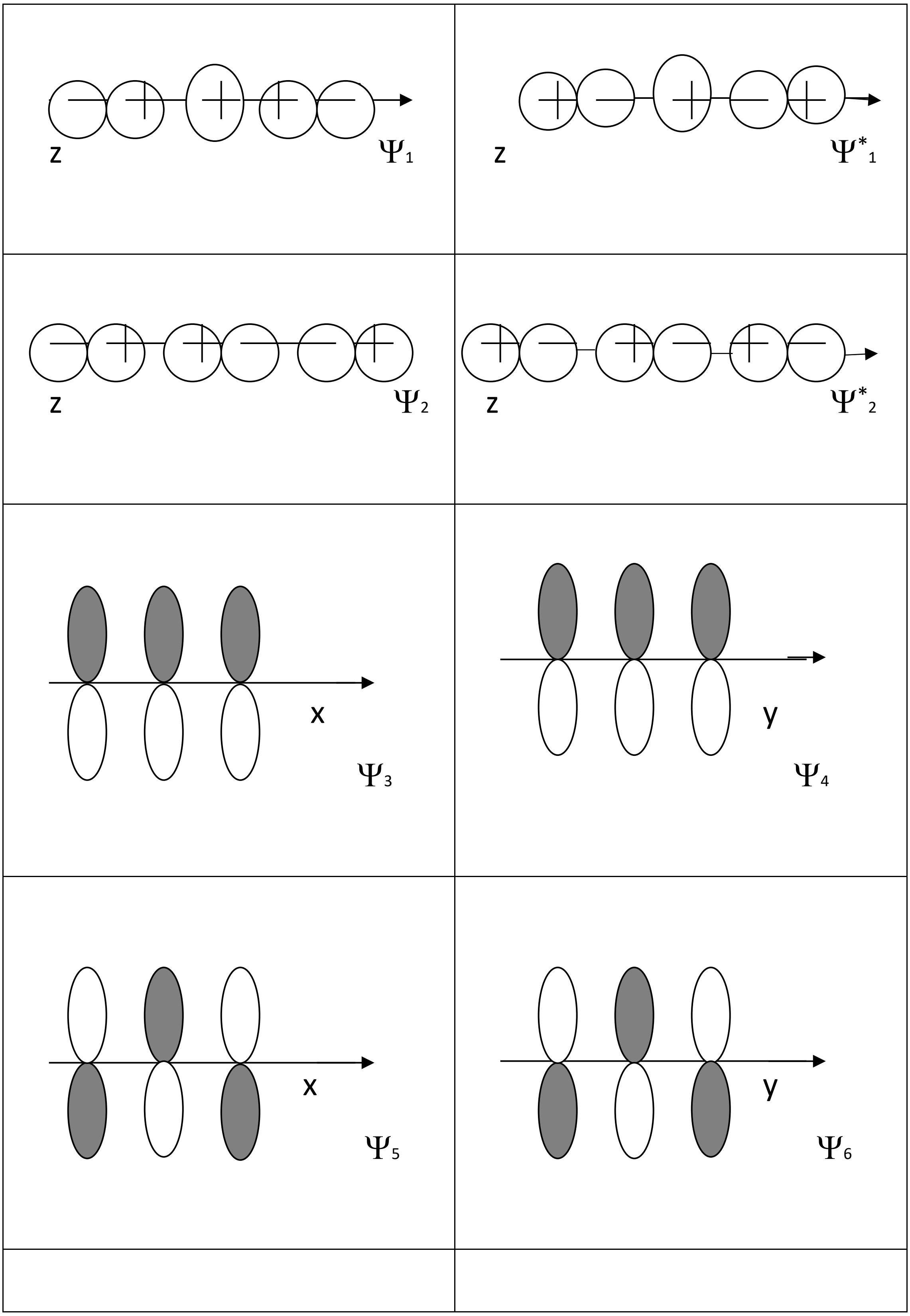
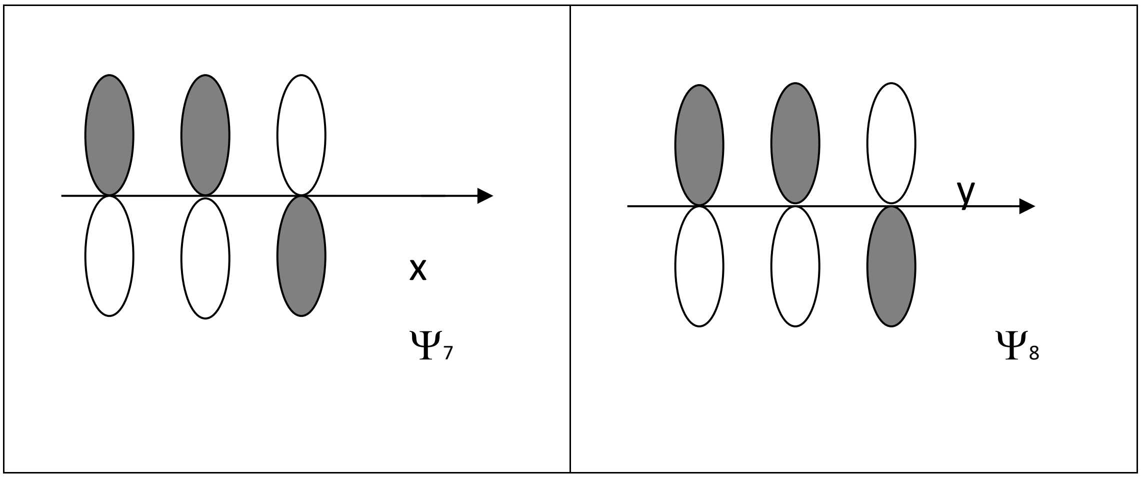
I will attach the wave functions, whose graphical representation is in fig.21:

