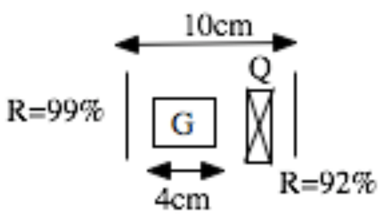
HW#9, Phys 168; Due Thursday 11/5 (Midterm on Tues 11/10)

1. Problem 8.4.

2. Problem 8.10. Do the sum of the E-fields explicitly, assuming that the intensity drops off like $e^{-\frac{(\nu-\nu_0)^2}{(300\,MHz)^2}}$.

3: Consider the cavity below, with a gain medium (G) and a Q-switch device (Q) in the cavity. With the Q-switch closed, the gain medium is pumped such that the population in the upper state is 10^{12} cm^{-3}. The lasing medium is dominated by lifetime broadening, and the energy level diagram is given. Each transmission surface has a loss of 1%, *including the surfaces of the Q-switch*!



7.3eV -------------- (2)

1.2eV --------------- (1)

0.0eV ---------------(0)

[all degeneracies =2]

$A_{21}=10^5$ Hz
$A_{20}=10^4$ Hz
$A_{10}= 1/(2\ 10^{-6})$ Hz

A) Find the cross section for the lasing transition (2->1).

B) Find the population of state 1 (before the Q-switch is opened). (Hint: you only need to consider the rate equation for state 1.)

C) What will be the peak **OUTPUT INTENSITY** of the Q-switched cavity? (*Not* power! Hint: you aren't given the volume of G, but the unknowns should cancel out just as you get to your final answer.)

4) A gaussian laser beam has z_R= 3.00 meters and λ=1.00μm.

A) What is the "FULL WIDTH HALF MAXIMUM" of the laser beam at a location 1.0 meters before the waist? (Note: not w!)

B) At a distance of 1.0m after the waist, a f=1.0m lens is placed. Find the radius of curvature of the beam immediately after this lens.

C) Exactly how far beyond the lens in part B will a new waist form? Show your answer on a sketch of the beam, indicating relevant features on both sides of the lens.