ARTICLE 09
ELECTRON PROBABILITY WITH NIN COUPLING IN n>2 AND NECESSARY NIN RELATIONSHIPS

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ABSTRACT

This is 9th article of 24 dedicated to atomic model based on Victoria equation (Articles index is at end). First part continues electron density study [6,8] with atoms in Groups I, II and from XIII to XVIII (s and p blocks) whose n principal quantum number is higher than 2. Fundamental difference lies in Origin Electronic System MON (OES MON), which decreases as n increases (P37 [6]). Another factor that affects to lesser extent is Ionization Energy (IE) decrease when n increases. As in articles past, IE is given by [9] as Initial Energy (E_o) [1] and Maximum Probability radius to compare with contributed by NIN coupling is given by [10] and [11].

In the second part $C_{POTI-AL}$ division and value are indicated and P44 Necessary NIN Relationships is introduced as one line to be deepened and implies that Electronic Systems values [6-8] follows trends along nuclear charge.

KEYWORDS

NIN coupling in n>2, Electron Probability, Maximum Probability, OES, BES, Necessary NIN relationships, Victoria Equation.

INTRODUCTION

A extern electronic extreme (EE_A) is indicated with a suffix (r_A, H_A or c_A), B intern with b suffix (r_B, H_B or c_B) and i suffix is used to both electronic extremes (EE_i). Suffixes B (Born) and O (Origin) appear from BES and OES concepts [6]. All abbreviations are compiled, in conjunction with those included in [6,8], at article end.

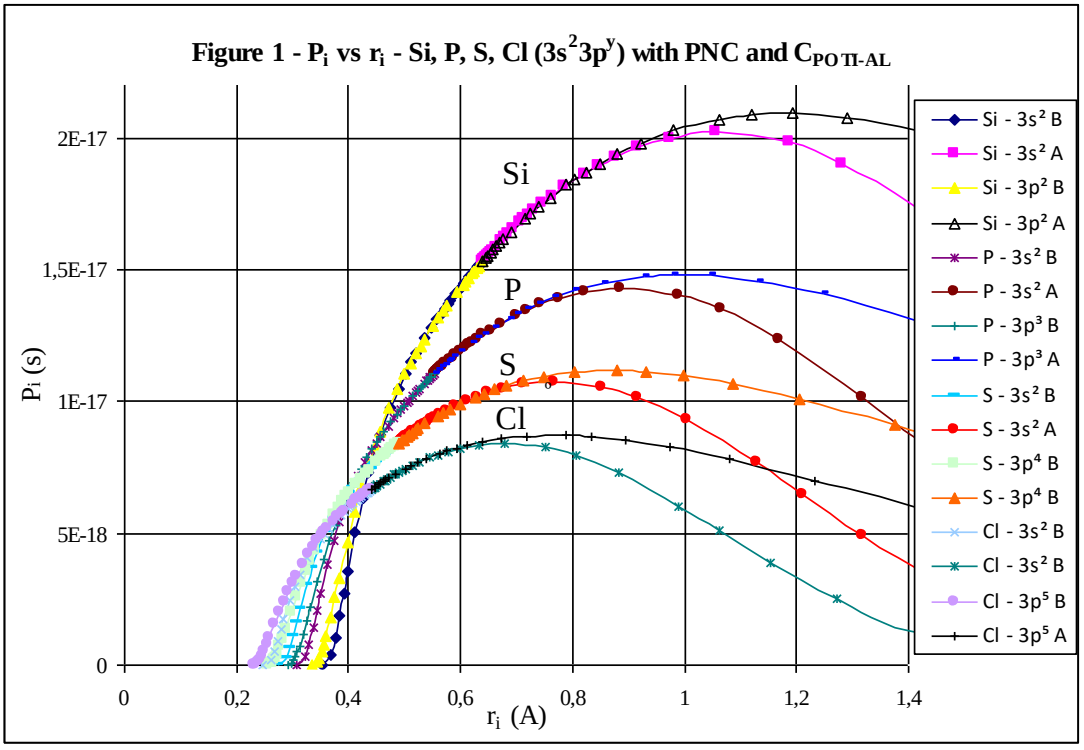
Based on [8] where n=2 Probability (P_i) curves coupling is studied by NIN coupling (P34 [6]), n>2 is going to be developed. To reach this NIN coupling, energy radial distribution must be known by Victoria Equation [1], right-angled triangle relation must be conformed by two sides (orbital circumference (c_i) and circular orbital height (H_i)) and hypotenuse or radial distance (r_i) [2] and P_i meaning as rotation time conditioned by Compaction Factor (CF) must be defined [3,6]. NIN coupling factors (Effective nuclear charge (z), C_{PEP}, C_{POTI} and MON) and Maximum P_i calculations seen in [6-8] for n=2 are applied for n>2.

P_i curves for n=3

For n=3 and according to P37 [6], 3s OES MON is 20 for Group I of Alkali Metals (Na), half of that value, i.e. 10, for Group II of Alkaline earth metals (Mg) and Groups XIII to XVIII of p-block are all MON=4. MON reminder for all n according to P37 is in **Table 1**.

