R1C12 diagram helping educators structuring nucleons in nuclei

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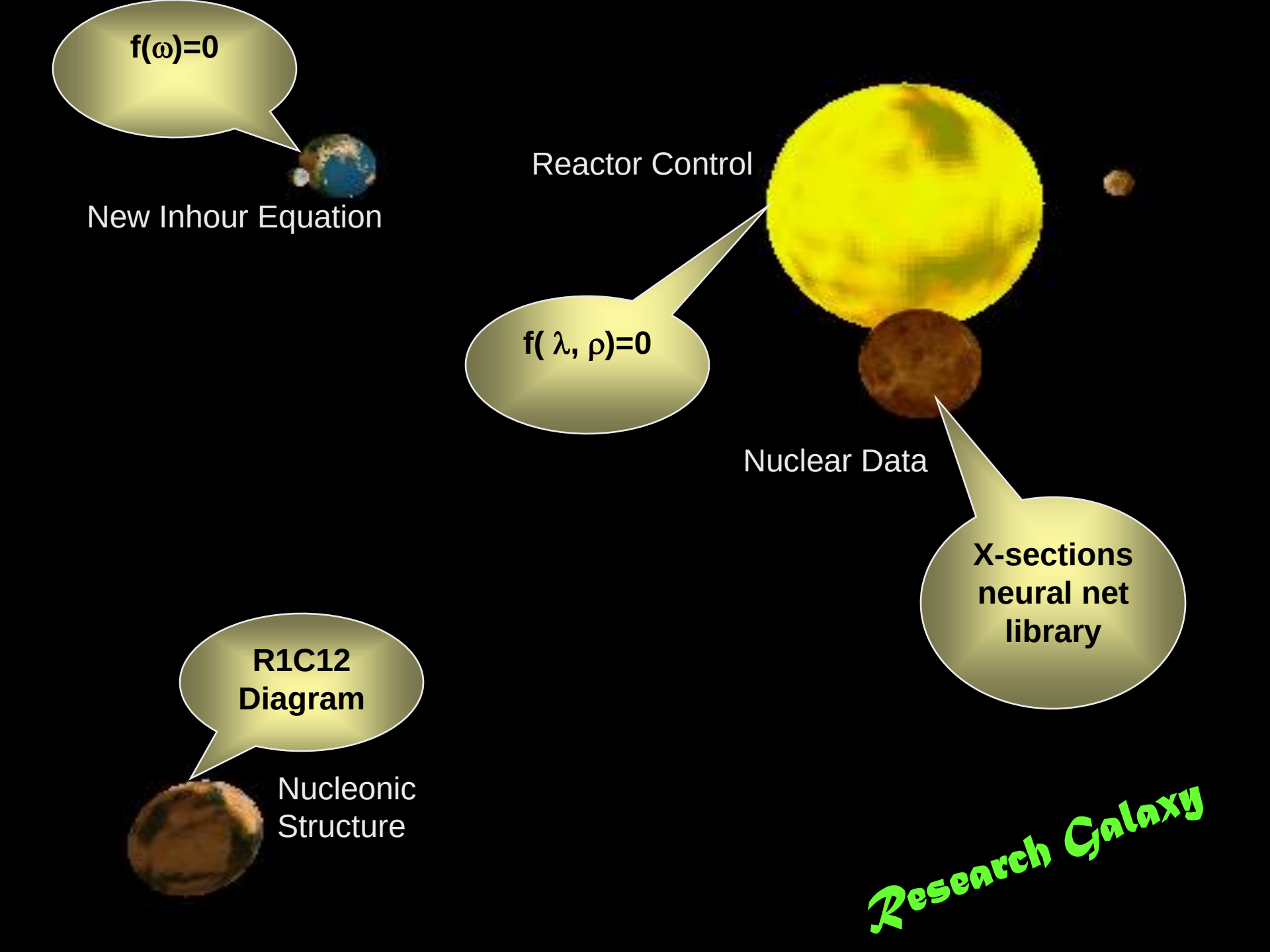
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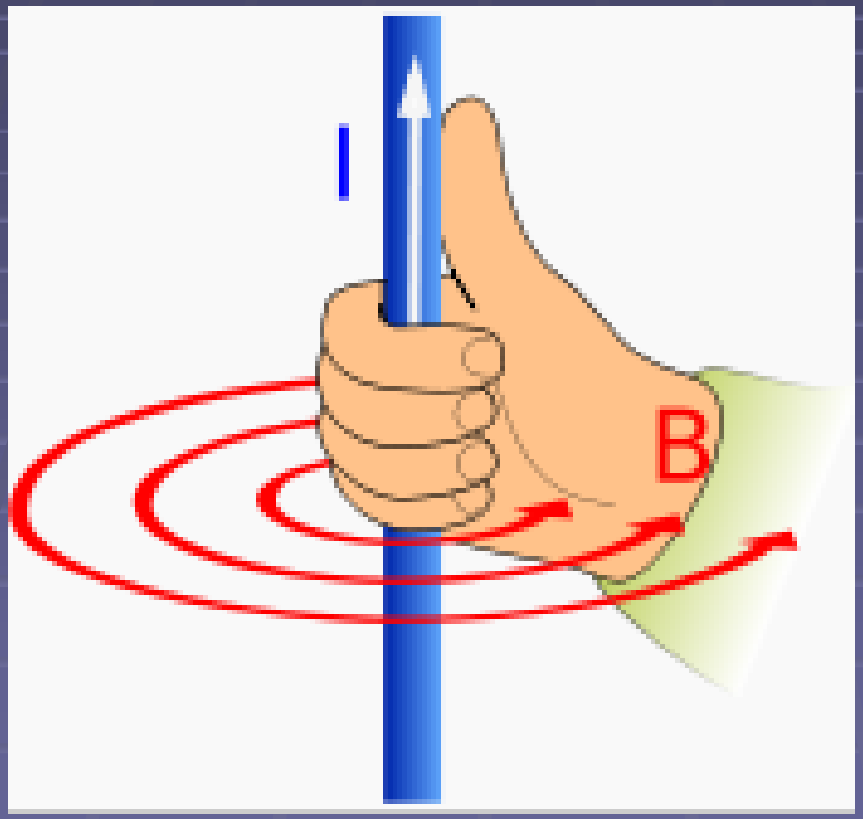
mnemonics for education



