ARTICLE 17

Excited electron: SPA IV: Silpovgar IV with Piepflui.
Excess relativistic: influence in LAN and SPA.

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ABSTRACT

This is 17th article of 24 dedicated to atomic model based on Victoria equation (Articles index is at end). Relation of Silva de Peral y Alameda (SPA) is studied in [5,7] and refers to excited states and provides linearity between specific energy relationship and LAN of Serelles Secondary Line [2,4] that allows creation of said secondary line obtained from Torrebotana Central Line [1].

[6] and [7] are first and second and this is third and last of three articles that make up a unit. First part of this article concludes Silpovgar study on ns→ns with Mc Flui transform for Silpovgar III and part two of Silpovgar I. Second part is centred on other jumps behaviour that lead to confluence of Silpovgar IV. Third part closes with 5) Other electronic jumps and emphasizes in Silpovgar IV: on the one hand at X→np jump location and on the other with Piepflui or Constant spacing. Finally, 1s²→1sns (Term=1S and J=0) brings two main points: Primitive energetic correlation of Silva de Peral y Alameda (SPA PEC) and First application of Relativistic effects.

KEYWORDS

Relation of Silva de Peral y Alameda, SPA relation, Silpovgar IV, Mc Flui transform, Piepflui, FEC, AFEC, PEC, Tete-Vic equation, LAN, Excess relativistic, ERo, ERdR, Feliz Theory of Eo, Feliz Representation of Eo

INTRODUCTION

This is third and last of triple article initiated with Relation of Silva de Peral & Alameda II: jump from ns to ns [6] and continued with SPA III: Mc Flui transform for Silpovgar III and Silpovgar IV[7] . Scheme, formulas and figures numbering is unique for three articles giving greater unity sense. Abbreviations Table is at end article. Scheme is as follows:

SPA IV: Silpovgar IV with Piepflui. Excess Relativistic: influence in LAN and SPA

5) Other electronic jumps (Continuation)
   C) ns(p or s)→np (Term=2P0 and J=3/2 (or 1/2)) with FEC adapted
   In general, this point is applied to any ns(p² or s²)→ns(p²⁻¹ or s²⁻¹)np
   P58 ns(p² or s²)→ns(p²⁻¹ or s²⁻¹)np jump location in Silpovgar IV
   P59 Piepflui: Constant spacing for Silpovgar IV
   D) 1s²→1sns (Term=1S and J=0)
   P60 Primitive energetic correlation of Silva de Peral y Alameda (SPA PEC)
6) Relativistic effects: First application made on D) 1s²→1sns (Term=1S and J=0)
   P61 IE Excess Relativistic in SPA PEC
P62 Feliz Theory of $E_o$ vision from electron as moves away.  
P63 ER$_o$, interatomic behaviour  
P64 Feliz representation of $E_o$ vision from electron as moves away.

C) $n_s(p \text{ or } s) \rightarrow np$ (Term=$2P^0$ and $J=3/2$ (or 1/2)) with FEC adapted

In general, this point is applied to any $n_s(p^y \text{ or } s^y) \rightarrow n_s(p^{y-1} \text{ or } s^{y-1})np$

Jumps may need intermediate excited state which is included in FEC conforming adaptation FEC (P57 FEC adapted or AFEC). This intermediate excited state for $n_snp \rightarrow np$ and, in general, for all jump $n_s p^y \rightarrow n_s p^{(y-1)}ns$ is given by (18) and in the case of $n_s s^x \rightarrow n_s x^{(x-1)}np$ by (19):

$$(18) \ n_s p^y \rightarrow n_s p^{(y-1)}(n-1)p \rightarrow n_s p^{(y-1)}np$$

$$(19) \ n_s s^x \rightarrow n_s x^{(x-1)}(n-1)p \rightarrow n_s x^{(x-1)}np$$

Initial state $\rightarrow$ intermediate excited state $\rightarrow$ excited state

As indicated in P57 FEC adapted or AFEC, intermediate excited state which is included in FEC conforming adaptation FEC (20), (20) is transformed into (1) when intermediate excited state does not exist.

