

## Atomic Term Symbols

Hund's Rules (not all of it described in text)

1. Terms with the greatest spin multiplicity have the lower energy.
2. Within each multiplicity, the term with greatest L has the lowest energy.
3. Within the same multiplicity and L - - - the state with the lowest J has the lowest energy if the subshell is less than half filled.

The opposite is true for subshell more than half filled *i. e.* the State with the highest J is lowest in energy.

**Example:** electron configuration  $nd^2$

From microstate counting (see P. A10 in handout)

Possible terms:  $^1G$ ,  $^1D$ ,  $^1S$ ,  $^3F$ ,  $^3P$

According to Hund's Rule #1, the triplet states are lower in energy.

According to Hund's Rule #2, the  $L=3$  term (or  $^3F$ ) is the lowest in energy.

In the  $^3F$  term, there are several states with different J values ( $J = L+S, L+S-1, \dots |L-S|$ ) (Clebsch-Gordon series)

Therefore  $^3F_4$   $^3F_3$   $^3F_2$

And according to Hund's rule #3, the  $^3F_2$  (with the lowest J) is the lowest in energy.

If for  $nd^8$  electron configuration, everything will be exactly the same as  $nd^2$ , except that (according to Hund's Rule #3)

$^3F_4$  is the lowest in energy