Table 1 – ns OES MON (extern lobe in ns electrons)								
n	Ns	ns^2	np	np^2	np^3	np^4	np^5	np^6
2	25	12,5	10	10	10	10	10	10
3	20	10	4	4	4	4	4	4
4	12,5	6,25	3	3	3	3	3	3
5	10	5	2	2	2	2	2	2
6	7,5	3,75	1	1	1	1	1	1

Figure 1 is P_i vs. r_i for A and B electronic extremes (EE_A and EE_B) of electrons with $3s^23p^y$ electronic configuration in outermost shell. Atoms in Figure 1 are Si, P, S and Cl. P_i curves and Maximum P_i radius (**Table 2**) are in agreement with [10] and [11] and are displaced to greater radial distance (r_i) values. 3 methods employed for Maximum Probability calculation in Table 2 are the same as those used in [8]. Method that only considers outermost electron ($3p^y$) is considered as first approximation whose deviation increases with n since maximum between extern (in this case, $3p^y$) and intern (now is $3s^2$) is increasingly separated. Unless otherwise indicated, geometry and probability treated is that of the outermost lobes of electrons in extern shell (in this case are $3s^2$ and $3p^y$ in n=3).



In Figure 1 and Table 2 is maintained what is seen in [8]:

1) NIN coupling for all atoms.
2) P_i curve and Maximum P_i become closer as z OES increases.

3) If all OES have C_{PEP}=1, P_i decreases as z OES increases:

$$\uparrow Z \text{ OES} \rightarrow \downarrow P_i \text{ and } P_i \text{ and Maximum } P_i \text{ closer to nucleus}$$

4) Maximum P_i is in agreement with [10] and [11].

Table 2 – radius of maximum Pi vs. [10] and [11] in n=3				
Atoms	**Na**	**Mg**	**Al**	**Si**
By extern lobe	177,9	136,8	146,6	118,2
Lobes Pi sum (C_{PEP}=1)			136,6	110,6
Lobes Pi sum with C_{PEP} coupling			138,2	112,7
[10]	180	137	143	118
[11]	179	136	142	115
Atoms	**P**	**S**	**Cl**	**Ar**
By extern lobe	99,5	86,9	76,6	68,6
Lobes Pi sum (C_{PEP}=1)	93,8	82,0	72,7	65,5
Lobes Pi sum with C_{PEP} coupling	95,8	84,2	74,6	67,1
[10]	97	85	75	Not reported
[11]	98	86	76	69

P_i curves for n=4

In p-block, MON variation from n=3 to n=4 is less than in step from n=2 to n=3 and greater in s-block (Table 1). This fact related to MON and similar IE [9] causes that P_i curves and maximum of n=3 and n=4 are similar in p-block, and are displaced to greater r_i in s-block (**Table 3**). As in P_i vs. r_i representation for n=3 (Figure 1), outermost lobes are represented in **Figure 2**.

Table 3 – radius of maximum Pi vs. [10] and [11] in n=4				
Atoms	**K (12,5)**	**Ca (12,5/2)**	**Ga**	**Ge**
By extern lobe	227,6	185,1	157,3	131,4
Lobes Pi sum (C_{PEP}=1)			142,1	119,7
Lobes Pi sum with C_{PEP} coupling			144,5	122,9
[10]	235	185	144	116
[11]	229	184	140	120

Atoms	**As**	**Se**	**Br**	**Kr**
By extern lobe	113,7	101,7	91,2	82,9
Lobes Pi sum (C_{PEP}=1)	104,6	93,7	84,9	77,8
Lobes Pi sum with C_{PEP} coupling	107,7	97,1	87,8	80,3
[10]	106	96	88	Not reported
[11]	107	97	89	83