$$\text{AFEC} \left( n_s(p' \text{ or } s') \rightarrow n_s(p^{x-1} \text{ or } s^{x-1})np \right) = \frac{-(\text{IE} + E_{E_{\text{of}} (n-1)p})}{E_{E_{\text{of}} np - E_{E_{\text{of}} (n-1)p}}}$$

Silpovgar IV compliance is demonstrated with several isoelectronic series examples with sufficient and accurate data in [7]. These isoelectronic series are in Table 16. These examples are represented in Figure 17 and also converge at the same Piepflui point (FEC=2.75). 2p*, 3p* and 4p* are other isoelectronic series with start state in 2p*, 3p* and 4p* respectively and have not been individually included. Two np→ns jumps are also included because of their relevance in P58. These two isoelectronic series are Al 3p→5s and B 2p→5s and are indicated as Al-5s and B-5s respectively in Figure 17 and Table 16.
Table 16 - X→5p electron jump: isoelectronic series examples that meet Piepflui with AFEC (Isoelectronic series of Al (3p→5s) and B (2p→5s) are also included)

<table>
<thead>
<tr>
<th>Isoelectronic series</th>
<th>Initial state</th>
<th>Intermediate (n=4) and excited state (n=5)</th>
<th>Atoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al (Al-5s)</td>
<td>3p (3P^0 1/2)</td>
<td>[Ne]3s^2ns 2S 1/2</td>
<td>Al I, Si II, S IV and K VII</td>
</tr>
<tr>
<td>B (B-5s)</td>
<td>2p (3P^0 1/2)</td>
<td>[He]2s^2ns 2S 1/2</td>
<td>B I, C II and N III</td>
</tr>
<tr>
<td>Na</td>
<td>3s (3S 1/2)</td>
<td>[Ne]np (3P^0 3/2)</td>
<td>[Na I, P V]</td>
</tr>
<tr>
<td>Mg</td>
<td>3s^2 (1S 0)</td>
<td>[Ne]3np (3P^0 1)</td>
<td>[Mg I, S V] and Ar VII</td>
</tr>
<tr>
<td>Be</td>
<td>2s^2 (1S 0)</td>
<td>[He]2np (3P^0 1)</td>
<td>Be I and B II</td>
</tr>
<tr>
<td>K</td>
<td>4s (3S 1/2)</td>
<td>[Ar]np (3P^0 3/2)</td>
<td>[K I, Ti IV]</td>
</tr>
<tr>
<td>Cu</td>
<td>4s (3S 1/2)</td>
<td>[Ar]3d^10np (3P^0 3/2)</td>
<td>Cu I, Ga III, Kr VIII, Rb IX, Sr X, Xe XXVI</td>
</tr>
<tr>
<td>Ca Zn</td>
<td>4s^2 (1S 0)</td>
<td>4np (3P^0 1)</td>
<td>Ca I, Ga II, Kr VII, Rb VIII</td>
</tr>
<tr>
<td>Kr</td>
<td>4p^6 (1S 0)</td>
<td>[Ar]3d^104s^24p^5(3P^0 3/2)np^2(1/2)1</td>
<td>[Kr I, Sr III]</td>
</tr>
<tr>
<td>2p* Ne</td>
<td>2p^6 (1S 0)</td>
<td>[He]2s^22p^5(2P^0 3/2)np^2(3/2)2</td>
<td>Ne I</td>
</tr>
<tr>
<td>C</td>
<td>2p^2 (1P 0)</td>
<td>[He]2s^22pn (1S 0)</td>
<td>C I</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[He]2s^22pn (1P 1)</td>
<td>C I</td>
</tr>
<tr>
<td>N</td>
<td>2p^3 (^4S^0 3/2)</td>
<td>[He]2s^22p^2np (^2S^0 1/2)</td>
<td>N I and O II</td>
</tr>
<tr>
<td>----</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>[He]2s^22p^3np (^4P^0 5/2)</td>
<td>N I and O II</td>
</tr>
<tr>
<td>O</td>
<td>2p^4 (^3P 2)</td>
<td>[He]2s^22p^3(^4S^0)np (^3P 1)</td>
<td>O I and Ne III</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[He]2s^22p^3(^4S^0)np (^3P 0)</td>
<td>O I</td>
</tr>
<tr>
<td>Ga</td>
<td>4p (^2P^0 1/2)</td>
<td>[Ar]3d^104s^2np ^2P^0 3/2</td>
<td>Ga I, Ge II and Kr VI</td>
</tr>
<tr>
<td>Al</td>
<td>3p (^2P^0 1/2)</td>
<td>[Ne]3s^2np ^2P^0 3/2</td>
<td>Al I and Si II</td>
</tr>
<tr>
<td>Si</td>
<td>3p^2 (^3P 0)</td>
<td>[Ne]3s^23pnnp (^1P 1)</td>
<td>Si I</td>
</tr>
<tr>
<td>Ar</td>
<td>3p^6 (^1S 0)</td>
<td>[Ne]3s^23p^5(^2P^0 3/2)np^2[3/2]2</td>
<td>Ar I</td>
</tr>
<tr>
<td>Ge</td>
<td>4p^2 (^3P 0)</td>
<td>[Ar] 3d^104s^24pnnp (^1P 1)</td>
<td>Ge I and Kr V</td>
</tr>
</tbody>
</table>

