AST 300B – Spring 2018

In-class/take-home Problems Due: Wednesday April 25th

44. In class and in a previous homework problem, we derived the terms for the energy levels of Carbon in the ground state $(1s^2 2s^2)2p^2$ and the terms for the energy levels of an excited state of Carbon with 1 p electron in a 3s orbital $(1s^2 2s^2)2p^1 3s^1$.

(a) Using Hund's Rules, order the terms of both these configurations in order of increasing energy. Sketch a rough energy level diagram (don't worry about looking up the exact energies of each level - just show which levels are higher or lower than others).

(b) What is the parity of the electronic terms in the ground electronic state and the excited electronic state.

(c) The rules for electric dipole or "resonance" transitions are given below. Using those rules, explain which resonance transitions are allowed between these energy levels (these will have the fastest Einstein A and be brightest generally).

Electric Dipole (Resonance) Transitions

- Only 1 e^- changes its (nl) state with $\Delta l = -1$ or $+1$
- Parity MUST change
- $\Delta L = -1, 0,$ or $+1$ ($0 \not\rightarrow 0$, no S → S term transitions)
- $\Delta J = -1, 0,$ or $+1$ ($0 \not\rightarrow 0$ NOT allowed)
- $\Delta S = 0$ (spin multiplicity does NOT change)