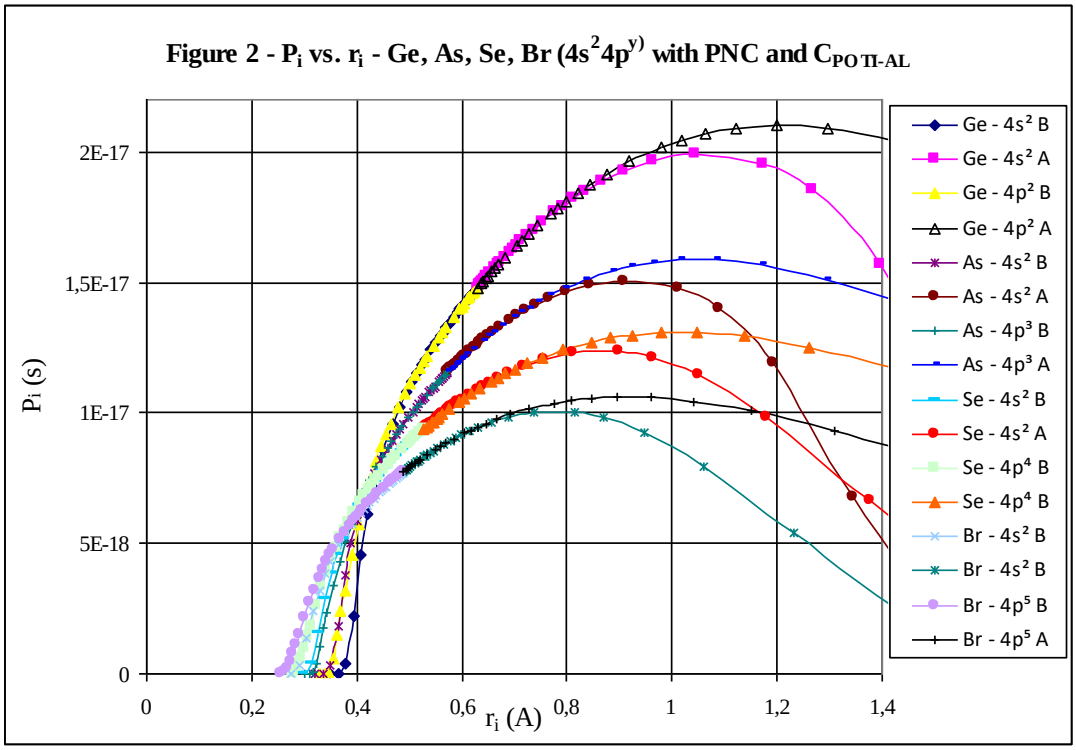
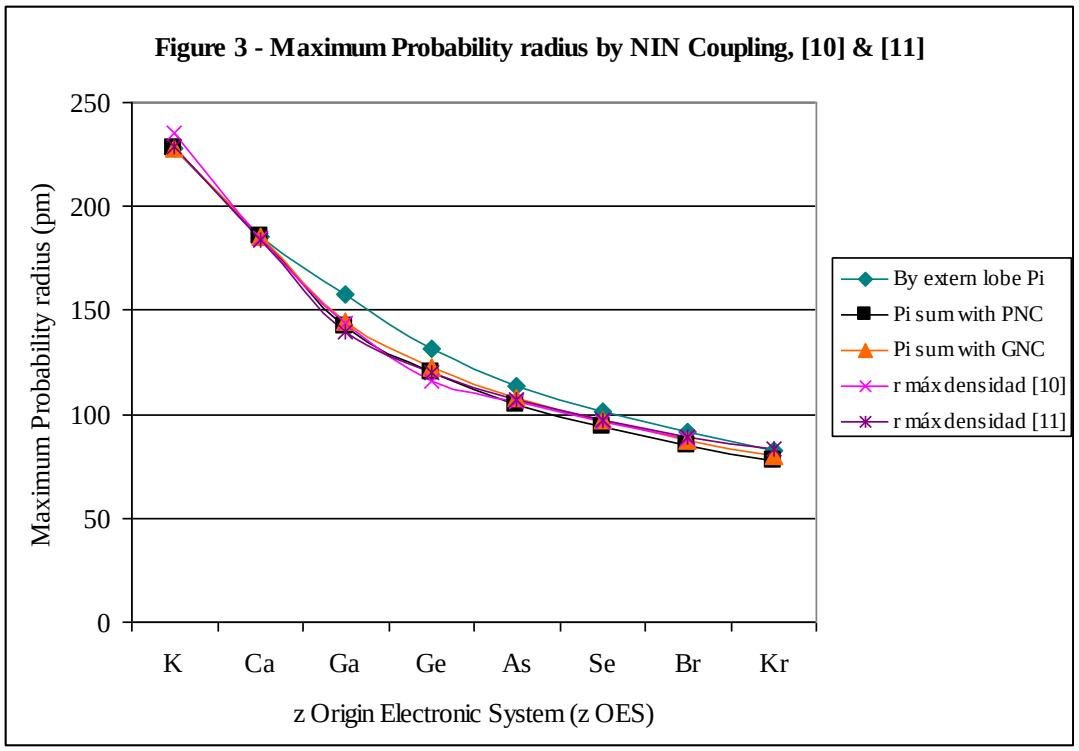


Table 3 data are compared according to method used in **Figure 3**. The only method that is slightly deviated is "P_i Maximum by extern electronic system (extern lobe)".



P_i curves for n=5

Methods and trends follow same guidelines as in P_i curves in the previous case as verified in **Table 4**.

