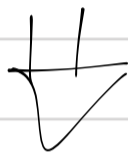


Laser

Light Amplification by
Stimulated Emission of Radiation

Amplificação de luz por

emissão estimulada de Radiação



Amplificação de Radiação por emissão estimulada

Radiation Amplification by Stimulated Emission
(RASE)

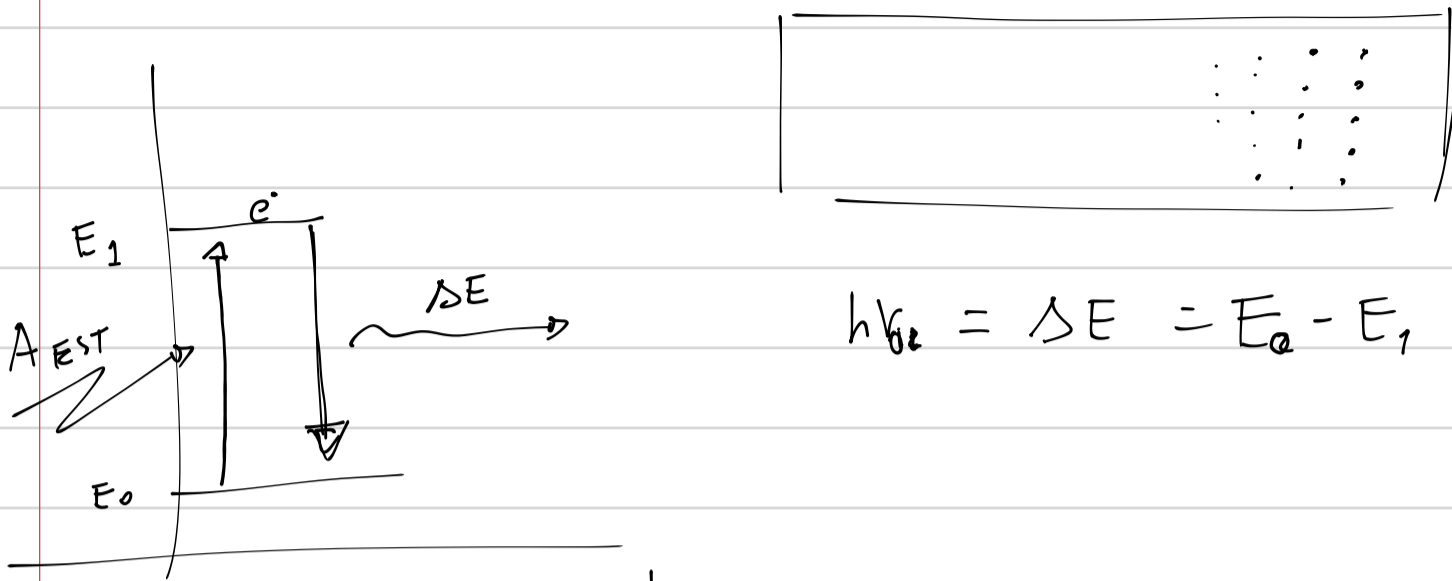
→ Características da Radiação Laser

- Colimada → alto brilho
- monocromática
- coerente
- polarizada

→ 3 condições de um Equipamento Laser

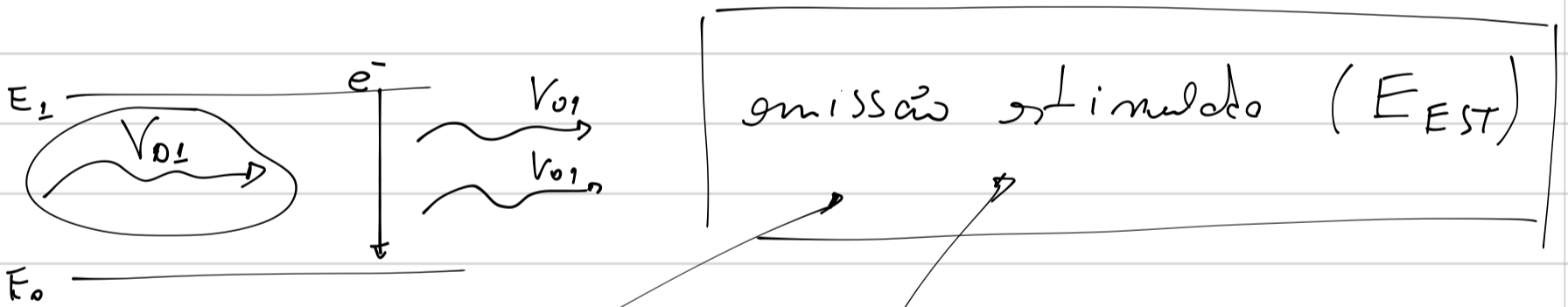
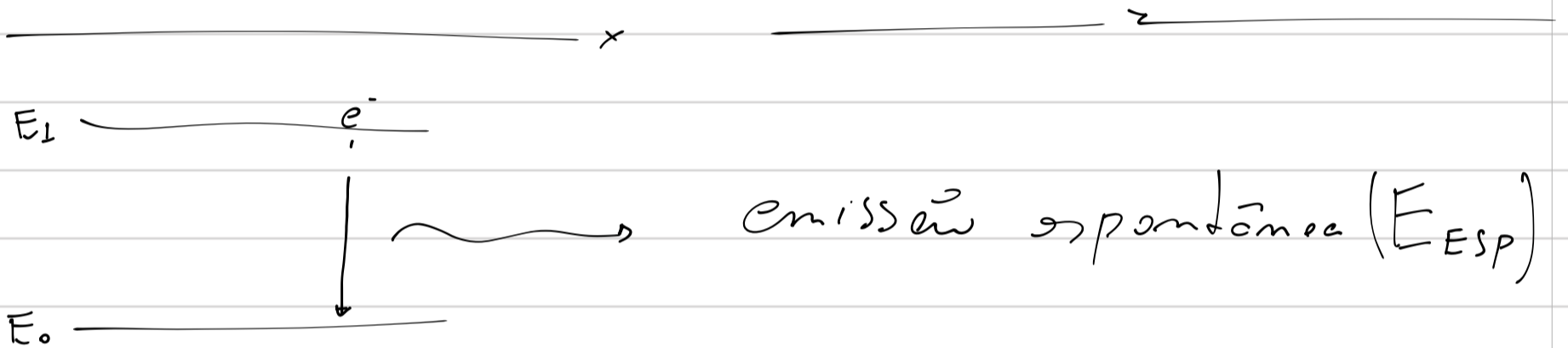
- ter um meio ativo
- ter inversão de população
- ter feedback óptico