**P58 n_s(p^y or s^y)→n_s(p^{y-1} or s^{x-1})np jump location in Silpovgar IV**

P58 is n_s(p^y or s^y)→ n_s(p^{y-1} or s^{x-1})np jump location in small space of AFEC vs LAN representation and corresponding to np→ns area.

There are two particular relevant details in Figure 17:

* Isoelectronic series are more concentrated in X→5p (Figure 17) than in X→5s (Figure 16). Both axes have been maintained for better comparison between two figures.
* Isoelectronic series concentration zone is located between 3p→5s (Al series) that exerts of centre and two theorists limits equidistant to centre (Figure 18):
  - 2p→5s (B isoelectronic series)
  - Hypothetical limit.

**P59 Piepflui: Constant spacing for Silpovgar IV**

Piepflui or convergence point in Silpovgar IV representation (AFEC vs. LAN) occurs when LAN=0 and its AFEC value has constant spacing (21). Most of jumps present Silva de Peral y Alameda linearity with AFEC and few exceptions belong to first excited state. n is destiny n or excited state n:

\[(21)\text{Piepflui} = \frac{1}{4} + \frac{n}{2} = \frac{1 + 2n}{4}\]

P59 Piepflui application examples:

P59.A) \(1s^2\rightarrow ns\) (Term=\(3S\) and \(J=1\))

First excited state (1s2s) presents problem to apply (17) since 1p does not exist. Regression, either lineal or polynomial of degree 2 with better \(R^2\rightarrow1\), tends to \(1+1/3\) instead of to \(1+1/4\) (21). Other jumps comply with P59 Piepflui as is appreciable in Figure 19 where atoms from He I to Na X are represented.

**Figure 19 - Piepflui Point. 1s^2→ns (Term=3S and J=1)**

This intermediate excited state in general case of \(n_sS\rightarrow n_x^{^{(x-1)}n_p}\) is given by (19), but Term and J should be specified when there is more than one option. In this case,
mechanism is (22). \(1s(n-1)p \ (\text{Term}=^{3}P^{0} \text{ and } J=2)\) has been represented and J can be 0, 1 and 2:

\[
(22) \ 1s^2 \rightarrow 1s(n-1)p \ (\text{Term}=^{3}P^{0} \text{ and } J=0,1,2) \rightarrow 1sn \ (\text{Term}=^{3}S \text{ and } J=1)
\]

Slight deviations from P59 Piepflui (21) are reduced when \(z_s\) increases (Figure 20). This aspect with its possible extrapolation to other electron jumps should be studied with Relation of Riquelme de Gozy curvature developed in next article. Several alternate atoms have been selected for Figure 20: S XV, Sc XX, Ti XXI, Co XXVI, Ga XXX and Kr XXXV.

