

AST 300B – Spring 2017
In-class Problems Due: Monday Mar. 27

34. Calculate the expression for the ratio of stimulated to spontaneous emission rates. Evaluate this ratio for the following transitions and comment on which transitions you could ignore Einstein B terms in the analysis of the level populations. Assume that the CMB is the dominant background radiation field.

- a. HI spin flip transition $\lambda = 21.1 \text{ cm}$ $A_{ul} = 2.9 \times 10^{-15} \text{ s}^{-1}$
- b. CO 1-0 rotational transition $\lambda = 2.7 \text{ mm}$ $A_{ul} = 7.2 \times 10^{-8} \text{ s}^{-1}$
- c. H₂O 1_{1,0} – 1_{0,1} rotational trans. $\lambda = 538 \text{ }\mu\text{m}$ $A_{ul} = 3.4 \times 10^{-3} \text{ s}^{-1}$
- d. CII fine structure transition $\lambda = 157.7 \text{ }\mu\text{m}$ $A_{ul} = 2.4 \times 10^{-6} \text{ s}^{-1}$