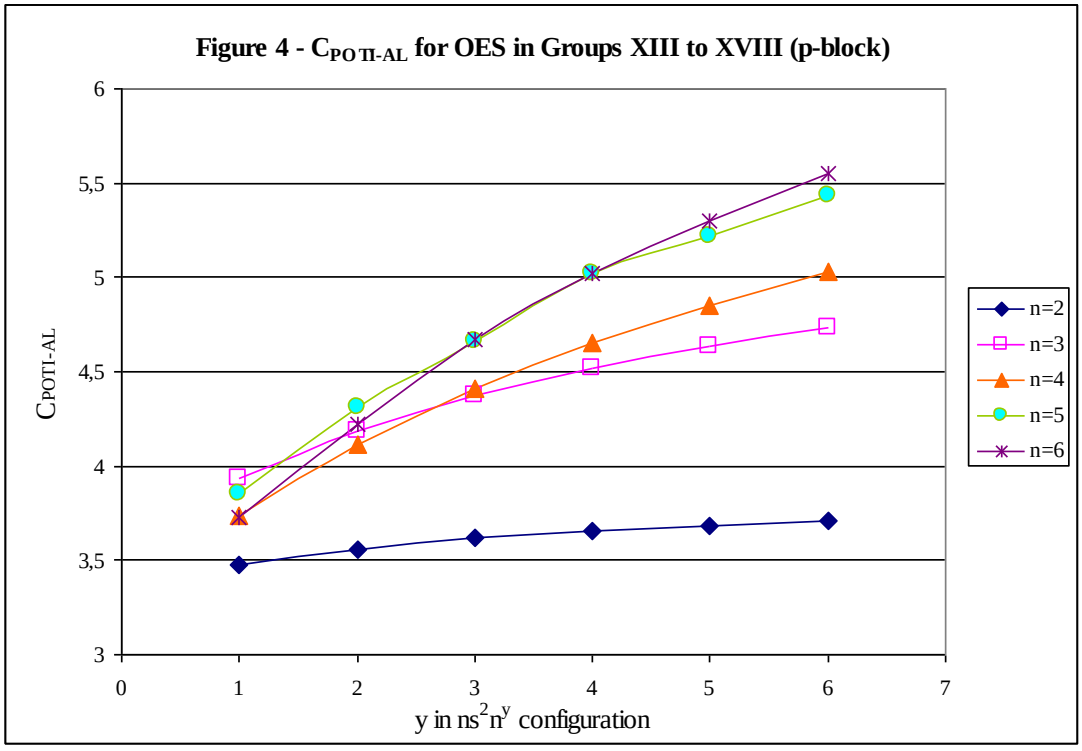
Table 4 – radius of maximum Pi vs. [10] and [11] in n=5				
Atoms	**Rb**	**Sr**	**In**	**Sn**
By extern lobe	248,9	207,9	189,4	161,3
Lobes Pi sum (C_{PEP}=1)			167,0	143,2
Lobes Pi sum with C_{PEP} coupling			170,3	147,7
[10]	256	207	160	139
[11]	246	201	156	140
Atoms	**Sb**	**Te**	**I**	**Xe**
By extern lobe	141,9	129,6	116,3	106,5
Lobes Pi sum (C_{PEP}=1)	126,8	116,0	105,3	97,0
Lobes Pi sum with C_{PEP} coupling	131,7	121,4	110,1	101,4
[10]	128	118	108	Not reported
[11]	127	117	110	103

$C_{POTI-AL}$ for OES

C_{POTI} angular limit or $C_{POTI-AL}$ (P32 [5]) is indicated for ns OES in **Table 5**. $C_{POTI-AL}$ for Born Electronic System (BES in P36 [6]) can be approximated by (1) (P43 [6])

$$(1)\ C_{POTI-B} = C_{POTI-O}\sqrt{\frac{(E_o)_B}{(E_o)_O}}$$

Table 5 – C_{POTI} angular limit for Origin Electronic System (OES $C_{POTI-AL}$)								
	$C_{POTI-AL}$							
Group	**S**	**n=3**	**S**	**n=4**	**S**	**n=5**	**S**	**n=6**
I	Na	3,185829012	K	3,44422195	Rb	3,49459953	Cs	3,59698735
II	Mg	3,694154767	Ca	4,13158458	Sr	4,26730776	Ba	4,45373513
III	Al	3,936798118	Ga	3,73385548	In	3,85762932	Tl	3,72797565
IV	Si	4,184539132	Ge	4,11224257	Sn	4,30731707	Pb	4,21800481
V	P	4,370760177	As	4,40948976	Sb	4,6630711	Bi	4,67031062
VI	S	4,51666214	Se	4,65181476	Te	5,02045403	Po	5,02045403
VII	Cl	4,63453954	Br	4,85100941	I	5,21644386	At	5,29879458
VIII	Ar	4,73156342	Kr	5,02827433	Xe	5,43647444	Rn	5,54965703



$C_{POTI-AL}$ continuous increase when OES z grows is broken in n>3 by (n-1)d intercalation and subsequent interspersed f-block. $C_{POTI-AL}$ shows this increase with a non-discontinuous curve for every n in p-block (**Figure 4**). $C_{POTI-AL}$ for n=2 is also included with data from [7]. Continuity in the increase is broken when passing from s-block to p-block by interspersed blocks as has been commented and also for the same reason, within the same p-block Groups.

P44 Necessary NIN relationships

Probability factors included in lobe or Electronic System [6] have tendencies that are fulfilled through EE z.

P34 main consequence is that two different energies meet in d→∞ (EE birth point [1]) and geometric and probabilistic NIN couplings (GNC or PNC) are achieved on both d→∞ sides. This accomplishment simultaneously opens possibility and dilemma that any energy can comply GNC and PNC. "P44 Necessary NIN relationships" emerges as research branch to avoid dilemma and to select energy possible.

P44 variation of $C_{POTI-AL}$ value and division is studied as introduction although are not the most sensible elements to energy variations. P44 variation is the studied element variation throughout Electronic System z.

$C_{POTI-AL}$ P44: behaviour and sensibility

$C_{POTI-AL}$ P44 behaviour has been seen in Table 5. Sensibility to OES Ionization Energy (OES IE) variation is now checked in **Figure 5**.