→ Meio Ativo



$$h\nu_{01} = \Delta E = E_0 - E_1 = h \frac{c}{\lambda_{01}}$$

Absorção estimulada (A_{EST})



RASE (LASER)

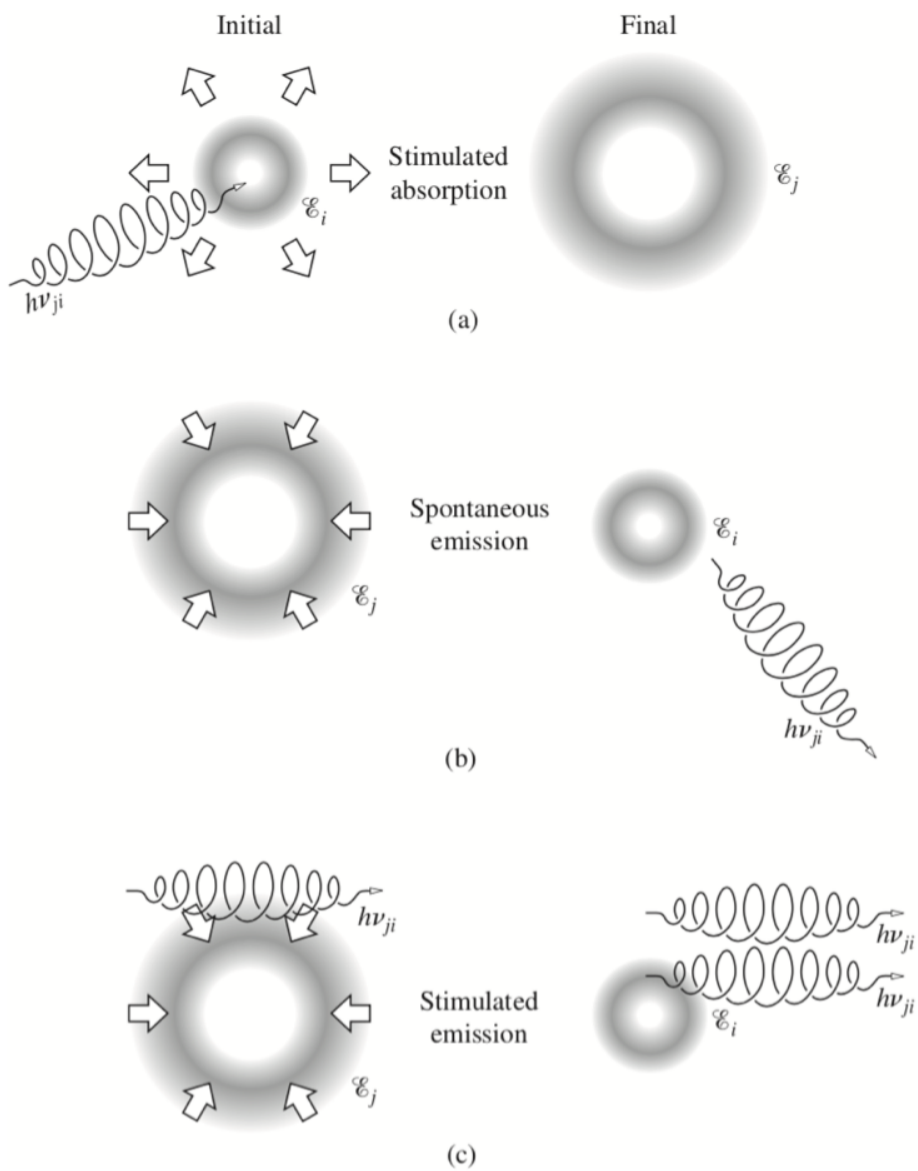


Figure 13.5 A schematic representation of (a) stimulated absorption, (b) spontaneous emission, and (c) stimulated emission.