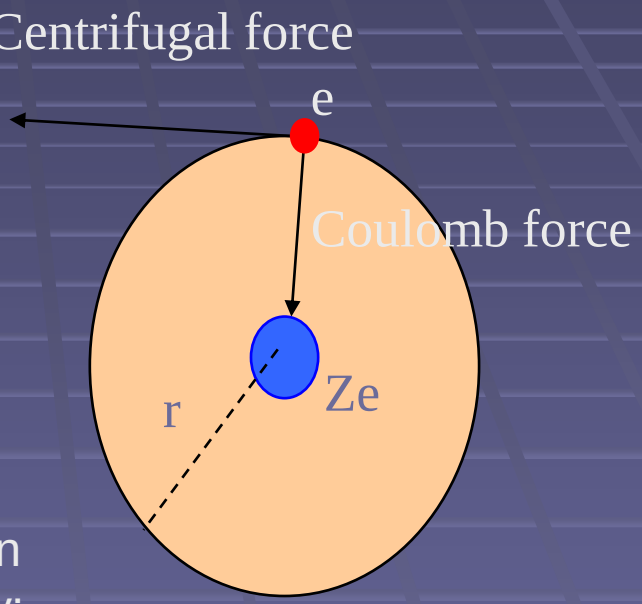
right hand grip rule

Electronic structure of atoms

- **Bohr Model**

(The 1st quantum number n)

$$\upsilon = \varepsilon \frac{Ze^2}{2h}\left[\frac{1}{r_2} - \frac{1}{r_1}\right]$$



Comparison with Ritz-Balmer equation shows that the stable radii in the hydrogen atom that an electron can orbit is given by:

$$r_n = n^2 r_0$$

Bohr theory failed to describe the structuring of more than one electron in the atom, and successfully introduced the first quantum number n.