Fig.21: T.O.M.





$\Psi_1 = N.\ \varphi_{C2s} + N'.\ \varphi_{O2pz} + N''.\ \varphi_{O2pz}$

$\Psi_1^* = N.\ \varphi_{C2s} - N'.\ \varphi_{O2pz} - N''.\ \varphi_{O2pz}$

$\Psi_2 = N.\ \varphi_{C2pz} + N'.\ \varphi_{O2pz} + N''.\ \varphi_{O2pz}$

$\Psi_2^* = N.\ \varphi_{C2pz} - N'.\ \varphi_{O2pz} - N''.\ \varphi_{O2pz}$

$\Psi_3 = N.\ \varphi_{C2px} + N'.\ \varphi_{O2px} + N''.\ \varphi_{O2px}$

Ψ_4 (the same but with 2py)

$\Psi_5 = N.\ \varphi_{C2px} - N'.\ \varphi_{O2px} - N''.\ \varphi_{O2px}$

Ψ_6 (the same but on the y axis)

$\Psi_7 = N.\ \varphi_{C2px} + N'.\ \varphi_{O2px} - N''.\ \varphi_{O2px}$

$\Psi_8 = N.\ \varphi_{C2py} + N'.\ \varphi_{O2py} - N''.\ \varphi_{O2py}$

And the OM that are left to complete the equality nºOA = nºOM is extracted from the two Ψ_{2s} of the oxygen.

And, put to do, when we are with AB_3, (for example BCl_3) we have fig.22.

Based on the mathematical expressions of the wave functions (Ψ) of case AB_3 (for exepmple BCl_3) that you have below, I leave for you the graphic representation in Molecular Orbitals (TOM). Keep in mind figures 7 and 8.