Inverzia populacia

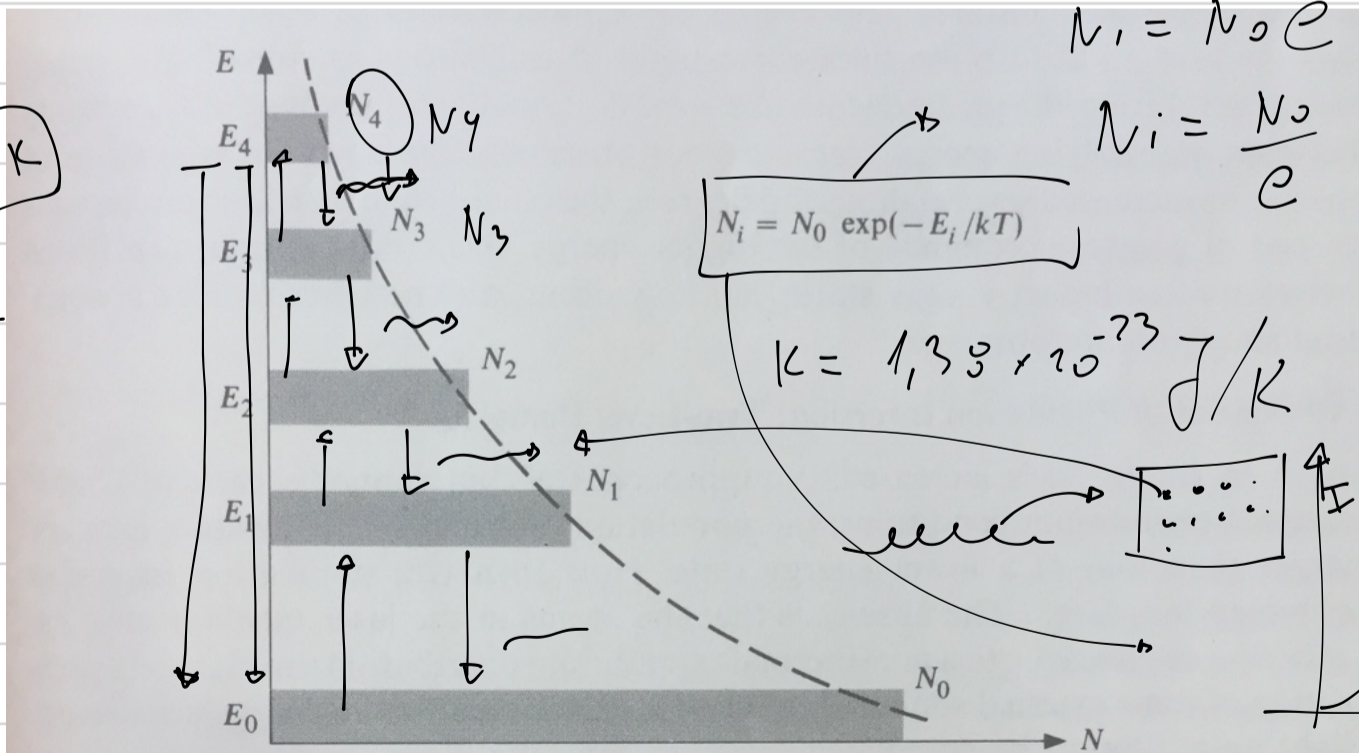


Fig. 3.3 Boltzmann distribution for several energy levels. Dashed line indicates the population of levels if the distribution of energy levels were continuous rather than discrete, as shown here.

