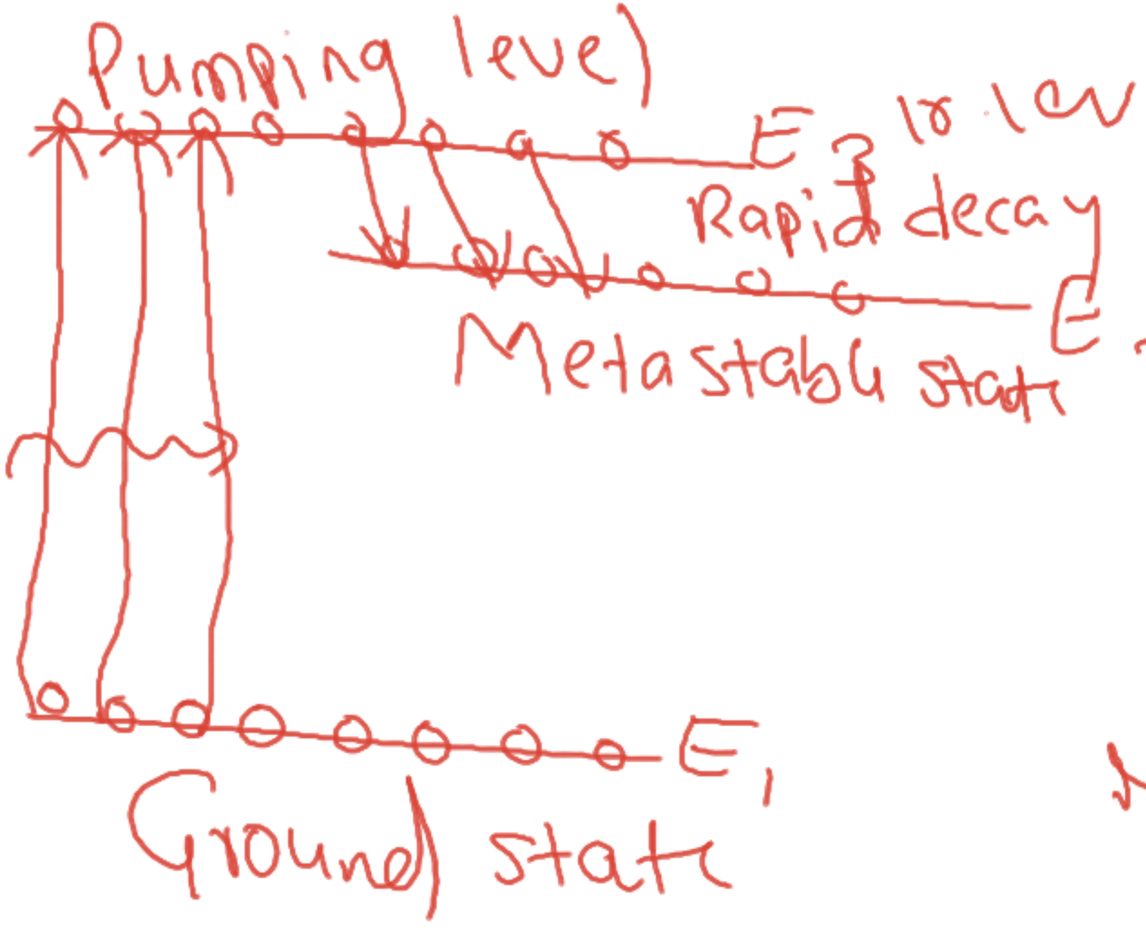
Pumping methods:- 1. Two level
2. Three level