$\Psi_1 = N.\varphi_{B2s} + N'.\varphi_{Cl\ 2px} + N''.\varphi_{Cl\ 2px} + N'''.\varphi_{Cl\ 2px}$

$\Psi_1^* = N.\varphi_{B\ 2s} - N'.\varphi_{Cl\ 2px} - N''.\varphi_{Cl\ 2px} - N'''.\varphi_{Cl\ 2px}$

$\Psi_2 = N.\varphi_{B\ 2px} + N'.\varphi_{Cl\ 2px} + N''.\varphi_{Cl\ 2px} +/- N'''.\varphi_{Cl\ 2px}$

$\Psi_2^* = N.\varphi_{B\ 2px} - N'.\varphi_{Cl\ 2px} - N''.\varphi_{Cl\ 2px} +/- N'''.\varphi_{Cl\ 2px}$

$\Psi_3 = N.\varphi_{B\ 2py} + N'.\varphi_{Cl\ 2px} + N''.\varphi_{Cl\ 2px} + N'''.\varphi_{Cl\ 2px}$

$\Psi_3^* = N.\varphi_{B\ 2py} - N'.\varphi_{Cl\ 2px} - N''.\varphi_{Cl\ 2px} - N'''.\varphi_{Cl\ 2px}$

$\Psi_4 = N.\varphi_{B\ 2s} +/- N'.\varphi_{Cl\ 2py} +/- N''.\varphi_{Cl\ 2py} +/- N'''.\varphi_{Cl\ 2py}$

$\Psi_5 = N.\varphi_{B\ 2py} +/- N'.\varphi_{Cl\ 2py} +/- N''.\varphi_{Cl\ 2py} +/- N'''.\varphi_{Cl\ 2py}$

$\Psi_6 = N.\varphi_{B\ 2px} +/- N'.\varphi_{Cl\ 2py} +/- N''.\varphi_{Cl\ 2py} +/- N'''.\varphi_{Cl\ 2py}$

$\Psi_7 = N.\varphi_{B\ 2pz} + N'.\varphi_{Cl\ 2pz} + N''.\varphi_{Cl\ 2pz} + N'''.\varphi_{Cl\ 2pz}$

$\Psi_7^* = N.\varphi_{B\ 2pz} - N'.\varphi_{Cl\ 2pz} - N''.\varphi_{Cl\ 2pz} - N'''.\varphi_{Cl\ 2pz}$

$\Psi_8 = N.\varphi_{B\ 2pz} + N'.\varphi_{Cl\ 2pz} + N''.\varphi_{Cl\ 2pz} - N'''.\varphi_{Cl\ 2pz}$

$\Psi_9 = N.\varphi_{B\ 2pz} + N'.\varphi_{Cl\ 2pz} - N''.\varphi_{Cl\ 2pz} - N'''.\varphi_{Cl\ 2pz}$

The strength of the links σ is greater than that of the links π .

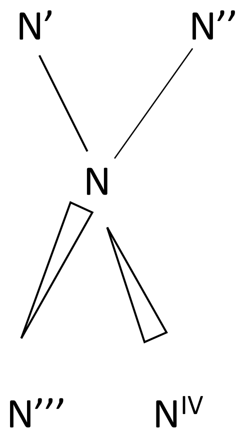
We will see that there are all the options in the links π .

And, finally, we will analyze the representations of the orbitals of AB_4 , located in fig.23.