$T=300K$
 $h\nu$
 Dostigeb

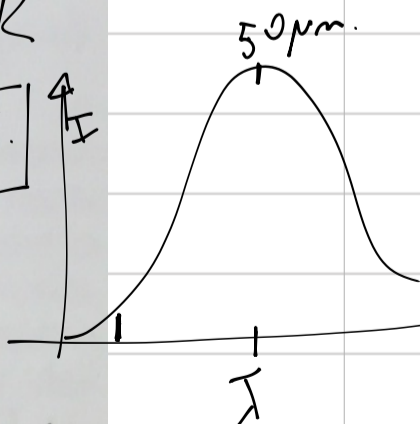
$$N_i = N_0 e^{-\frac{E_i}{kT}}$$

$$N_i = \frac{N_0}{e^{E_i/kT}}$$

$$E_i = kT$$

$$E_i = h\nu_i$$

$$k = 1,38 \times 10^{-23} \text{ J/K}$$



$$h\nu = \frac{hc}{\lambda} = kT$$

$$\lambda = 50 \mu m$$

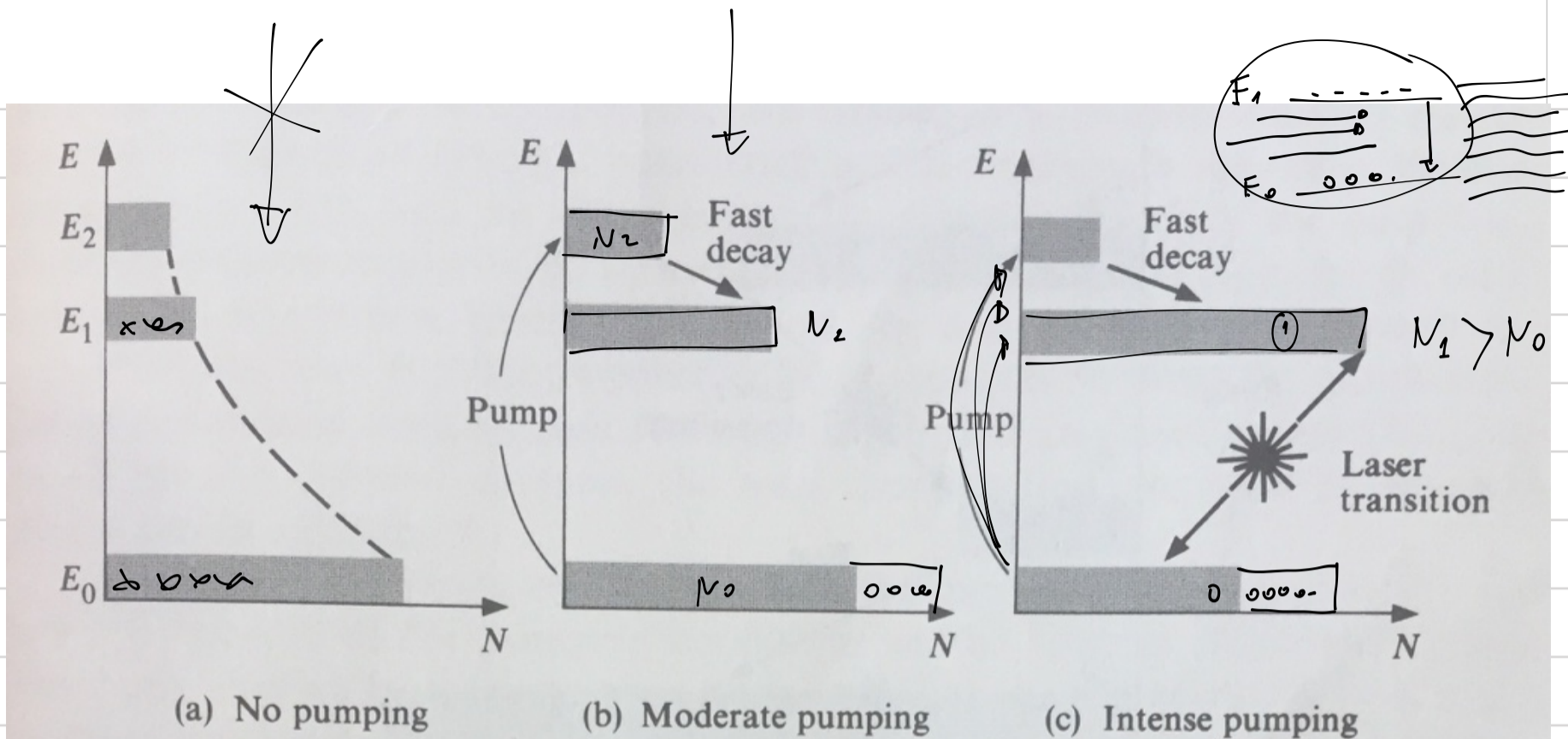
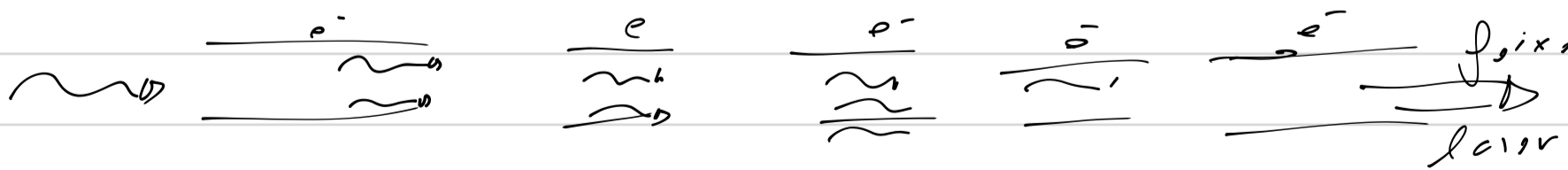
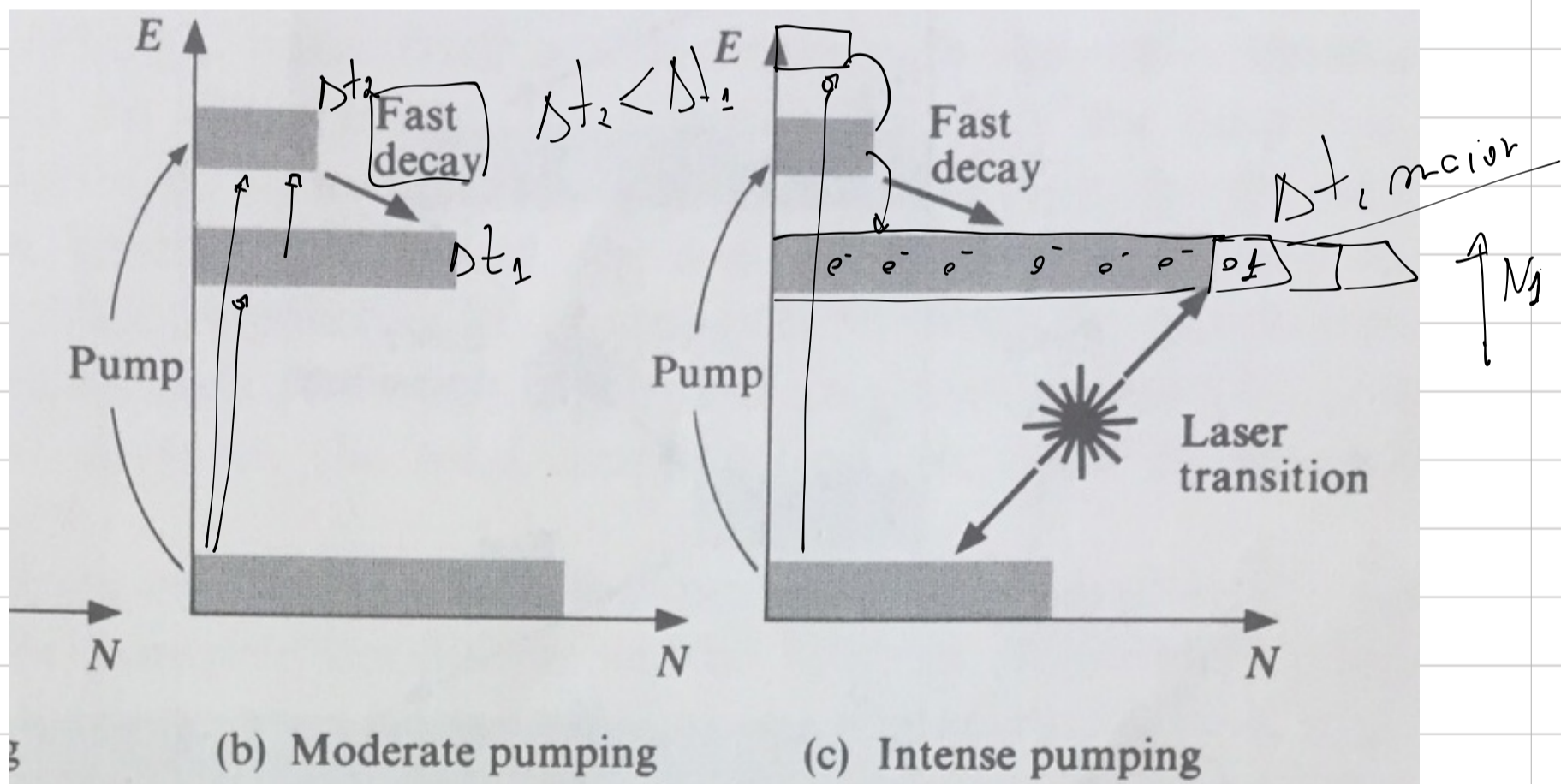
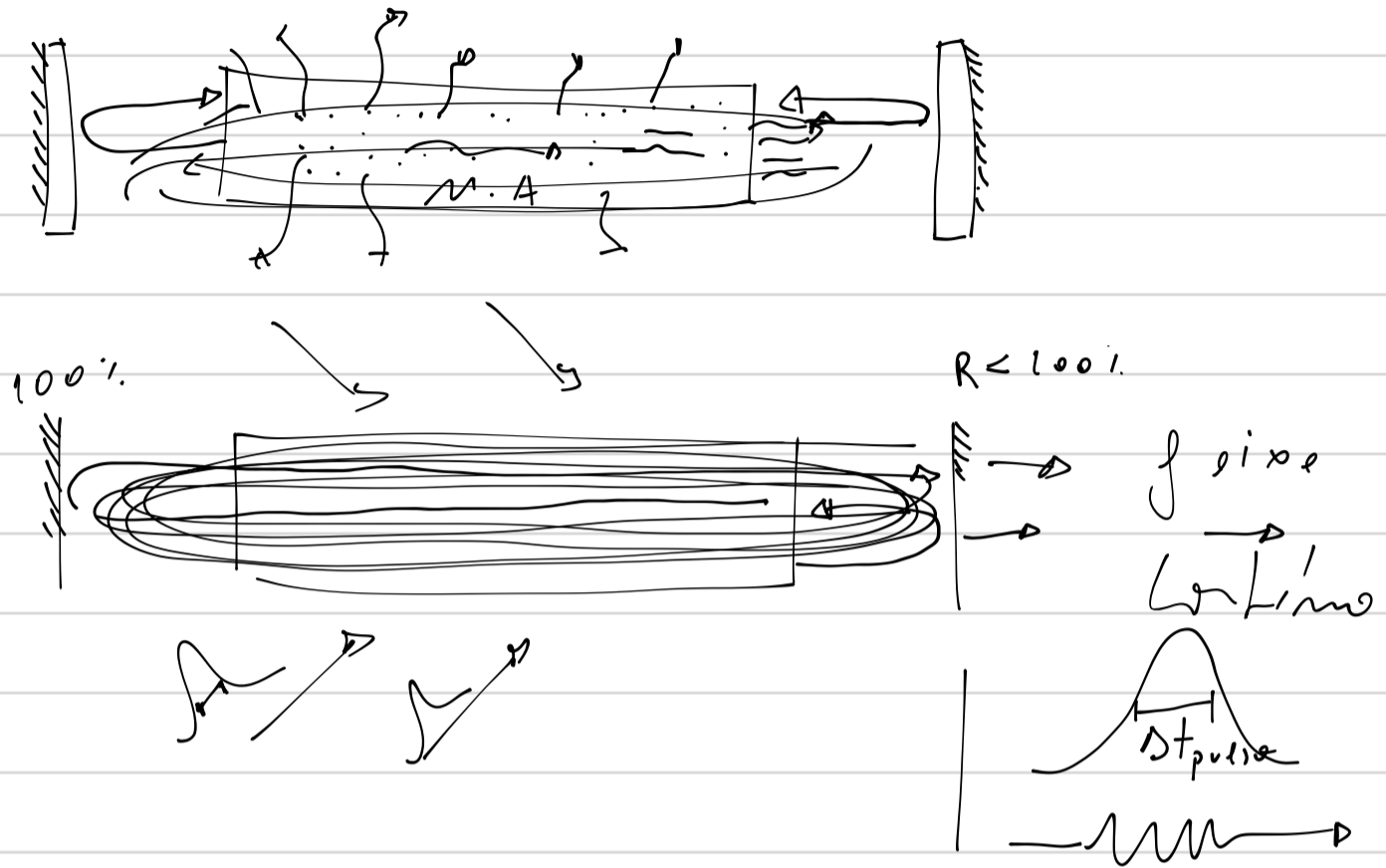


