Phys 585 Spring 2024

Homework #7

(due Wednesday, June 5, 2024)

1. (10 pts) Consider a three-level laser system.

   (a) Write down rate equations for the population of each level

   (b) Introduce the fluorescent quantum efficiency η for this case following the same logic as we did in class for a four-level system

   (c) Write down the steady-state population difference N_2-N_1 in terms of total number of atoms N, pumping rate W_p, radiative lifetime τ_{rad}, fluorescence quantum efficiency, and a parameter $\beta = \tau_{32}/\tau_{21}$.

   (d) Under what condition does the population inversion occur? Compare with the case of a four-level system.

2. Reading assignment: Chapter 15 of B&J.