If there are two electrons in p-suborbit, possible configurations will be 15, the electrons present in them produce more than one energy level due to mutual interaction. These energy levels are called excited and ground energy level. Electrons present in a suborbit show three types of effects-

(i) Electrical Repulsion
(ii) Spin magnetic field coupling
(iii) Orbital magnetic field coupling.

Coupling of orbital angular moments —

Interaction of orbital angular momentum of electrons present in orbitals of a sub orbit. All electrons present in a suborbit have the same value of azimuthal quantum number.

For example, the azimuthal quantum number of each electron present in p, d and f suborbits will be 1, 2 and 3 respectively. Value of l for each electron of p^2 configuration is one. The maximum and minimum resultant values of L will be obtained by both the electrons as follows:-

$$1 + 1 \longrightarrow \overset{\uparrow}{1} \qquad 1 + 1 \longrightarrow \overset{\uparrow}{1}$$

$l=1 \quad l=1 \quad L=2$ (highest value) $\qquad l=1 \quad l=1 \quad L=0$ (lowest value)

Therefore for p^2 configuration the permissible value of L will be 0, 1 and 2.

Symbols of various values of L are as follows:-

L →	0	1	2	3	4	5	6
Symbol →	S	P	D	F	G	H	I

These symbols are called also state.

Coupling of Spin angular moments —

The value of spin quantum number for a single electron is $+1/2$ or $-1/2$. If more than one electrons are present, the magnetic moment produced by them interact with each other. This interaction

is called spin angular momentum coupling. Values of all electrons present in a suborbit will give resultant value of S due to coupling.
For example — For p^2 or d^2 configuration resultant value of S for two value i.e $+\frac{1}{2}$ and $-\frac{1}{2}$ may be

$\uparrow\uparrow \longrightarrow 1$ $\qquad$ $\uparrow\downarrow \longrightarrow 0$

$S = +\frac{1}{2} + \frac{1}{2}$ $\quad S = 1$ $\qquad$ $S = +\frac{1}{2} - \frac{1}{2}$ $\quad S = 0$

In the same way, value of S for p^3 or d^3 configurations

$\uparrow\uparrow\uparrow$ $\qquad$ $\uparrow\uparrow\downarrow$

$S = +\frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 1\frac{1}{2}$ $\qquad$ $S = +\frac{1}{2} + \frac{1}{2} - \frac{1}{2} = \frac{1}{2}$

$S = 1\frac{1}{2}$ $\qquad$ $S = \frac{1}{2}$

All other possible configuration of these electrons will give the same value of S.

Spin-Orbit Coupling =

Coupling of resultant spin angular momentum and orbital angular momentum quantum number of electrons present in any suborbit is the interaction between them. This interaction gives a new quantum number. This is called total angular quantum number. It is denoted by J. Hence all permissable value of J can be determined by lowest and highest value of them. For example — for p^2 configuration permissible values of L are 0, 1 and 2 and for S are 1 and 0. Hence all possible values of J will be $|L+S|$ to $|L-S|$. Only values of L+S and L-S are used without sign. Then if

Total L values = 0, 1, 2 and Total S values = 0, 1

$|L+S|$ = (i) $0+1 = 1$ and $0+0 = 0$

(ii) $1+1 = 2$ and $1+0 = 1$

(iii) $2+1 = 3$ and $2+0 = 0$

and

$|L-S|$ = (i) $0-1=1$ and $0-0=0$

(ii) $1-1=0$ and $1-0=1$

(iii) $2-1=1$ and $2-0=2$

Total values of J will be 0, 1, 2 and 3.

Then for p^2 configuration –

Maximum $|L+S| = 2+1 = 3$

Minimum $|L-S| = 1-1 = 0$

Generally above electronic configurations are called spectroscopic states. It is denoted by a full term symbol.

The values of multiplicity is $= 2S+1$

To write full term symbol $\boxed{{}^{2S+1}L_J}$

For example for p^2 configuration, first possible configuration is

m	+1	0	−1
	1	1	

Then $L = 1+0 = 1$

$S = +\frac{1}{2}+\frac{1}{2} = 1$

and $J \Rightarrow |L+S| = 1+1 = 2$

$|L-S| = 1-1 = 0$ then J = 0, 1 and 2

multiplicity $2S+1 = 2\times1+1 = 3$

For L = 1 state will be P

In this way ${}^{2S+1}L_J$ full term symbols are

$^3P_2$, $^3P_1$ and $^3P_0$

All above values are only permissible values.

For p^2 configuration, total values of J can be obtained by L-S coupling in the following manner :-

$L = 0, 1, 2$

$S = 0, 1$

L	2	2	2	1	1	1	0	0	1	2
S	1	1	1	1	1	1	1	0	0	0
J	3	2	1	2	1	0	1	0	1	2

Term Symbols $^3D_3$ $^3D_2$ $^3D_1$ $^3P_2$ $^3P_1$ $^3P_0$ $^3S_1$ $^3S_0$ $^1P_1$ $^1D_2$