Fig. 3.5 Population of energy levels by pumping in a three-level system. (a) Boltzmann distribution of energy states with no pumping. (b) Nonequilibrium distribution with moderate pumping. (c) Population inversion created by intense pumping of the highest energy state followed by decay to the intermediate state.



_____ x _____ x _____

Resonador óptico

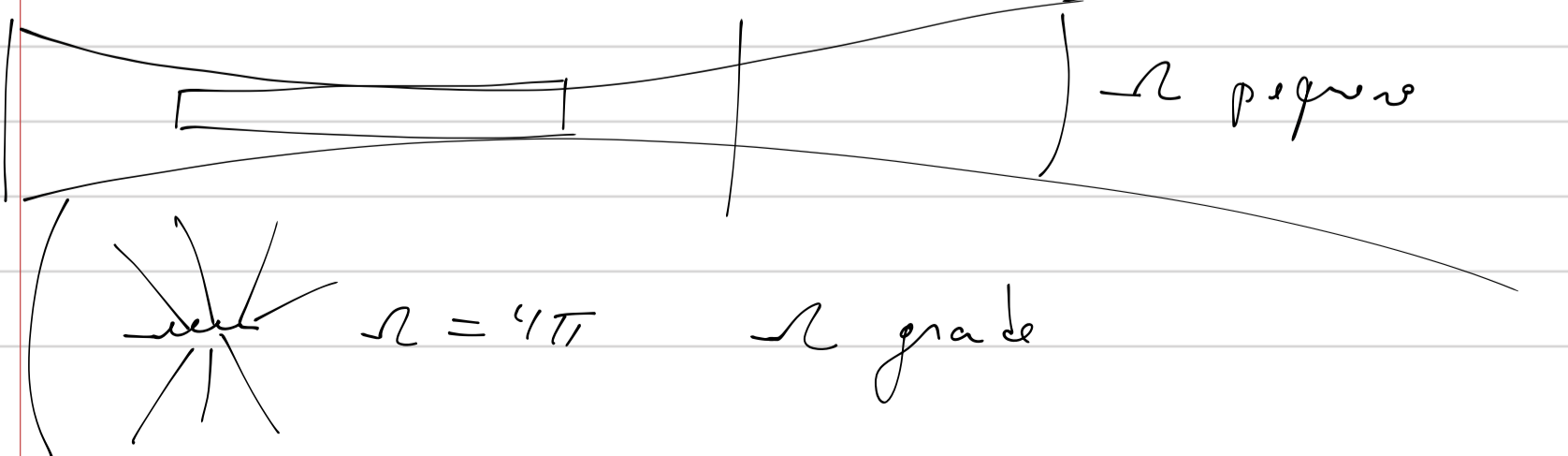


→ Pelajar de Einstein

→ coef de ganho e absorções

Características de Radiação Laser

→ Colimada



→ alto Brilho α

Radiância $\frac{W}{m^2 \cdot sr}$

Luminância $\frac{lm}{m^2 \cdot sr}$

$\frac{1 W}{m^2}$

Ω

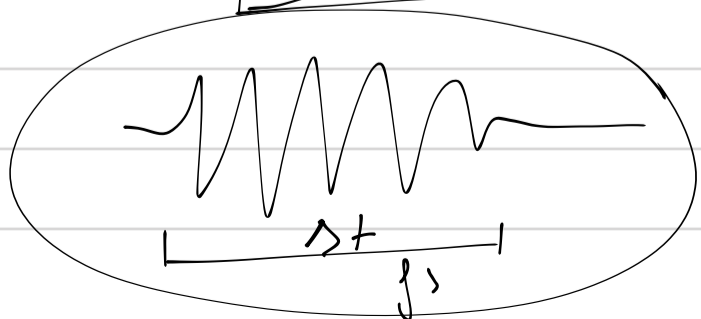
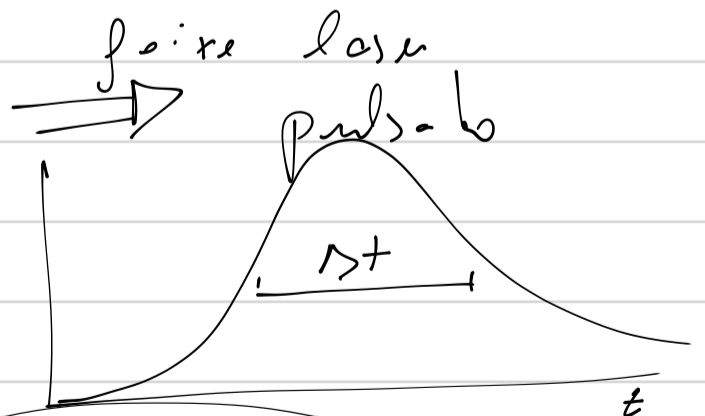
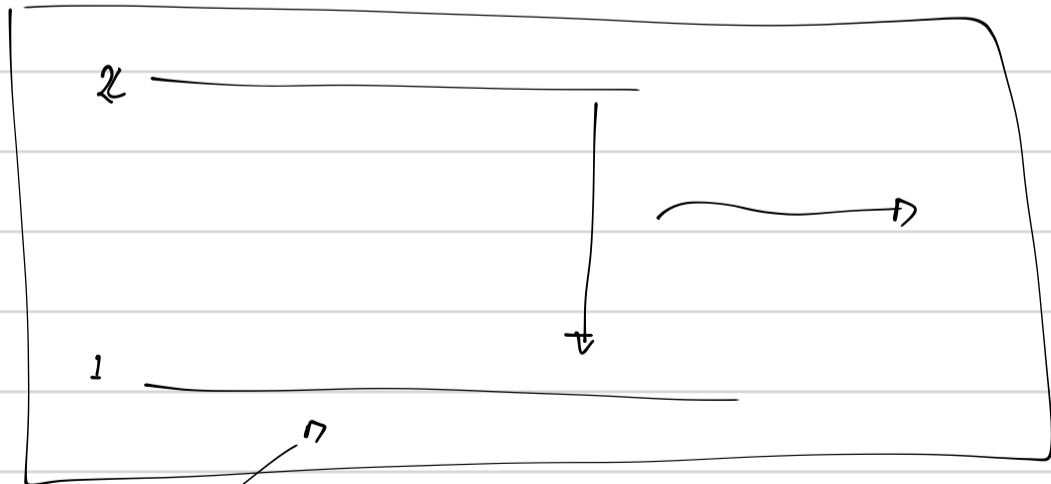
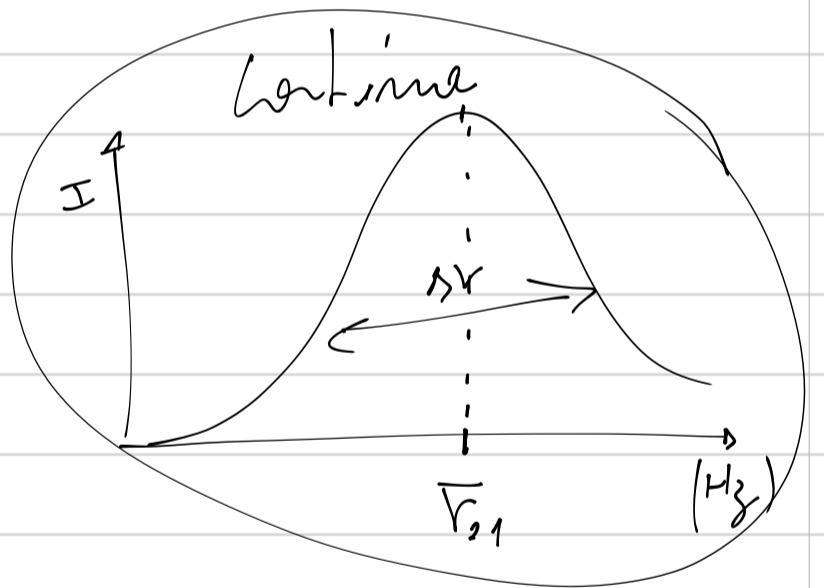
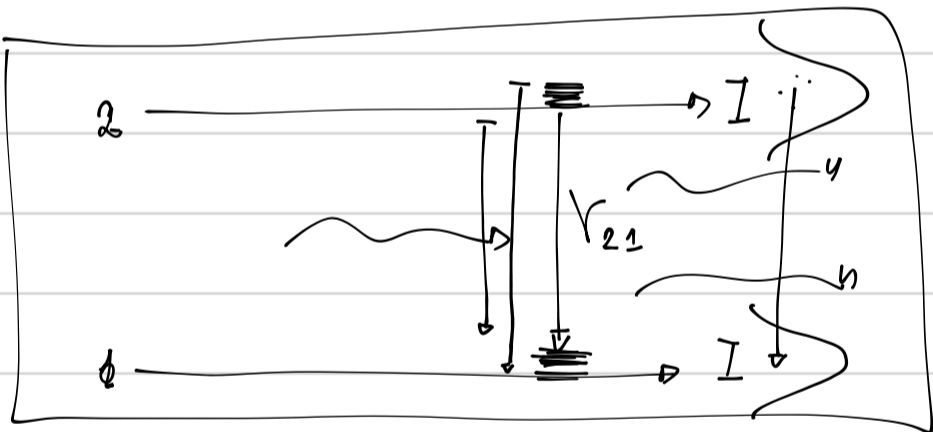
Radiância pequena