Figure 5 - $C_{POTI-AL}$ OES in n=2 with and without +1% IE in N

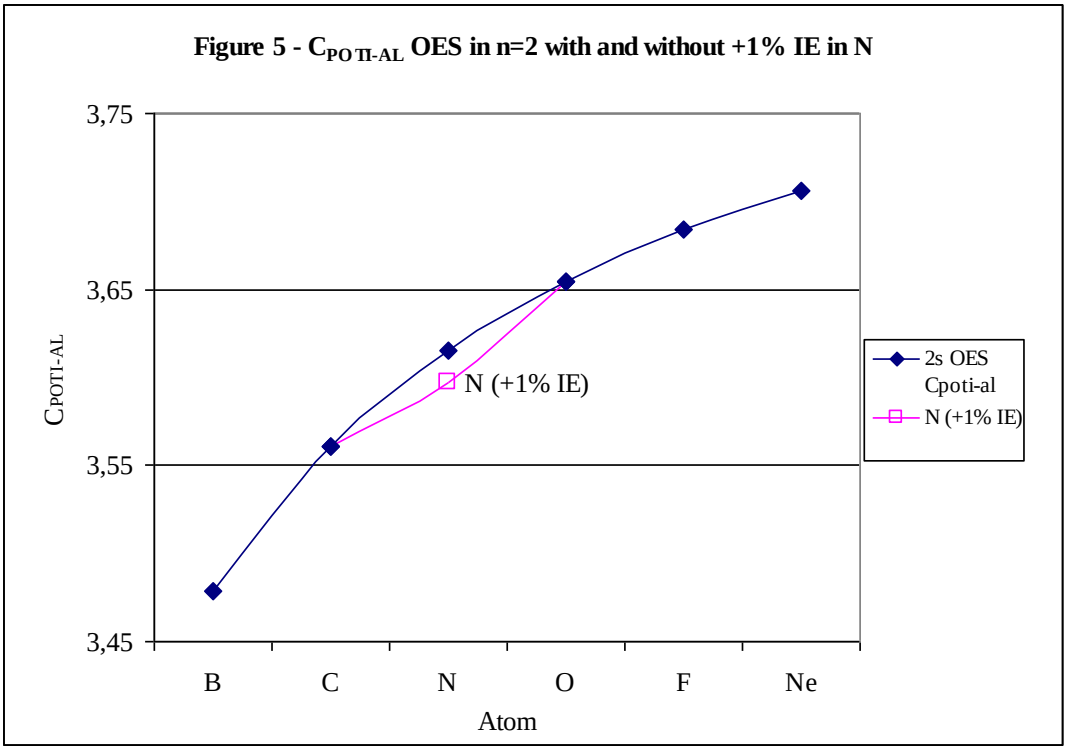


Figure 5 has two $C_{POTI-AL}$ curves for 2s OES from Group XIII to XVIII. On the one hand, curve made with experimental IE and on the other, curve called "N(+1% IE)" which is experimental IE, but in the case of 2s Nitrogen IE has been increased by 1%. R^2 of potential trend line falls with modified 2s Nitrogen IE and Nitrogen point is misaligned with trend line. For example, R^2 of three degree polynomial regression falls from 0.9999 to 0.9939.

$C_{POTI-AL}$ division P44: behaviour and sensibility

ns OES $C_{POTI-AL}$ divisions with n=[2-5] are in **Tables 6 to 9**. As for n=2 [7], $C_{POTI-AL}$ division undergoes sudden changes when MON is modified and is practically constant when MON does not vary (for example, p-block in a given n). "Practically constant" is actually a slight increase in accordance with OES z. This outstanding relationship between $C_{POTI-AL}$ divisions and MON has not been seen in $C_{POTI-AL}$ value (Table 5).

Table 6 – $C_{POTI-AL}$ division for OES 2s (n=2)

	Li	Be	B	C	N	O	F	Ne
d	38,50	22,32	19,07	19,34	19,53	19,67	19,78	19,86
MON	25	12,5	10	10	10	10	10	10

Table 7 – $C_{POTI-AL}$ division for OES 3s (n=3)

	Na	Mg	Al	Si	P	S	Cl	Ar
d	32,09	19,81	10,43	10,70	10,92	11,09	11,23	11,36
MON	20	10	4	4	4	4	4	4

Table 8 – $C_{POTI-AL}$ division for OES 4s (n=4)

	K	Ca	Ga	Ge	As	Se	Br	Kr
d	22,71	14,66	8,58	8,84	9,07	9,26	9,43	9,58
MON	12,5	6,25	3	3	3	3	3	3

Table 9 – $C_{POTI-AL}$ division for OES 5s (n=5)

	Rb	Sr	In	Sn	Sb	Te	I	Xe
d	19,11	12,63	6,93	7,11	7,26	7,43	7,53	7,64
MON	10	5	2	2	2	2	2	2

ns OES $C_{POTI-AL}$ division with z=1 (i.e., and according to P14 [1], OES z=1 is Group I: Alkaline) has linear trends with R^2=0.9997 for n=[2,5] (**Figure 6**) although is expected a curvature of said linearity towards point (0,0) (MON=0 and $C_{POTI-AL}$ division=0 when

n→∞). In fact, R^2=1.000 for n=[2-4] and curvature is increased when n=6 is included in regression.

