Atoms + Periodic Table

Helium $\psi(r_1 r_2) = \psi_{100}(r_1)\psi_{100}(r_2) \; \frac{1}{\sqrt{2}}\left(|+-\rangle - |-+\rangle\right)$

ground state

$2e^-$ in the $n=1$ $\ell=0$ $m=0$ Hydrogen level (ignore e^-/e^- interaction) ↗

spin singlet ↗

parahelium : spin singlet states

orthohelium : spin triplet states

↙ Spectroscopic notation

s	$\ell = 0$	sharp	
p	$\ell = 1$	principal	folks at GRE
d	$\ell = 2$	diffuse	love this
f	$\ell = 3$	fundamental	

smallest ℓ fills first : closest to nucleus

H	$(1s)$	$^2S_{1/2}$	$^{2S+1}L_J$; $S=1/2$, $L=0$, $J=1/2$
He	$(1s)^2$	$^1S_0$	$S=0$, $L=0$, $J=0$
Li	$(1s)^2 2s$	$^2S_{1/2}$	
Be	$(1s)^2(2s)^2$	$^1S_0$	↑ closed shell always
B	$(1s)^2(2s)^2 2p$	$^2P_{1/2}$	$S=1/2$, $L=1$, $J=1/2, 3/2$

Hund's Rules

1) Highest S → lowest Energy

2) Highest L → lowest Energy

3) < 1/2 filled lowest J → lowest E
   > 1/2 filled highest J → lowest E } Explains Boron

C ~~...~~ $(1s)^2(2s)^2(2p)^2$

$S = 1/2 + 1/2 = 0, 1$ ← Hund!

~~so spin symmetric~~
~~→ spatially antisymmetric~~

$L = 1 + 1 = 2, 1, 0$
↑ antisymmetric one (see 1+1 calculation from weeks ago)

$J = 1 + 1 = 2, 1, \boxed{0}$ lowest J

$$^{2S+1}L_J = {}^3P_0$$