![Figure 20 - Piepflui Point. 1s^2→ns (Term=^{3}S and J=1)](image)

P59.B) Several jumps

Figure 21 has been realized considering mechanisms (14), (16), (18) and (19) and formulas (15), (17) and (20). Jump legend indicates: isoelectronic series – destiny \(n\) and \(s\) or \(p\) destiny. For example, “Al-5p” means Aluminium isoelectronic series and 5p destiny (3p→5p). In Figure 21, Piepflui (21) has also been included in regressions calculation for first time. Figure 21 is focused on destiny \(n\) equal to 3, 4 or 5.

P59 Piepflui: Constant spacing for Silpovgar IV begins with: “Most of jumps present Silva de Peral y Alameda linearity with AFEC and few exceptions belong to first excited state.” First excited state in \(n_p^{6} \rightarrow n_p^{5}(n_s+1)s\) is only exception of Figure 21 and therefore are legends: Ne-3s, Ar-4s and Kr-5s and their LAN vs. AFEC points are located following second-order polynomial regression.
Figure 22 is equivalent to Figure 21 but n destiny is the later ones: 6, 7 and 8. Piepflui protagonism is demonstrated in both figures.
D) $1s^2 \rightarrow 1sns$ (Term=1S and J=0)

$1s^2 \rightarrow 1sns$ (Term=3S and J=1) and $n_s \rightarrow ns$ (Term=2S and J=1/2) has been studied as example fulfilling Relation of Silva de Peral y Alameda (SPA relation) as well as Piepflui point (Figure 19 and 20) [5] and [6]. Another $1s^2 \rightarrow 1sns$ jump remains to be analyzed because there are two destination states (excited states) (Table 17). "Destiny state 1" maintains opposite spins as start state and is treated now. "Destiny state 1" is considered as "Primitive Jump" or "First Jump" because is the simplest jump of atom with more than one electron. "Destiny state 1" has particular energetic correlation (EC) as is introduced in [5]. "Primitive Jump" or "First Jump" is governed by P60 Primitive energetic correlation of Silva de Peral y Alameda (SPA PEC).

| Table 17 - Start and destiny states for $1s^2 \rightarrow 1sns$ |
|-----------------------|-------------------|-------------------|-------------------|
| State                | Start state       | Destiny state 1   | Destiny state 2   |
| Configuration        | $1s^2$ (3S and 0) | $1sns$ (3S and 0) | $1sns$ (3S and 1) |
| Spin                 | ↑↓                | ↑                 | ↓                 |


P60 Primitive energetic correlation of Silva de Peral y Alameda (SPA PEC)

SPA PEC is quotient between 1s ionization energy ($E_o$) and 1$s^2$ ionization energy (IE) (23). SPA PEC is jump energy independent and therefore is outstanding difference with respect to FEC (Fundamental energetic correlation) that is equal to quotient between ionization energy of excitable electron (IE) and excited state energy ($E_k$) (24).

\[
(23)\text{PEC} = \frac{E_o}{IE}
\]

\[
(24)\text{FEC} = \frac{IE}{E_k} = -\frac{IE}{E_k}
\]

LAN vs. FEC and PEC for 1$s^2$$\rightarrow$1s2s (Term=$^1S$ and $J=0$) from He to Kr is represented in Figure 23. SPA relation of PEC ($R^2=0.9991$) is better than $R^2=0.9956$ of FEC. Important difference between both energetic correlations is different sense when $z_s$ increases:

* FEC: $\uparrow z_s \rightarrow \uparrow F$EC and FEC$\rightarrow$F-\text{lipoint}
* PEC: $\uparrow z_s \rightarrow \downarrow PEC$ and PEC$\rightarrow$1 (IE=$E_o$)

![Figure 23 - SPA relation with FEC and PEC for 1s^2→1s2s (Term=^1S J=0)](image)

LAN (FEC)

\[
y = -0.9684x + 1.2857
\]

$R^2 = 0.9595$

LAN (PEC)

\[
y = 0.1222x - 0.1217
\]

$R^2 = 0.9992$
P61 IE Excess Relativistic in SPA PEC

PEC vs. LAN has slight curvature when Z is high (PEC→1) whose explanation must consider IE which is the most important change between 1s→1s2s and another closely studied jump such as 1s2s→1s23s:

\[
\text{/IE(1s)}/ > > \text{/IE(2s)}/ \text{for same } z_\text{s} \rightarrow 1s2s \text{ER} > > 1s^3\text{3s ER}
\]

and affects to greater extent LAN(1s2s) calculation.

