(f) Prediction of Angular Momentum and Nuclear Ground State

Each level is characterized by a principal quantum number n, a l- value and a j- value. The lowest stationary states are occupied first with the maximum number of nucleons given by $(2j+1)$. When a shell is completely filled (characterized by the magic number) the net angular momentum is zero and the nucleus has even parity ($P=+1$). If there is any unpaired nucleon, then this will determine the angular momentum and parity of whole nucleus.

(i) Even-Even Nuclei

In even-even nuclei, all the protons and neutrons should pair off to cancel out one another's spin and orbital angular momenta. Thus even-even nuclei ought to have zero nuclear angular momenta, as observed.

Total ground state angular momentum $=0$

Parity (π) = even or $+1$.

(ii) Even-Odd or Odd-Even Nuclei

In even-odd and odd-even nuclei, the half integral spin of a single "extra" nucleon should be combined with the integral angular momentum of the rest of the nucleus for a half integral total angular momentum.

Total angular momentum will be equal to the half integral angular momentum j of the unpaired particle.

Parity, $\pi=(-1)^l$, where l corresponds to the last unpaired particle.

(iii) Odd-Odd Nucleus

Odd-odd nuclei each have an extra neutron and an extra proton whose half-integral spins should yield integral total angular momenta.

Find j_N, l_N and j_P, l_P of unpaired nucleons,

If $j_N+l_N+j_P+l_P=even$, then $J=\left|j_N-j_P\right|$

and if $j_N+l_N+j_P+l_P=odd$, then $J=\left|j_N+j_P\right|$

Parity, $\pi=(-1)^{l_P+l_N}$