two level Pumping → four level Pumping

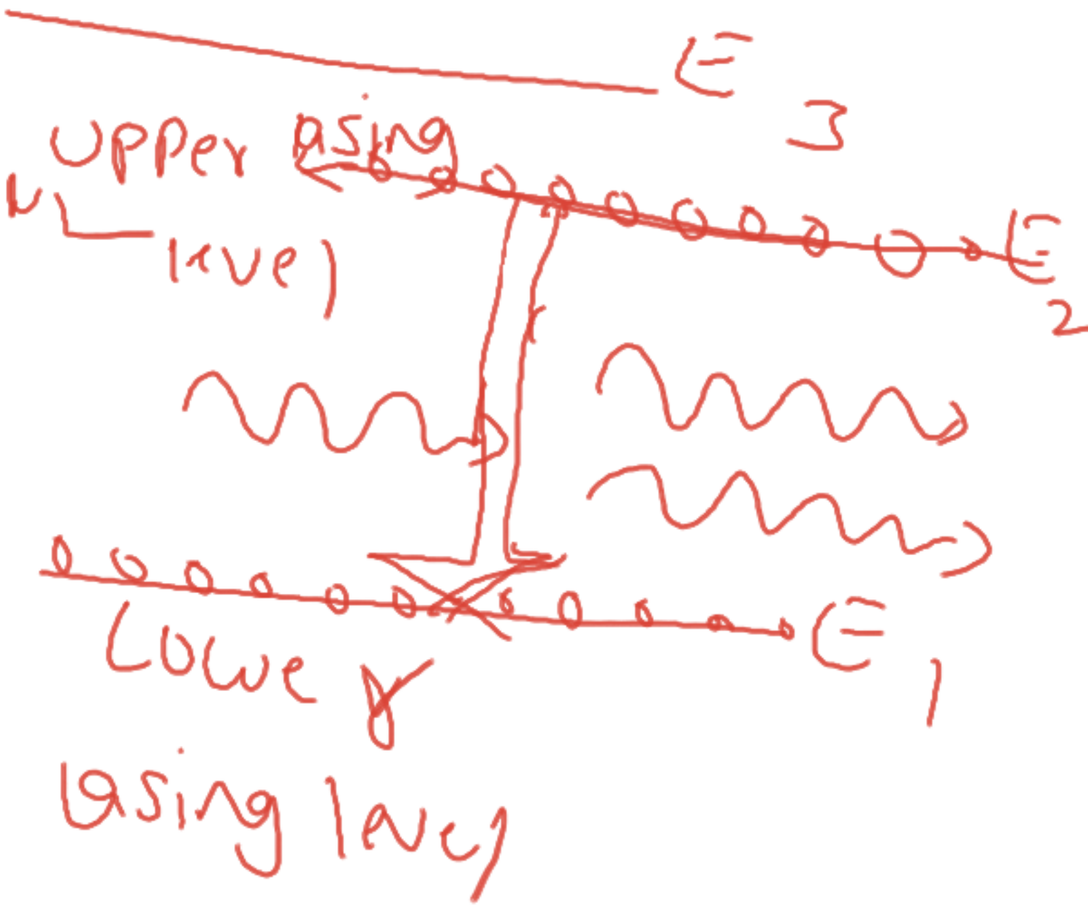




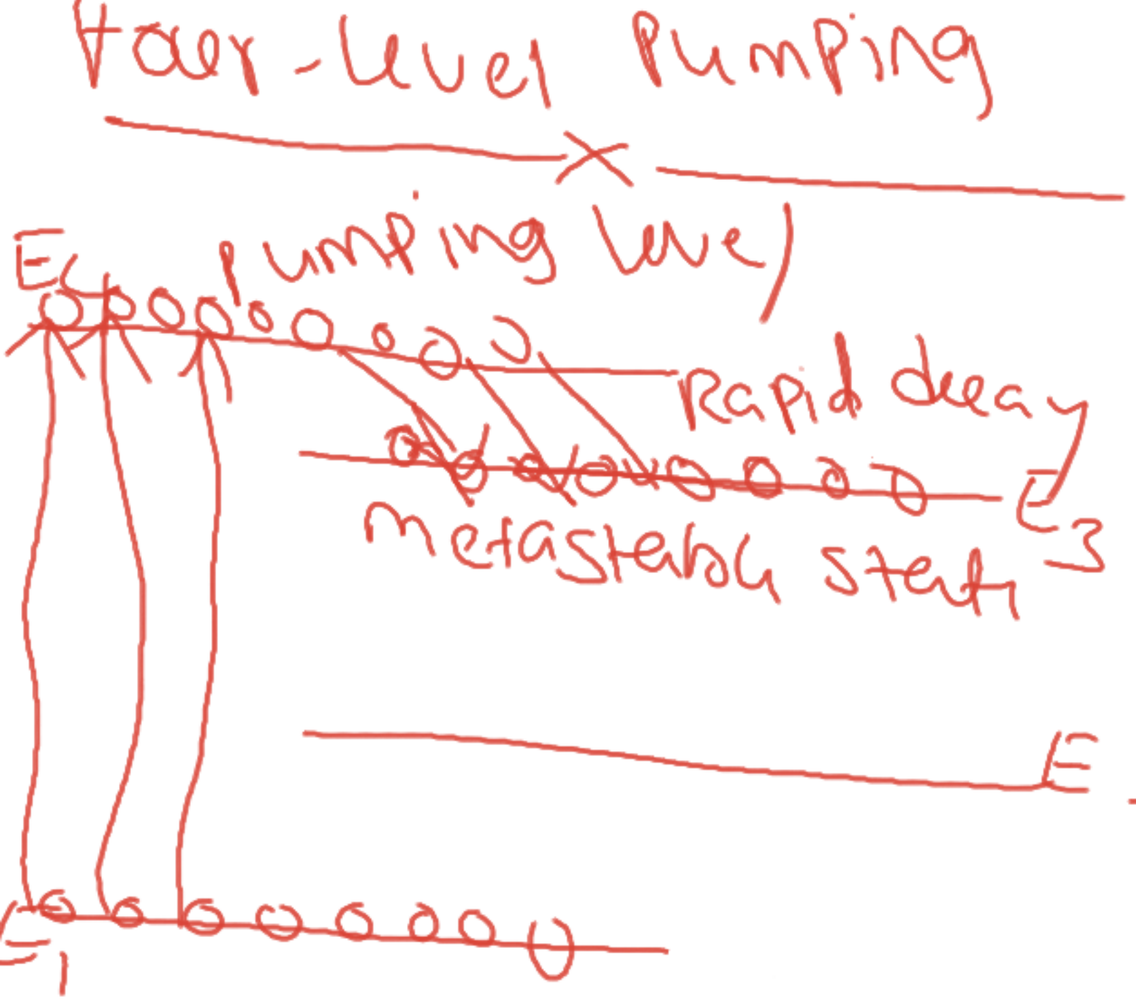
Three level Pumping