Figure 6 - $C_{POTI-AL}$ division vs MON in OES with z=1 (Alkaline)

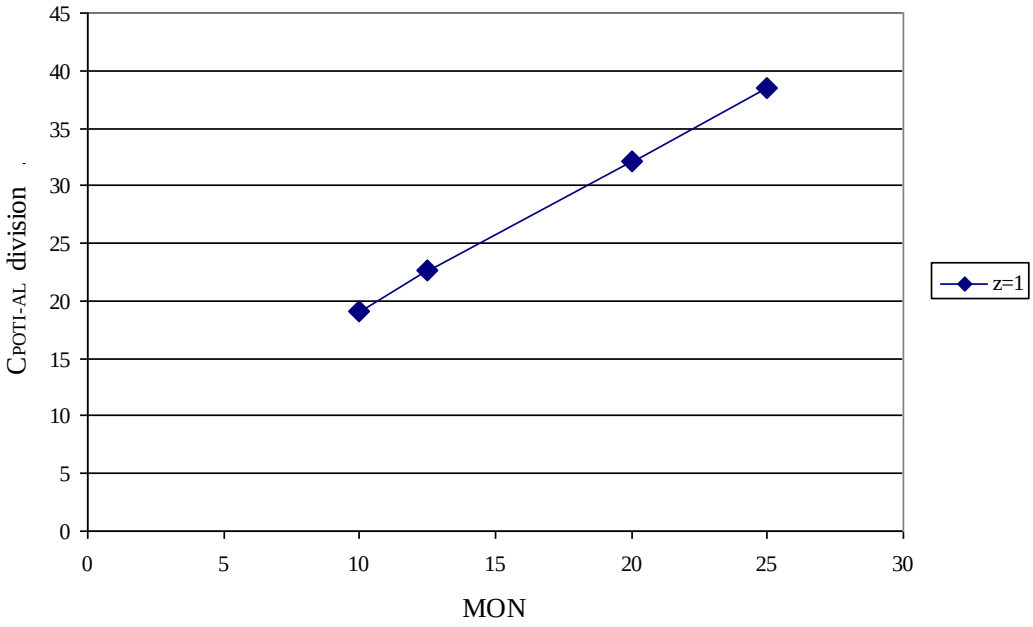
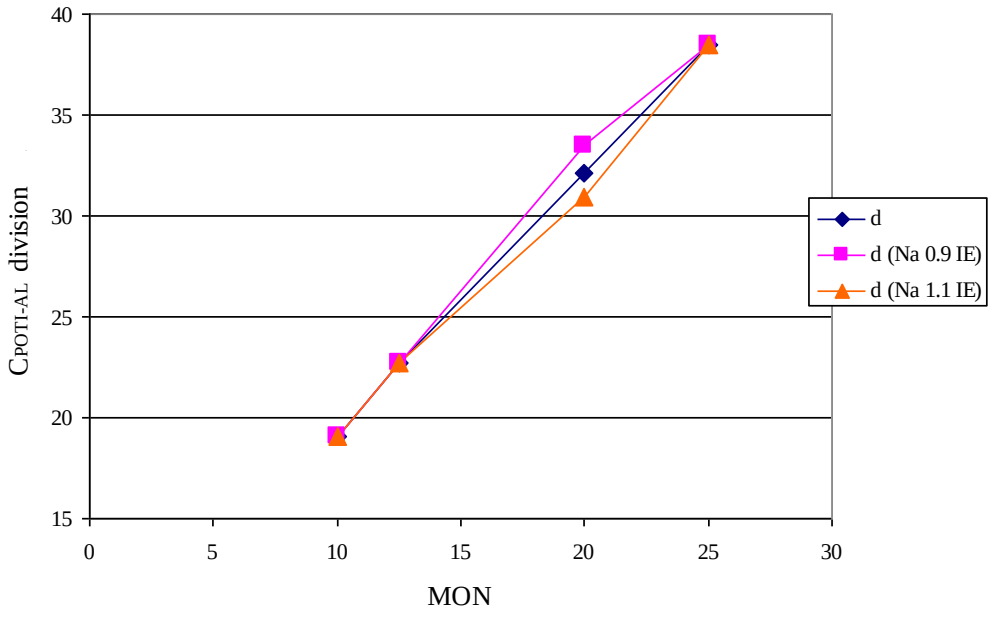


Figure 7 - $C_{POTI-AL}$ d vs MON in Alkaline OES with IE modification



$C_{POTI-AL}$ division sensitivity to IE variations is reduced due to this outstanding relationship with MON. **Figure 7** is Figure 6, but includes ±10% modification for 3s

OES IE. This IE modification is very high and, although with a minor modification also there is trend alteration, there are elements that show a remarkable sensitivity to low IE variations (less than 0.1%). This high energy sensitivity is seen in third part (See Articles index at end)

All $C_{POTI-AL}$ division vs. MON for OES from z=1 (Group I) to z=8 (Group XVIII) are in **Figure 8**. Tendencies for these new OES considered have greater curvature than if OES is from Group I (Figure 6) since their MON are inferior and are in the curvature expected zone towards point (0,0) previously commented. Block-p curves run approximately parallel and $\frac{\text{Division of } C_{POTI-AL}}{\text{MON}}$ ratio increases with OES z (**Figure 9**).