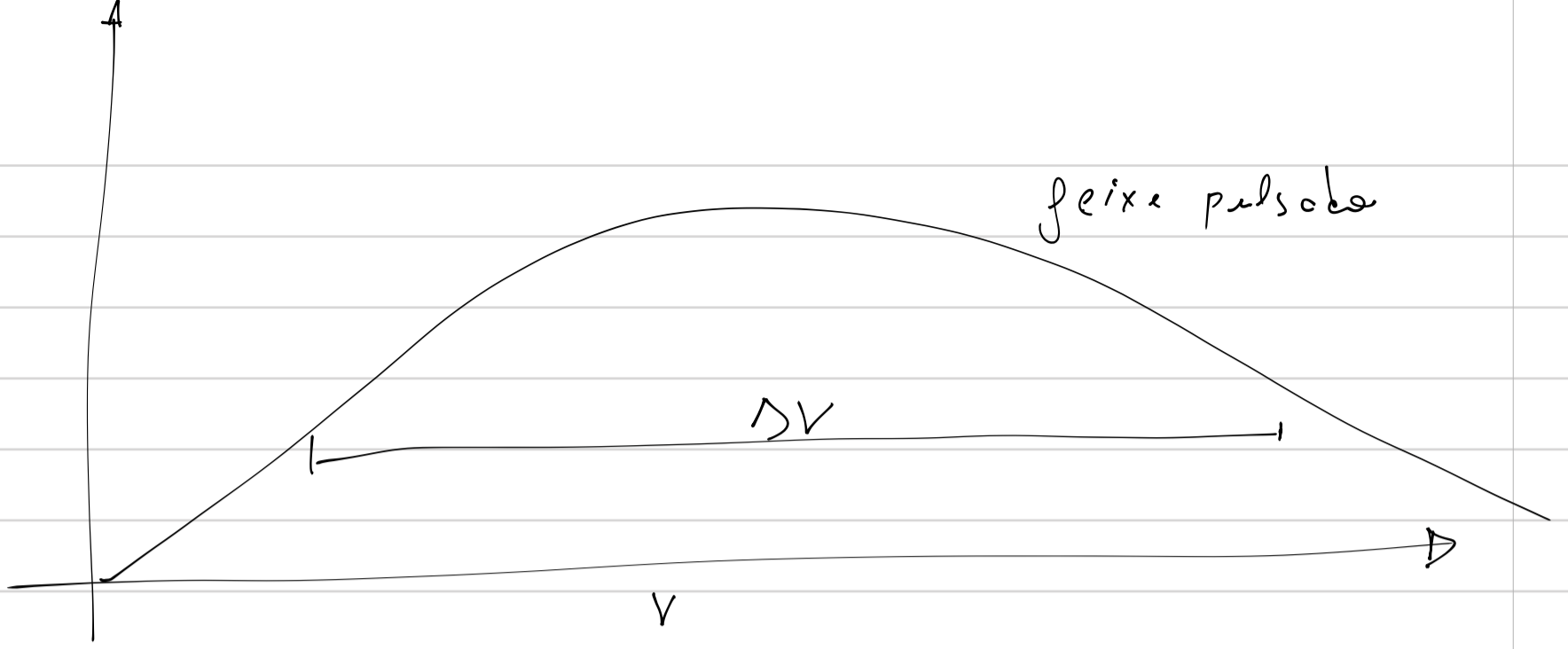
$\frac{1 W}{m^2}$

Ω pequeno

Radiância alta

→ monocromática





→ coerência

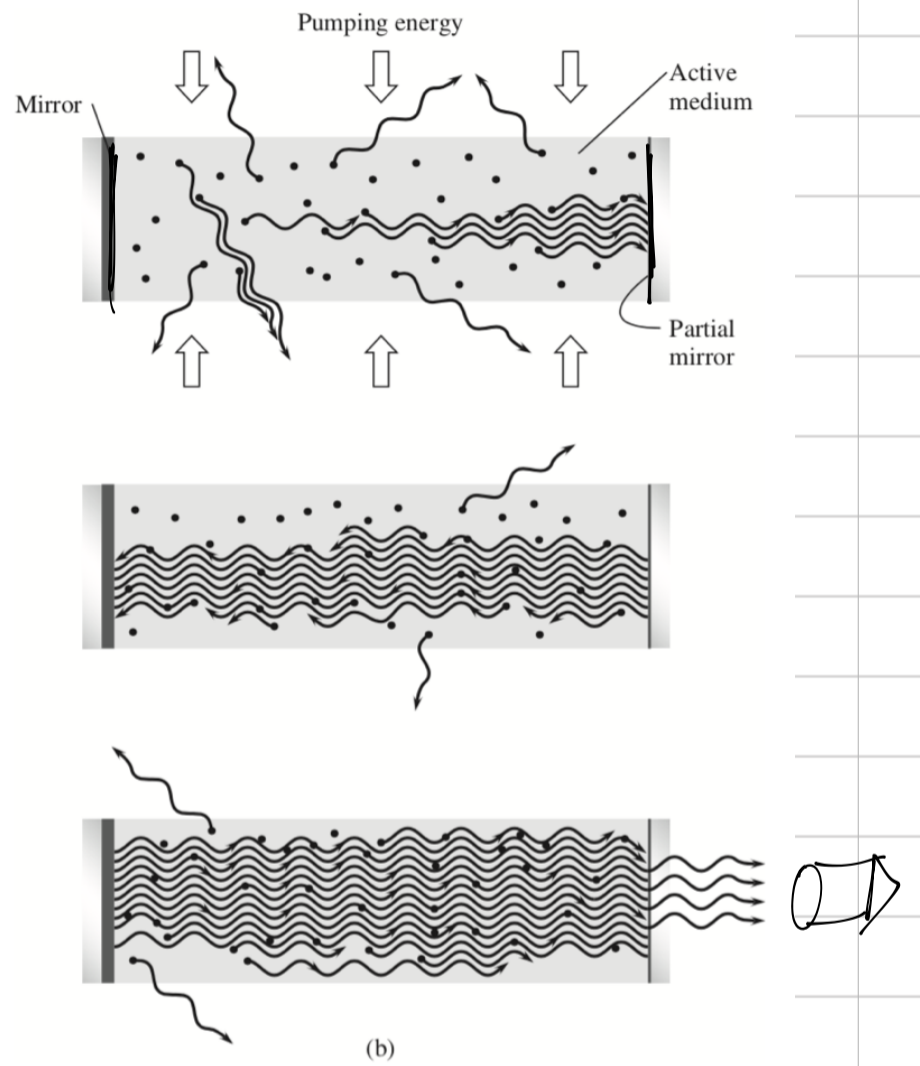
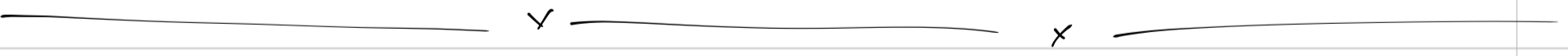


