**Excitations**

Let’s consider the properties of core electron states. Being tightly bound as they are, their energy levels probably won’t broaden too much into bands. We can also probably treat them as non-interacting – well, within the CFA and Hund’s rules.

So recall that from CFA and Hund’s rules, the excited states accessible to valence subshell are characterized by reorganizing their degenerate|ℓsmℓms>N subspace into the |LTSTJTmJT> space. Hund’s rules tell us the lowest lying states:

1. Maximize ST consistent with the Pauli exclusion principle (having same spin requires spatial part of total electron wavefunction to be anti-symmetric, minimizing their repulsion and hence lowering energy)
2. Maximize LT consistent with ST and the Pauli exclusion principle (going in same orbital direction minimizes chance of crossing, and hence electrical repulsion)
3. Now allowed JT values are J ∈ |LT – ST| …. (LT + ST). With freedom left, Maximize/Minimize JT if filling of valence is >, < ½ filled. If it is half-filled then there is only one possible value of JT anyway because LT = 0. This procedure is basically taking account of SO interaction.
4. Then we’ll have 2JT + 1 degenerate states left. Higher states have much less likelihood of being populated even at room temperature, apparently.

We’ll note that for a filled subshell, we’d have ST = LT = JT = 0. And for a ½ filled – 1 subshell we’d get the same thing.