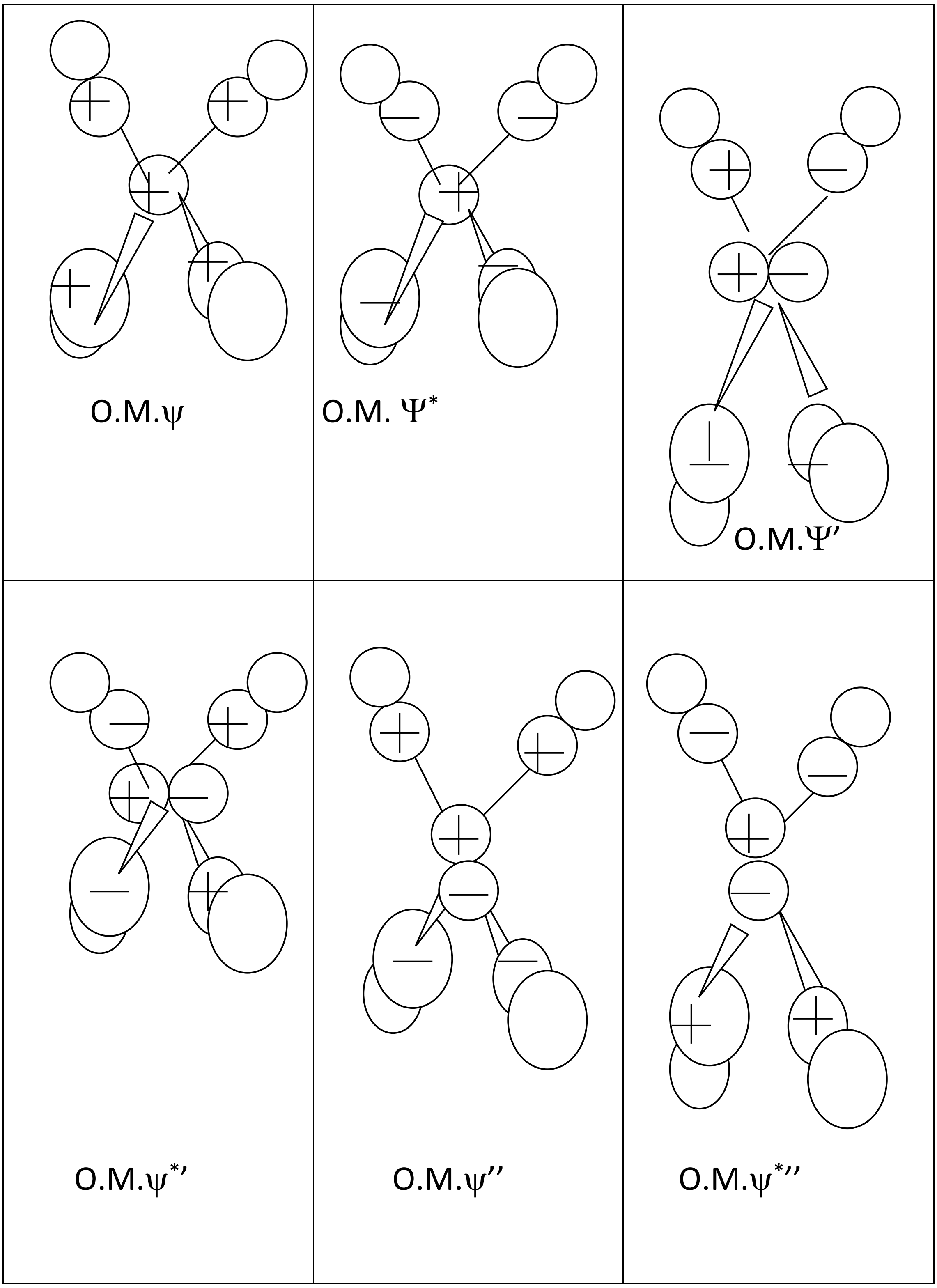
Fig. 23:

