

Electrons, protons, and neutrons are fermions

Photons, pions, and gluons are bosons

Fermions are  $\frac{1}{2}$  integral spin, only one per state.

Bosons are integral spin, many can occupy the same state.

For more than one electron atoms, the energy levels differ from those of the hydrogen atom because of the "screening effect".

$$E_n = \frac{-13.6 \text{ (eV)}}{(n - D(l))^2}$$

↑ quantum defect. It varies with  $l$  (shell #)

From the exclusion principle, the maximum # of  $e^-$  in one subshell is  $2(2l+1)$ .

The order of filling the subshell levels with  $e^-$  follows the minimum energy principle.

Hund's rule states that  $e^-$  usually fill different orbitals with unpaired spins.