-10% OES IE modification effect is easy to appreciate when being parallel curves. Said modification has been included in As (z=5 for its OES) in **Figures 10** and curve showing -10% OES IE alteration effect is "z=5 (*)".

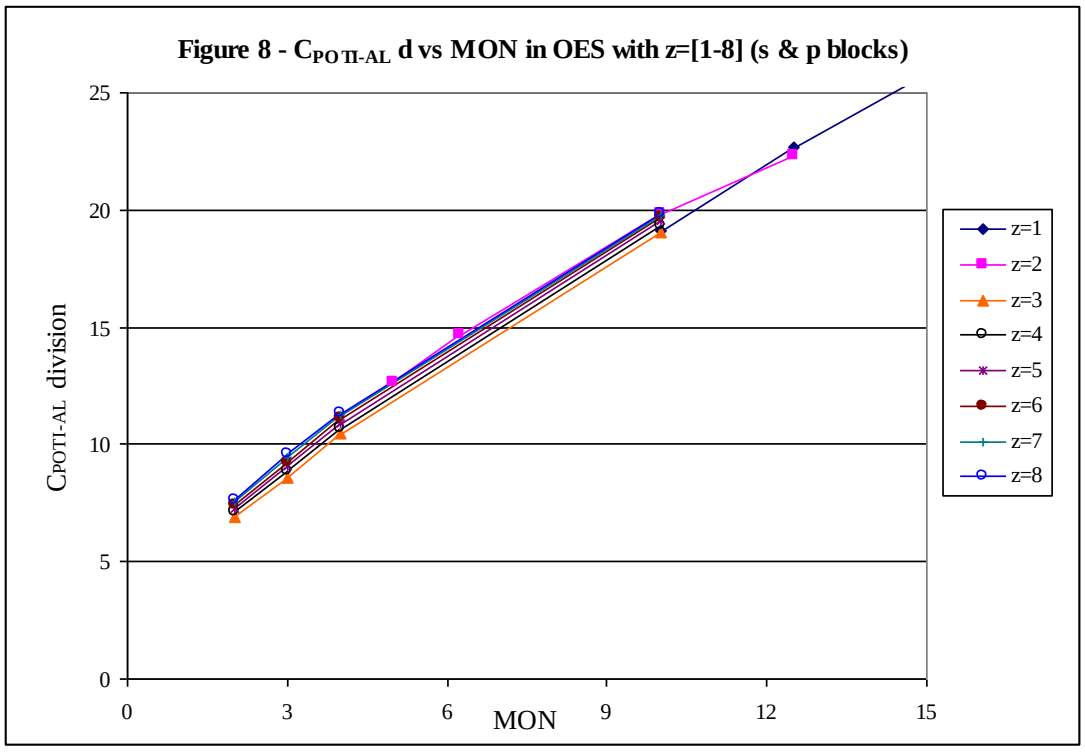


Figure 9 - p-block: $C_{POTI-AL}$ d vs MON in OES (Low MON zone)