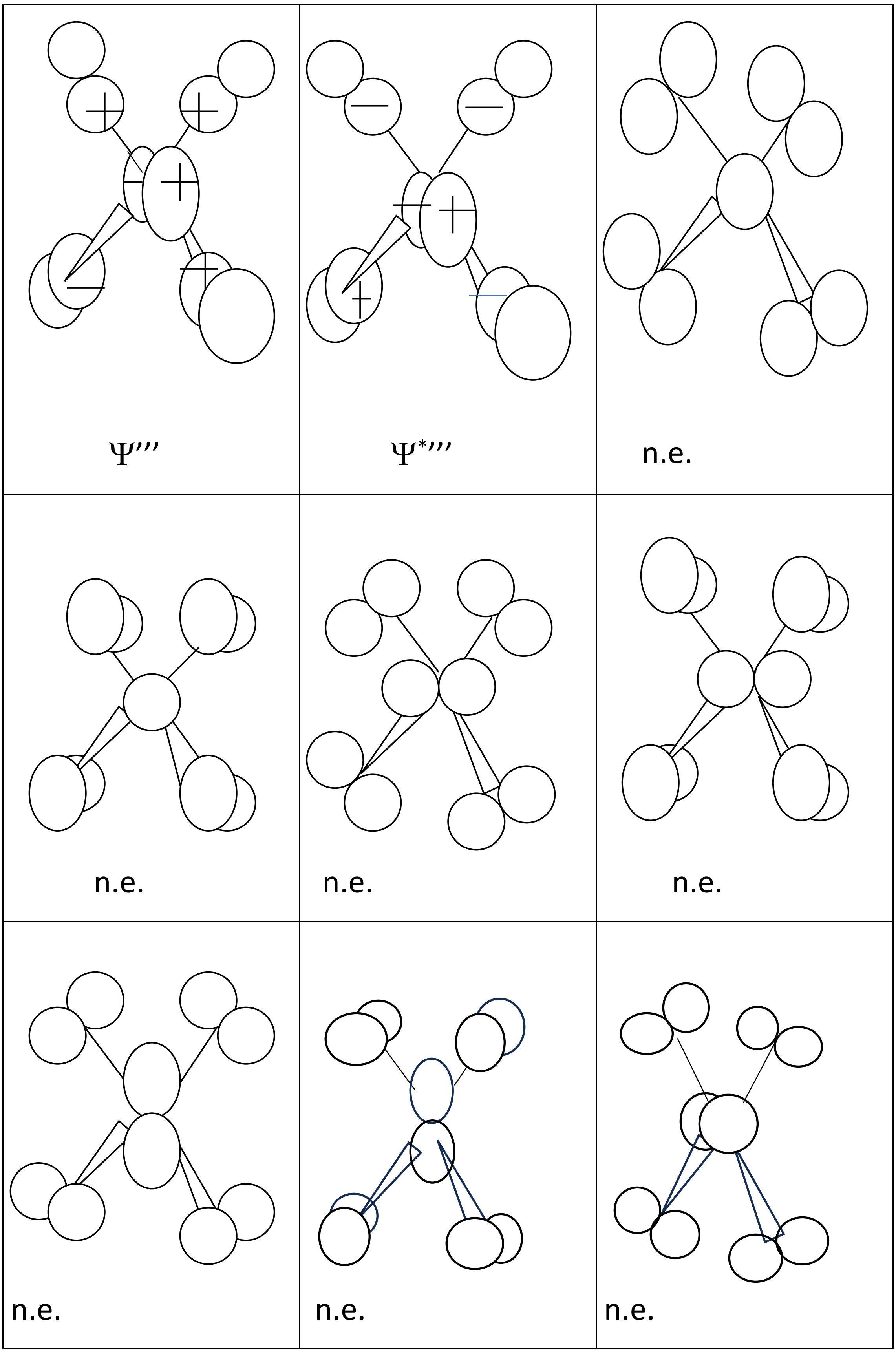
As we have seen in fig.19, we start from the shape of the tetrahedron.

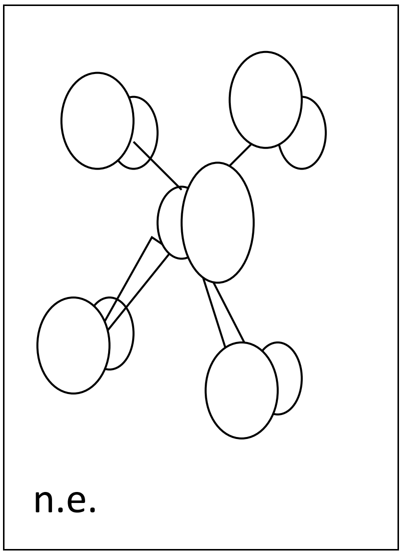
I also show the order of the normalization factors I have taken in such a tetrahedron; Let's remember that the representation of the Ψ is in the "repesca". I care that “n.e” ≡ nonbonding.