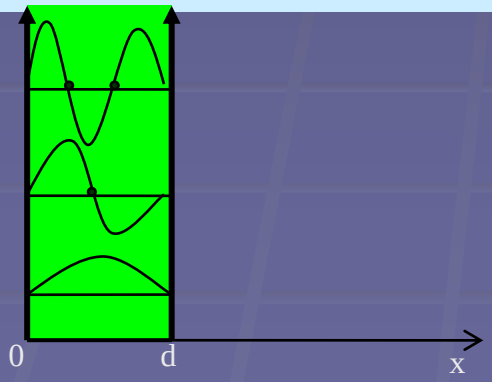
Electronic structure of atoms….continued

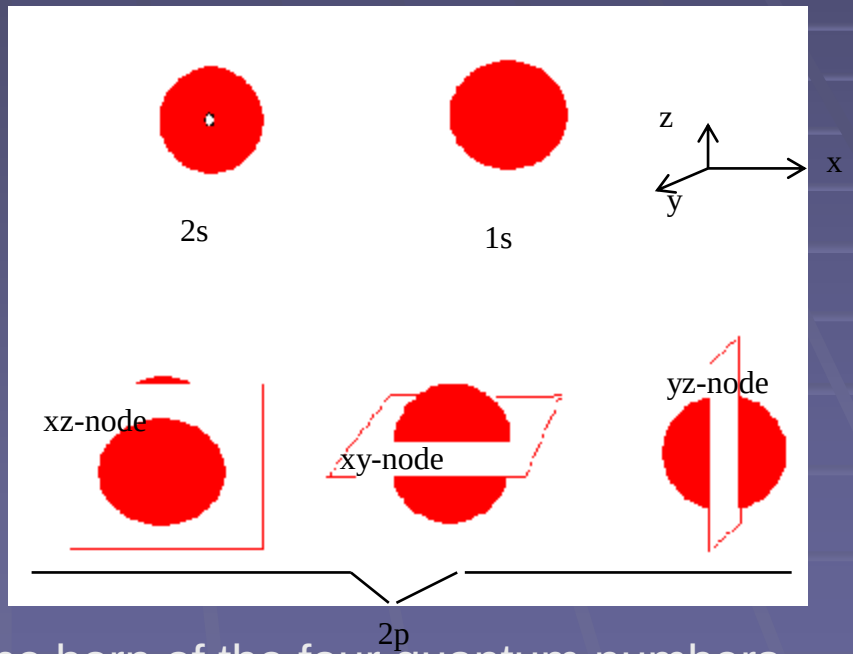
The wave-particle duality (de Broglie equation) $\lambda = \frac{h}{p}$

