

antisymmetric = <sup>orb</sup> symmetric <sup>spin</sup> asymmetric (singlet → parahelium)  
 antisymmetric = <sup>orb</sup> asymmetric <sup>spin</sup> symmetric (triplet → orthohelium)

per sub-shell, for every  $l$  as  $(nl)^i$  ← occupation of electrons per shell

$l$  is noted as s, p, d,

$(1s)^2 (2s)^2 (2p)^2$   
 2 electrons in  $(1, 0)$   
 2 electrons in  $(2, 0)$   
 2 electrons in combination of  $(2, 1)$   $(2, 1, 0)$   $(2, 1, -1)$

$2s+1 L_J$

sometimes  $n^{2s+1} L_J$  ← letter

ground state  $n=0$

$1^1 S_0$

first excited state

$n=2$   $n=1$  ↓  
 $S=0$   $L=0$

$2^1 S_0$

Example

$$|\Psi\rangle = \frac{1}{\sqrt{2}} \left( |4_1\rangle_1 \otimes |4_2\rangle_2 + |4_2\rangle_1 \otimes |4_1\rangle_2 \right) \otimes \frac{1}{\sqrt{2}} \left( |\downarrow\rangle_1 \otimes |\uparrow\rangle_2 - |\uparrow\rangle_1 \otimes |\downarrow\rangle_2 \right)$$

↑ state ↑ orbital

exchange 1 and 2 everywhere → introduces a minus sign → total wavefunction is antisymmetric