Figure 13.7 The first ruby-laser configuration, just about life-sized.



→ polarizada → ① janela no ângulo de Brewster

→ ② Devolve a emissão estimulada

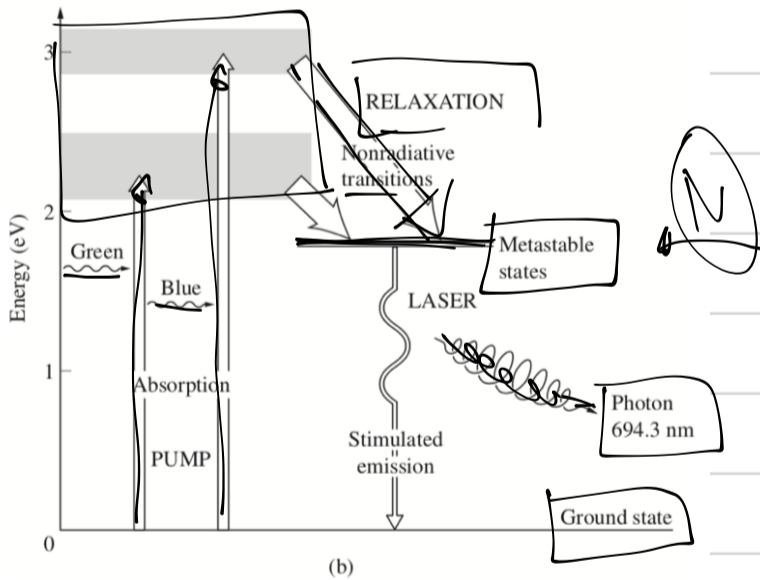
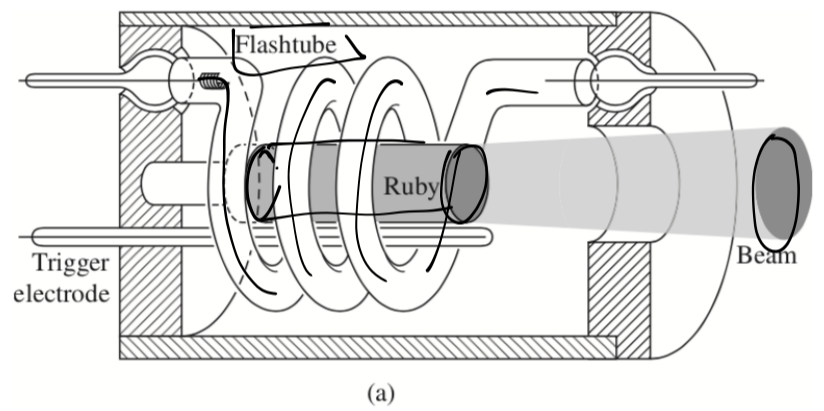
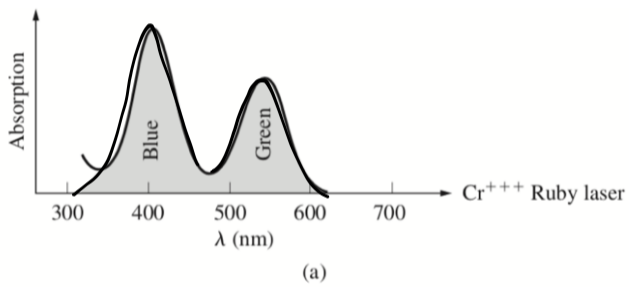
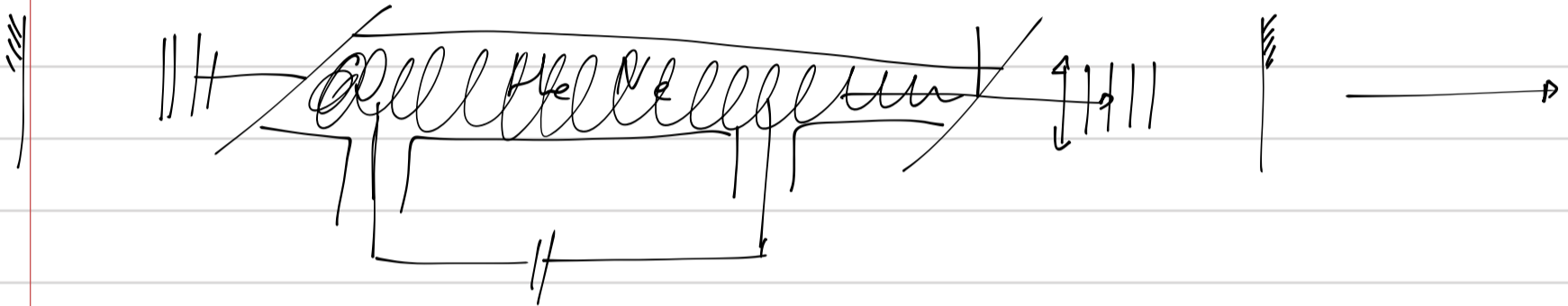


Figure 13.8 Ruby-laser energy levels.

----- x ----- x -----