- **Schrödinger Model**

$$\nabla^2\Psi + \frac{8m\pi^2(E-V)\Psi}{h^2} = 0$$

$$\Psi(x) = A\sin\frac{\pi jx}{d}; \quad j = 1,2,3,\ldots$$





The born of the four quantum numbers

n, ℓ , m_ℓ , and m_s

The success of describing all of electrons in atoms

Aufban Diagram

$1s^2$

$2s^2\ 2p^6$

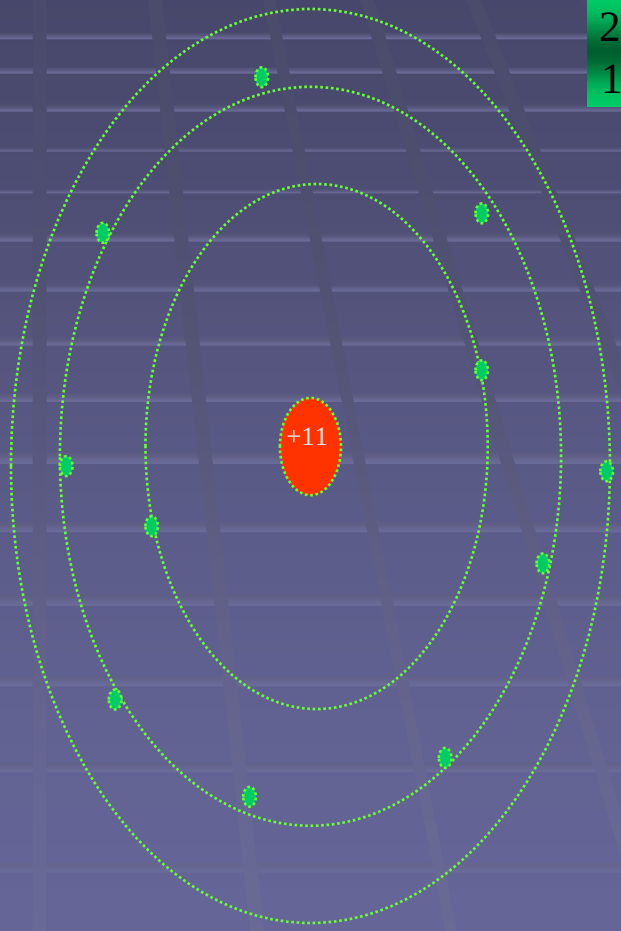
$3s^1\ 3p^6\ 3d^{10}$

$4s^2\ 4p^6\ 4d^{10}\ 4f^{14}$

$5s^2\ 5p^6\ 5d^{10}\ 5f^{14}$

$6s^2\ 6p^6\ 6d^{10}$

$7s^2$



$^{23}_{11}Na$

Nucleonic structure of atoms

- Magic Numbers

(2, 8, 20, 28, 50, 82,126,..)

- solution of Schrödinger wave equation in a parabolic potential well gives the energy of the nucleon as :

$$E_{nucleon} = h\sqrt{\frac{2U_0}{mr^2}}\left[2(n-1)+\ell\right] = h\omega\left[2(n-1)+\ell\right]$$

ω is the frequency of the harmonic oscillator

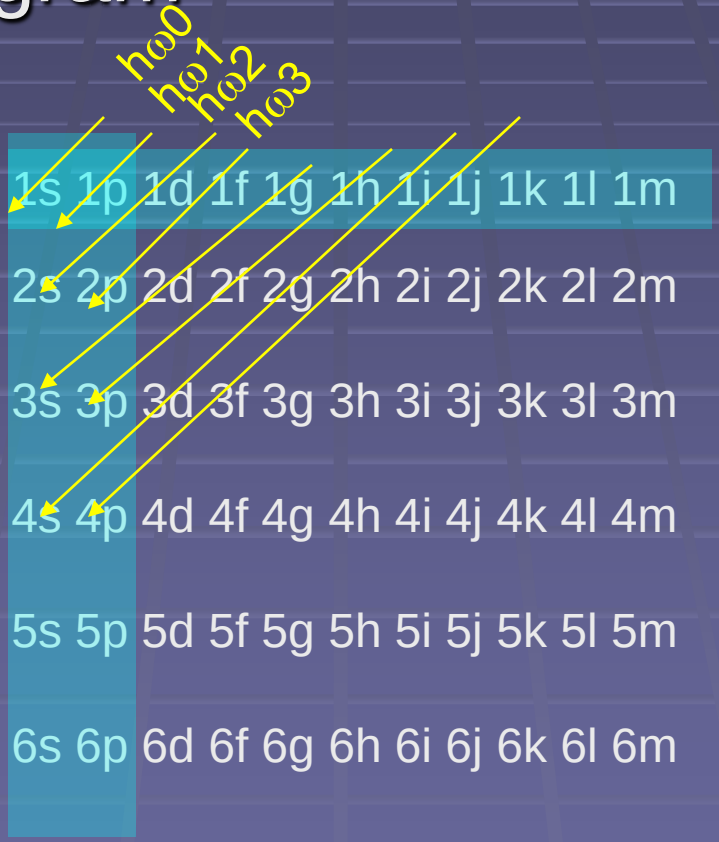
Nucleonic structure of atoms…..continued

Sequence of energy level fillings with nucleons (parabolic potential well)

Energy level hw[2(n-1)+ ℓ]	n	ℓ	Sub-levels	Number of nucleons in the level	Accumulative number
hω0	1	0	1s	2	2
hω1	1	1	1p	6	8
hω2	1 2	2 0	1d 2s	12	20
hω3	1 2	3 1	1f 2p	20	40
hω4	1 2 3	4 2 0	1g 2d 3s	30	70
hω5	1 2 3	5 3 1	1h 2f 3p	42	112