Reversion to linearity is promoted through Excess Relativistic (ER) of \(E_{\text{dR}}(1s2s)\) which is estimated from 1s ER. 1s ER defined as difference between theoretic \(E_o\) (\(E_{\text{oT}}\)) and experimental \(E_o\) \([7]\) (25):

\[
(25) \text{1s ER} = E_{\text{oT}} - E_o = -13.6056899 \text{ eV} * Z^2 - E_o
\]

1s ER is obtained from Be to Si, \([\text{Be}, \text{Si}]\), with \(E_o=[-217.718577, -2673.182]\) and \(\text{ER}=[0.0275382, 6.4667796]\) and second degree polynomial equation is (26):

\[
(26) \text{1s ER} [\text{Be, Si}] = 0.000000932 E_o^2 + 0.000072416 E_o + 0.000392871
\]

\[R^2 = 1.000000\]

Same operation is performed from Si to Ge with \(E_o=[-2673.182, -14119.429]\) and \(\text{ER}=[6.4667796, 187.202542]\) and second degree polynomial equation is (27):

\[
(27) \text{1s ER} [\text{Si, Ge}] = 0.000000954 E_o^2 + 0.000231027 E_o + 0.300557746
\]

\[R^2 = 1.000000\]

(25) and (27) are applied for calculation of 1s2s ER, i.e. for first excited state 1s\(^2\)→1s2s (Term=\(^1\)S and J=0) from He to Kr represented in Figure 23. This 1s2s ER is included in reference destiny energy (\(E_{\text{dR}}\)) (Table 18).

<table>
<thead>
<tr>
<th>Symbol</th>
<th>(E_{\text{dR}}(1s2s))</th>
<th>ER (E_{\text{dR}}(1s2s))</th>
<th>(E_{\text{dR}}(1s2s)) with ER</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>-125,65171</td>
<td>0,0060</td>
<td>-125,6457</td>
</tr>
<tr>
<td>O</td>
<td>-170,44018</td>
<td>0,0151</td>
<td>-170,4251</td>
</tr>
<tr>
<td>F</td>
<td>-222,0069</td>
<td>0,0303</td>
<td>-221,9766</td>
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<td>Ne</td>
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<td>0,0534</td>
<td>-280,4187</td>
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<td>0,0868</td>
<td>-345,7022</td>
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<td>Mg</td>
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<td>-417,8349</td>
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<tr>
<td>Al</td>
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<td>0,1946</td>
<td>-496,8337</td>
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<td>Si</td>
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<td>0,2749</td>
<td>-582,7061</td>
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<td>S</td>
<td>-775,6534</td>
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<td>Ar</td>
<td>-996,3648</td>
<td>0,8535</td>
<td>-995,5113</td>
</tr>
<tr>
<td>K</td>
<td>-1116,8178</td>
<td>1,0820</td>
<td>-1115,7358</td>
</tr>
</tbody>
</table>
PEC vs. LAN of Figure 23 is enlarged in curvature zone with Figure 24 when curvature increase as PEC decreases is appreciated. In addition, LAN calculated with $E_{dr}(1s2s)$ including ER is represented as LAN*. Conclusion is that $E_{dr}(1s2s)$ including ER corrects LAN curvature and SPA PEC linearity is achieved.

