Population Inversion

- Condition for population inversion $N_2 > N_1$

      N_2= population of excited state, N_1= population of ground state.

For a *two level* system :-

$$\frac{dN_2}{dt} = B_{12}N_1\rho - B_{21}N_2\rho - A_{21}N_2$$

Solving for N_2, using Einstein relations:- $B_{12} = B_{21} = B$, $A_{21} = A$

$$N_2 = \frac{B\rho Nt}{A + 2B\rho} \qquad here, N = N1 + N2$$

Since A > 0 always, so

$$\frac{N_2}{N} \leq \frac{1}{2} \quad \text{or} \quad N_2 \leq N_1$$

But for population inversion $N_2 > N_1$, so in a two level system population inversion can't be achieved.