T.O.M




Ψ'''
Ψ*'''
n.e.
n.e.
n.e.
n.e.
n.e.
n.e.
n.e.



While in terms of TEV, we have already analyzed it at the beginning, they are hybrids. We have left the AB case that is easy to deduce:

$$\Psi_{sp} = \sqrt{1/2}.\ \varphi_s + \sqrt{1/2}.\ \varphi_{px}$$
$$\Psi_{sp} = \sqrt{1/2}.\ \varphi_s - \sqrt{1/2}.\ \varphi_{px}$$

“REPESCA”:

TOM AB_4:

Ψ= N.ϕA2s+N’.ϕB2px+N’’.ϕB2px+ N’’’.ϕB2px + N^{IV}.ϕB2px

Ψ*= N.ϕA2s-N’.ϕB2px-N’’.ϕB2px-N’’’. ϕB2px- N^{IV}.ϕB2px

Ψ’= N.ϕA2px+N’.ϕB2px+N’’.ϕB2px+ N’’’.ϕB2px+ N^{IV}.ϕB2px

Ψ*’= N.ϕA2px-N’. ϕB2px-N’’. ϕB2px- N’’’. ϕB2px- N^{IV}. ϕB2px

Ψ1= N.ϕA2s+/-N’. ϕB2py+/-N’’. ϕB2py+/- N’’’. ϕB2py+/- N^{IV}. ϕB2py

Ψ2= N.ϕA2s+/-N’. ϕB2pz+/-N’’. ϕB2pz+/- N’’’. ϕB2pz+/- N^{IV}. ϕB2pz

Ψ3= N.ϕA2px+/-N’. ϕB2py+/-N’’. ϕB2py+/- N’’’. ϕB2py+/- N^{IV}. ϕB2py

Ψ4= N.ϕA2px+/-N’. ϕB2pz+/-N’’. ϕB2pzy+/- N’’’. ϕB2pz+/- N^{IV}. ϕB2pz

Ψ5= N.ϕA2py+/-N’. ϕB2py+/-N’’. ϕB2py+/- N’’’. ϕB2py+/- N^{IV}. ϕB2py

Ψ6= N.ϕA2py+/-N’. ϕB2pz+/-N’’. ϕB2pz+/- N’’’. ϕB2pz+/- N^{IV}. ϕB2pz

Ψ7= N.ϕA2pz+/-N’. ϕB2py+/-N’’. ϕB2py+/- N’’’. ϕB2py+/- N^{IV}. ϕB2py

Ψ8= N.ϕA2pz+/-N’. ϕB2pz+/-N’’. ϕB2pz+/- N’’’. ϕB2pz+/- N^{IV}. ϕB2pz

Ψ’’= N.ϕA2py+ N’. ϕB2px+ N’’. ϕB2px+/- N’’’. ϕB2px+/- N^{IV}. ϕB2px

Ψ*’’= N.ϕA2py- N’. ϕB2px- N’’. ϕB2pz-/- N’’’. ϕB2pz-/- N^{IV}. ϕB2pz

Ψ’’’= N.ϕA2pz+/-N’. ϕB2px+/-N’’. ϕB2px+ N’’’. ϕB2px+ N^{IV}. ϕB2px

Ψ*’’’= N.ϕA2pz+/-N’. ϕB2px+/-N’’. ϕB2px- N’’’. ϕB2px- N^{IV}. ϕB2px

On de Ψ1 a Ψ8 són no enllaçants