If only Excess Relativistic (ER) of $E_{dr}(1sns)$ effect exists, SPA PEC linearity without considering this effect must be accomplished gradually as n increases because $/E_{dr}$ decreases and implies ER decreases.

\[
\uparrow n \rightarrow /E_{dr} \downarrow \rightarrow \text{ER} \downarrow \rightarrow \text{Effect on LAN} \downarrow \rightarrow \text{SPA PEC linearity without 1sns ER}
\]
This situation occurs, but more rapidly that predicted by such prior consideration. \(1s^2 \rightarrow 1s3s\) (Term=\(^1\)S and J=0) without considering \(E_{\text{dr}}(1s3s)\) ER is already located on SPA PEC linearity marked by LAN* 2s (LAN calculated with \(E_{\text{dr}}(1s2s)\) including ER) in **Figure 25**. Figure 25 shows \(1s^2 \rightarrow 1s\) ns for \(n=[2,5]\) without ER as LAN ns and LAN calculated with \(E_{\text{dr}}(1s2s)\) including ER is represented as LAN* 2s. In addition, \(1s^2 \rightarrow 1ns\) with \(n>3\) initiate deviation in reverse direction to that observed with \(1s^2 \rightarrow 1s2s\). Conclusion is that there is another effect of inverse sense to \(E_{\text{dr}}\) ER: Excess Relativistic (ER) of \(E_o\) (1s) is source of this inverse effect because is included in LAN numerator while \(E_{\text{dr}}\) is in LAN denominator.

![Figure 25 - SPA PEC for 1s^2→1sns (Term=\(^1\)S J=0)](image)

Relativistic (ER) of \(E_o\) (1s) is introduced with **LAN Feliz solution:**

**P62 Feliz Theory of \(E_o\) vision from electron as moves away.**

Linearity drift resolution in LAN vs. PEC (Figure 25), and in general for SPA relation, is obtained with progressive 1s ER (25) elimination in the vision of said 1s ER (25) by electron as it moves away.

Excess Relativistic (ER) of \(E_{\text{dr}}\) (1sns) in \(1s^2 \rightarrow 1sns\) (Term=\(^1\)S and J=0) with \(n=[3,5]\) is calculated using (26) because all jumps have \(|E_{\text{dr}}|<2673.182\) eV. Kr 1s3s has high energy with \(|E_{\text{dr}}|=2113.987\) eV. LAN equation with ER incorporation in \(E_{\text{dr}}\) and \(E_o\) is given by (28) where ER consideration is indicated with *. \(E_{\text{dr}}^*\) and \(E_o^*\) are in (29) and (30). \(E_{\text{dr}}^*\) is Excess Relativistic of reference destiny energy \((E_{\text{dr}})\) in general form to be indicated in (28) since when ER is of concrete jump is represented for example as “1s2s ER” or, more in detail if is not clear, as “1s2s (Term=\(^1\)S and J=0) ER”. On the other hand, \(E_o^*\)
is Excess Relativistic of 1s ionization energy ($E_o$) in the vision of said 1s ER (25) by electron as it moves away.

$$ (28) \ - \ LAN^* \approx -LAN_n^* = \left( -\frac{E_o}{E_{dr}} \right)^{1/2} z_o - n = \left( -\frac{E_o - ER_o}{E_{dr}} \right)^{1/2} z_o - n $$

$$ (29) \ E_{dr}^* = E_{dr} + ER_{dr} $$

$$ (30) \ E_o^* = E_o + ER_o $$

$ER_o$ value (31) is obtained from (30) and (28):

$$ (31) ER_o = -E_o - \left[ \left( -\frac{LAN^* + n}{z_o} \right)^{1/2} - \frac{E_{dr}}{z_o} \right]^2 $$

$LAN^*$ for $1s^2 \rightarrow 1sns$ (Term=1S and J=0) is the same that $LAN^*$ for $1s^2 \rightarrow 1s2s$ (Figure 24 as $LAN^*$ and Figure 25 as $LAN^*$ 2s) because PEC is jump energy ($E_k$) independent. FEC is $E_k$ dependent and thus obtaining $LAN^*$ differs. $ER_o$ vs. $E_o$ for $1s^2 \rightarrow 1sns$ (Term=1S and J=0) with $n=[3,5]$ is represented in Figure 25 and shows curves without discontinuities where higher destiny $n$ implies higher $ER_o$ value. On the one hand, last comment, higher destiny $n$ implies higher $ER_o$ value, represents first contact with “P62 Feliz Theory of $E_o$ vision from electron as moves away” because verifies progressive 1s ER (25) elimination.
By other hand, P63 is intercalated in P62 explanation and develops ER$_o$ interatomic behaviour where, among other conducts, ER$_o$ vs. E$_o$ curves must be studied.

