

Pauli Exclusion Principle

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No 2 electrons in a single atom can have the same set of quantum numbers (n, l, m_l, m_s).
That is, no 2 electrons can lie in the same quantum state.

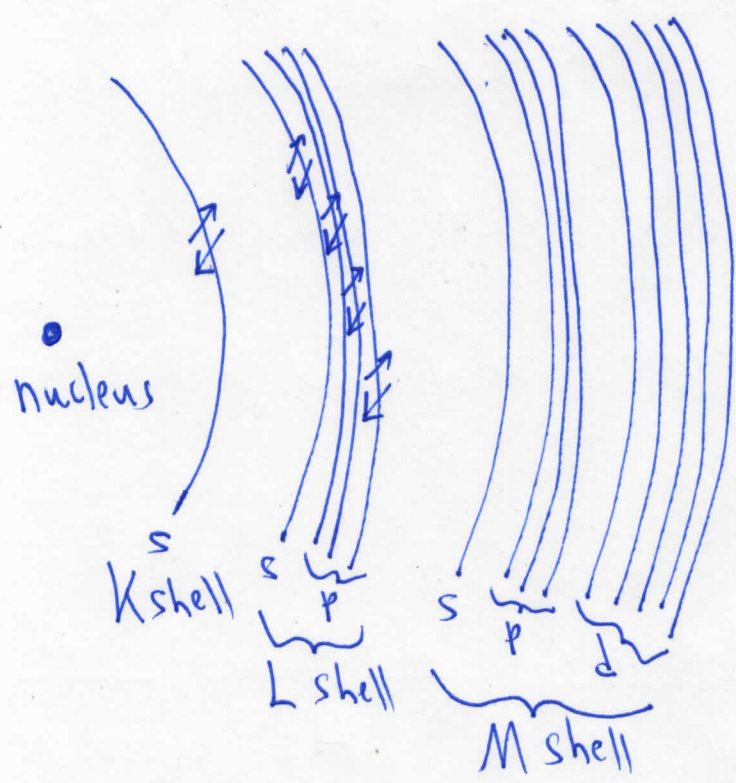
Let's build atoms based on this principle

let e^- with $\begin{cases} m_s = \frac{1}{2} \equiv \uparrow \text{ (spin up)} \\ m_s = -\frac{1}{2} \equiv \downarrow \text{ (spin down)} \end{cases}$

Atom	Notation	(n, l, m_l, m_s)	energy levels	electronic configuration
Hydrogen	^1H	$(1, 0, 0, \frac{1}{2})$	$m_l = 0 \rightarrow \uparrow \rightarrow 1s$	$1s^1$
Helium	^2He	$e^{-\#1} (1, 0, 0, \frac{1}{2})$ $e^{-\#2} (1, 0, 0, -\frac{1}{2})$	$m_l = 0 \rightarrow \uparrow \downarrow \rightarrow 1s$	$1s^2$
Lithium	^3Li	$e^{-\#3} (2, 0, 0, \frac{1}{2})$	$m_l = 0 \rightarrow \uparrow \rightarrow 2s$ $m_l = 0 \rightarrow \uparrow \downarrow \rightarrow 1s$	$1s^2 2s^1$
Beryllium	^4Be	$e^{-\#4} (2, 0, 0, -\frac{1}{2})$	$m_l = 0 \rightarrow \uparrow \downarrow \rightarrow 2s$ $m_l = 0 \rightarrow \uparrow \downarrow \rightarrow 1s$	$1s^2 2s^2$
Boron	^5B	$e^{-\#5} (2, 1, 1, \frac{1}{2})$ $\nearrow$ could be $m_l = -1, 0, 1$ I selected $m_l = +1$	$m_l = -1 \rightarrow \text{---} \rightarrow 2p$ $m_l = 0 \rightarrow \uparrow \rightarrow 2p$ $m_l = 1 \rightarrow \text{---} \rightarrow 2p$ $m_l = 0 \rightarrow \uparrow \downarrow \rightarrow 2s$ $m_l = 0 \rightarrow \uparrow \downarrow \rightarrow 1s$	$1s^2 2s^2 2p^1$

We are constructing what is called the Shell Model for atoms :

$n =$ 1 2 3 4 5
 Shell = K L M N O



How electrons fill up the shells is a little more complicated in nature;