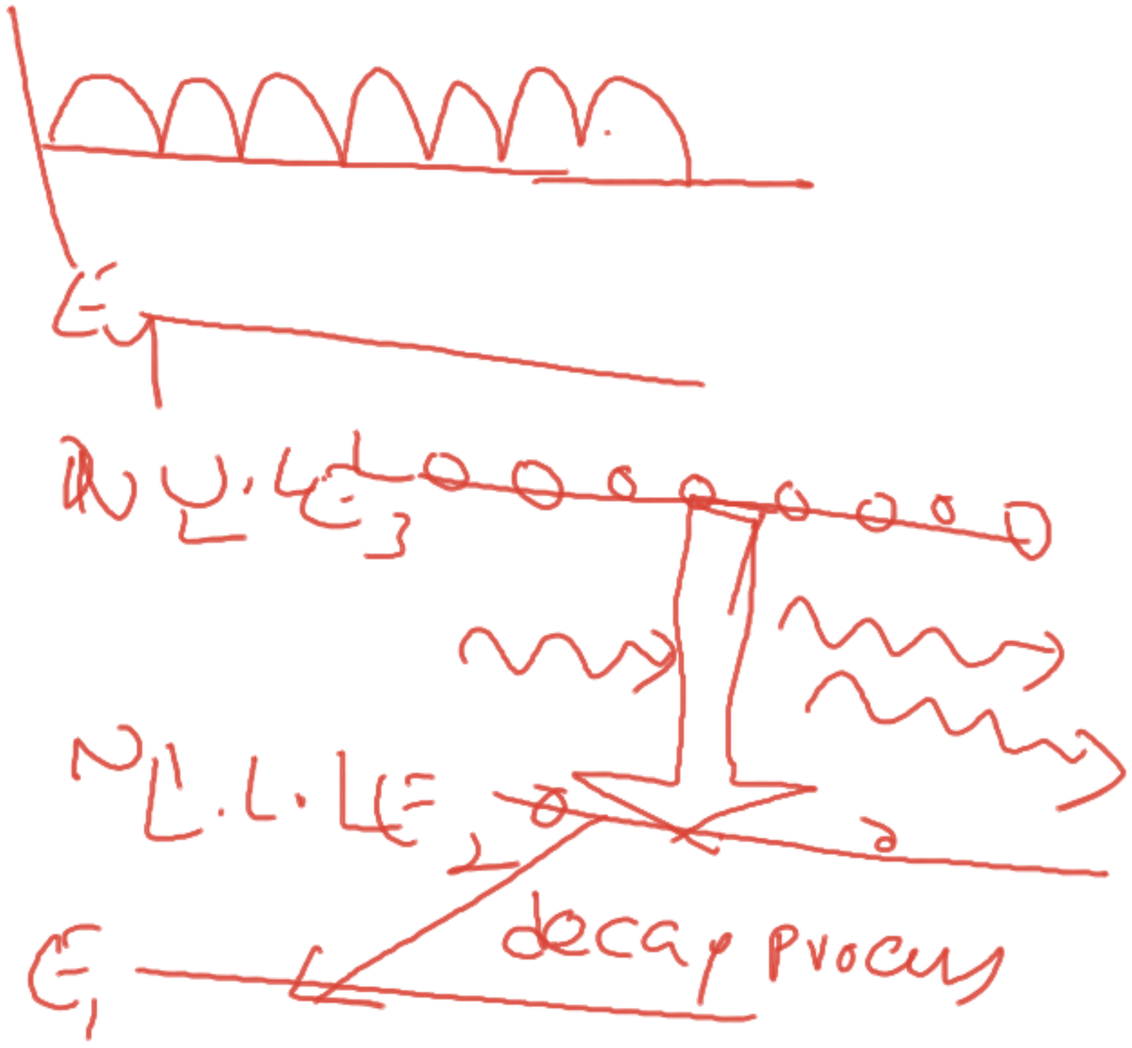


$N_2 > N_1$



Four-level Pumping





$N_2 > N_1 \rightarrow E_3 \& E_2$

TYPES OF LASERS

1. Solid state lasers — En:- Ruby laser, Nd:YAG laser etc.
2. Gas lasers — En:- He-Ne laser, CO_2 laser
3. Semiconductor diode laser — En:- GaAs laser, InP laser etc.