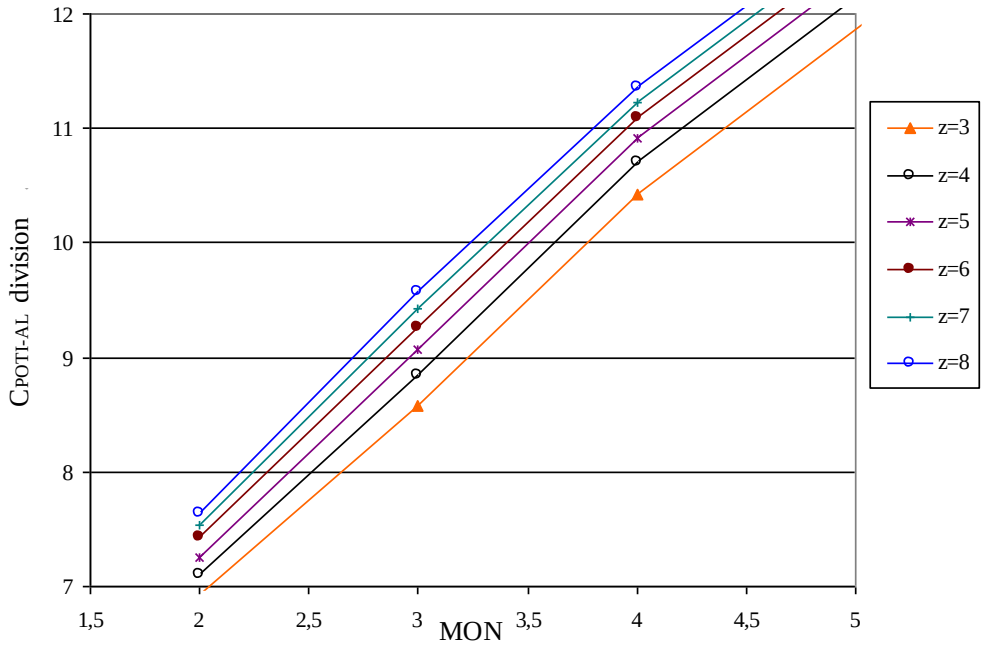
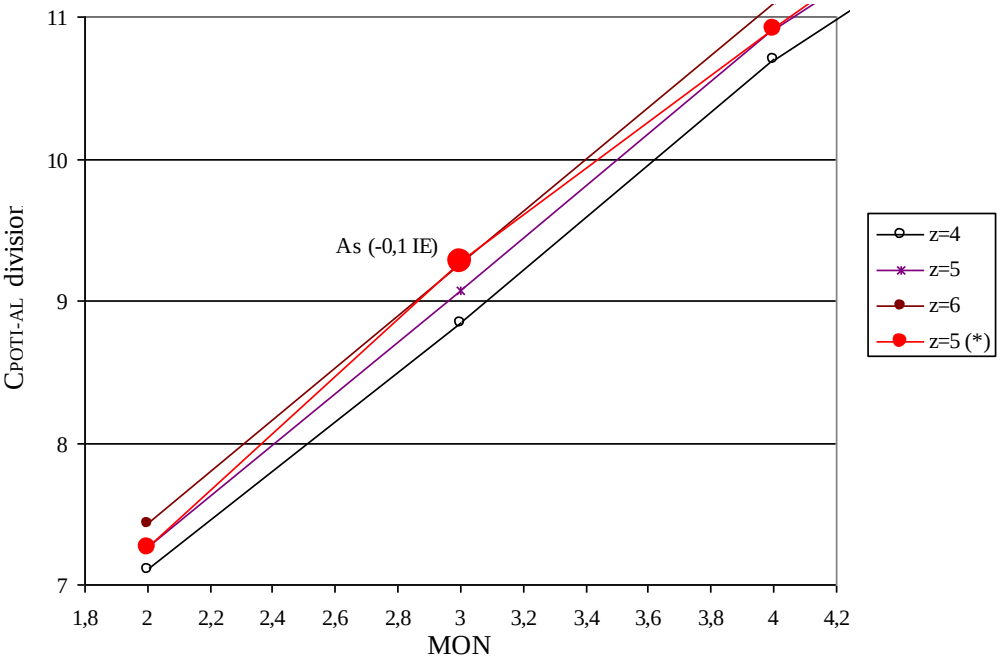


Figure 10 - $C_{POTI-AL}$ d vs MON. Modification effect of -0.1 IE in As



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Abbreviations List

Suffix indicates electronic extreme considered and i suffix is used to both electronic extremes (EE_i). Following Table indicates abbreviations used in this theory and its use in article in question is marked with X. 9 is present article. Jump from "Article 09" to "Article 20" is consequence of second part inclusion.

Abbreviations Table						
Abbreviation	**6**	**7**	**8**	**9**	**20**	**Meaning**
α_{NOA}		X				Nucleus-Orbit-Angle
BES	X	X	X	X		Born Electronic System
c_i	X	X	X	X		EE Orbital circumference
C_F	X		X	X		Wavelength compaction factor
C_{MON}	X	X				C_F without C_{POTI}
C_{PEP}	X	X	X	X		Probability electrons pair coefficient
C_{POTI}	X	X	X	X		Probabilistic Orbital Tide in Third Feliz Solution
$C_{POTI-AL}$		X	X	X		C_{POTI} Angular Limit
$C_{POTI-GAL}$			X			C_{POTI} Geometric Angular Limit

$C_{POTI-LAG}$			X			C_{POTI} Lobe always growing
d	X	X	X	X		Birth wavelength division or simply, division
EE	X	X	X	X		Electronic extreme
E_o	X	X	X	X		Initial, birth or output energy
E_i			X			EE energy
f	X					Constant in Victoria Equation
F		X				Constant f multiplied by z
GNC	X	X	X	X		Geometric NIN Coupling
ħ	X		X			Reduced Planck´s constant
H_i	X	X	X	X		EE Circular orbit height
IE	X	X	X	X		Ionization Energy
m_e			X			Electron mass
J	X					C_F order in Second Feliz Solution (From x=1 to J)
K_P						Probability constant in Variable C_F
λ_{Birth} λ		X	X			Birth wavelength
M	X					MON (Modified Orbital Number)
MON	X	X	X	X		Modified Orbital Number
NIN	X	X	X	X		Negative in Negative (Electron in electron concept)
OES	X	X	X	X		Origin Electronic System
OPA			X			Orbital Planes Axis
P_i	X	X	X	X		EE Probability
P	X					PEP (Principal Electronic Part)
PEP	X					Principal Electronic Part
PNC	X	X	X	X		Probabilistic NIN Coupling
$P_{Y\ to\ X}$	X					P_y with respect to X lobe
r_i	X	X	X	X		Distance between nucleus and EE
v_i			X			EE velocity
z	X	X	X	X		Effective nuclear charge
Z		X	X			Atomic number

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