Nucleonic structure of atoms…..continued

- R1C12 Diagram



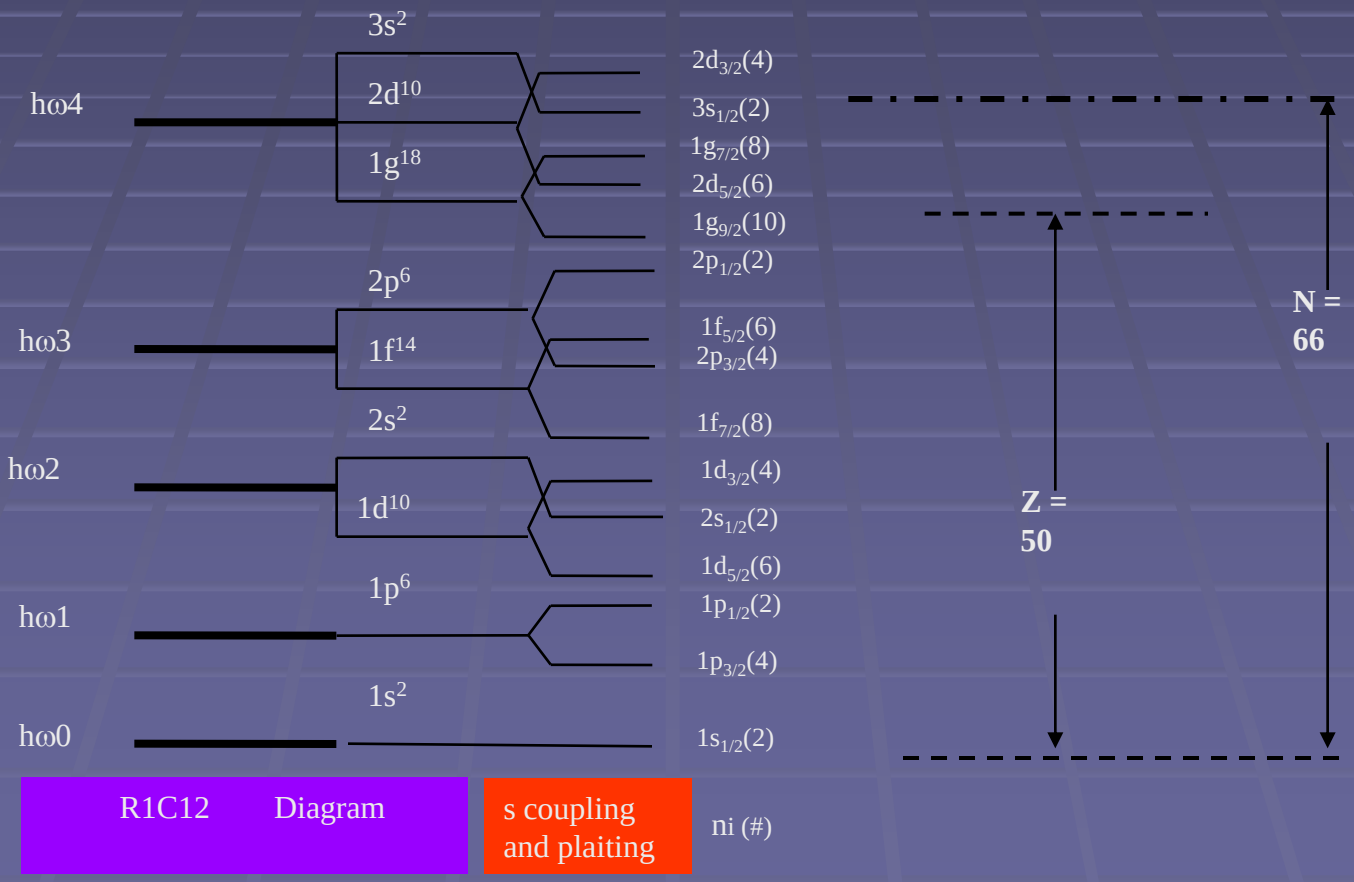
Nucleonic structure of atoms…..continued

- Results of parabolic potential well
  (R1C12 Diagram)
- orbital angular momentum and spin coupling , i.e. $\ell \pm S$
- and level plaiting

Work together to Reproduce the magic numbers
(success of shell model)

structuring of nucleons (p, n) for Tin

$^{116}_{50}Sn_{66}$



Conclusion

- mnemonics are important tools for teaching
- Aufban diagram proved its self for quick structuring of electrons in atoms
- R1C12 could do as well for quick structuring of nucleons in nuclei
- If you are convinced, Please pass the word!

Thank you.....