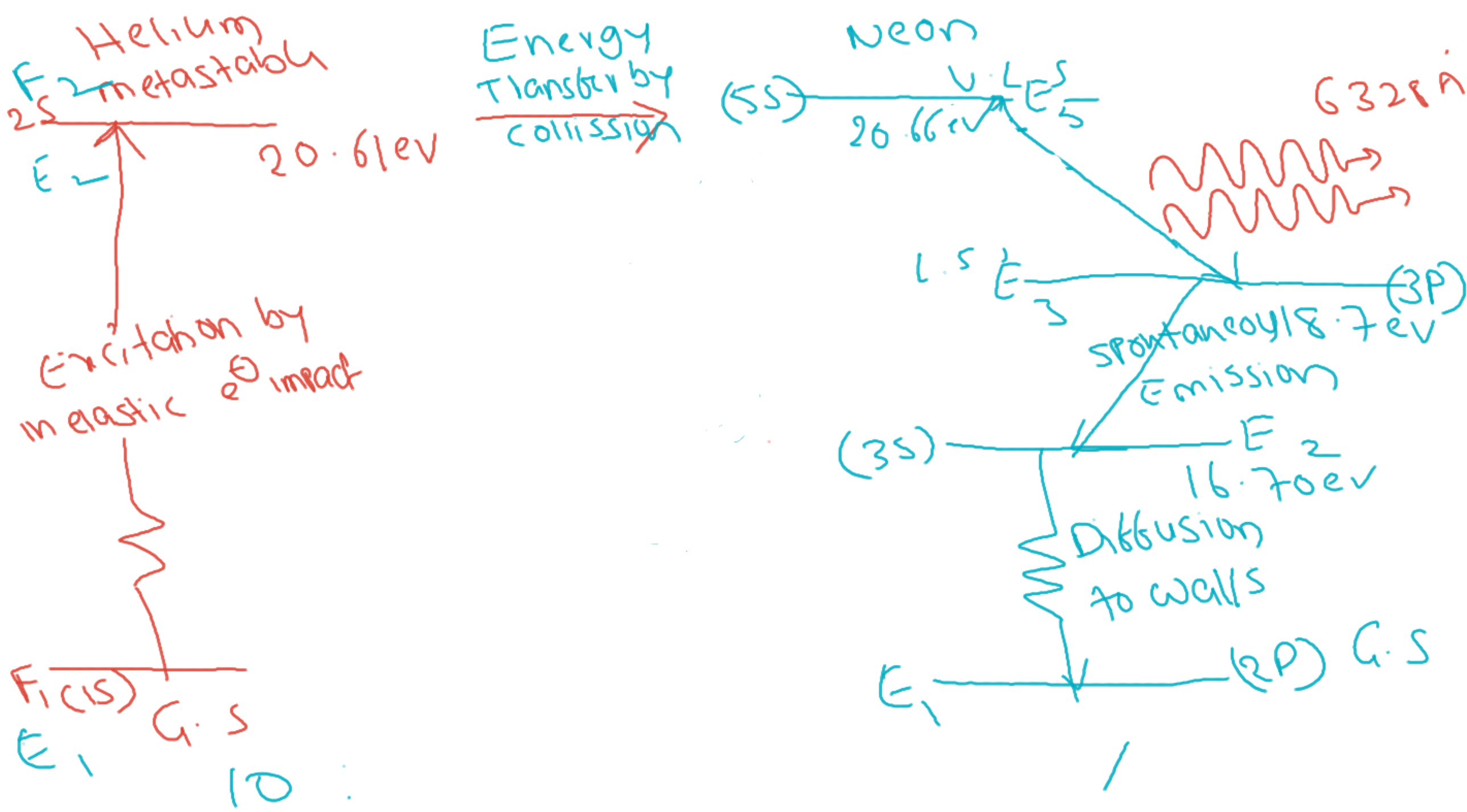
Ruby laser

Al_2O_3 → 0.05% Chromium atoms

Cr^{3+} → active entity

$AlSO$ → inert


100% R
PRM
1cm
6cm
Active medium
Pump
Resonator
Optical pumping


Helium
metastable
F2
2S
20.61ev
E2
Excitation by
inelastic e⊖ impact
F1(1S)
G.S
E1
Energy
Transfer by
collission
Neon
(5S)
20.66ev
E5
6328 Å
1.5
E4
(3P)
spontaneous 18.7ev
Emission
(3S)
E3
16.70ev
Diffusion
to walls
E1
(2P)
G.S

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