**P63 ER$_o$ interatomic behaviour**

ER$_o$, Excess Relativistic of 1s ionization energy ($E_{o}$) in the vision of said 1s ER (25) by electron as it moves away, show interatomic trends:

P63.A) ER$_o$ vs. E$_o$ has polynomial degree two polynomial regression (Figure 26) according selected n destiny which, considering curve between E$_o$ and 1s ER, ends in P63.B

P63.B) ER$_o$ vs. 1s ER (25) presents linearity as function of selected n destiny (Figure 27).

**Figure 27 - SPA PEC for 1s$^2$→1sns (Term=1S J=0)**

![Figure 27 - SPA PEC for 1s$^2$→1sns (Term=1S J=0)](image)

P62 continues with P64: representation of 1s ER (25) elimination in the view from electron as it moves away.

**P64 Feliz representation of E$_o$ vision from electron as moves away.**

Feliz representation of $E_o$ vision from electron as moves away is ER$_o$ vs. (-E$_{dr}$)$^{1/2}$ curve (32). Y-intercept must be equal to 1s ER (25) and therefore said 1s ER must be obtained from extrapolation of experimental data.

\[(32)ER_o \propto (- E_{dr})^{1/2}\]
Feliz representation is carried out with Kr $1s^2\rightarrow1sns$ (Term=$^1S$ and $J=0$ and $n=[2,4]$) in Figure 28. Three jumps are adjusted to grade two polynomial regression (33). $Y$-intercept provided by equation is 295 eV and therefore very close to that expected: $1s\ ER= ER = E_{OT} - E_o = -13.6056899\ eV * 36^2 - (-17936.208) = 303.23\ eV$. In addition, $ER_o\rightarrow0$ when is $EdR$ of $1s4s$: $(-EdR)^{1/2}=(-4269.834\ eV)^{1/2}=65.344\ eV^{1/2}$

$$(33)ER_o = a + b(-E_{dr})^{1/2} + c(-E_{dr})$$

In fact, inclusion of these two points, $(0, 303.23)$ and $(65.344, 0)$ provide $R^2=0.9999$ in grade two polynomial regression.

For example, Ga and Ti also give values with very good approximation with $Y$-intercept of 161 and 42 eV against 164 and 41 eV provided by (25).

In next article, corroboration of Feliz Theory of $E_o$ vision from electron as moves away is done on other jumps as $[Ne]3s\rightarrow[Ne]ns$ that brings with important differences:

* $|IE/| << |E_o/|$ implying that $ER_{dr}$ is very small compared to $ER_o$ and that difference increases as excitable electron is at higher n. $ER_{dr}$ effect may be negligible especially at low $z_s$. Therefore, $ER_o$ effect can be studied individually in some cases.

For example in Na, $1s$ ionization energy ($E_o$) is -1648,702 eV and similar to $1s^2$ $IE=-1465.121\ eV$ and this has been situation seen in P62, P63 and P64 because jump studied has been: $1s^2\rightarrow1sns$ (Term=$^1S$ and $J=0$). In contrast, for example $[He]2s$ $IE=-299,864\ eV$ or especially $[Ne]3s$ $IE=-5,13908\ eV$ are much lower. $ER_o >> ER_{dr}$ of 3s excited states.
* Electrons with low $z_s$ usually have data at high $n$ and, if also fulfill $|IE| << |E_0|$, allow to investigate $ER_o$ individually when $E_{dr} \rightarrow 0$ and consequently X-Axis of Feliz relativistic representation as well: $(E_{dr})^{1/2} \rightarrow 0$.

* $ER_o$ vs. $(-E_{dr})^{1/2}$ section with medium-high $n$ is approximated to line equation (34) from curve adjusted to grade two polynomial regression (33).

$$ (34) ER_o \approx a + b(-E_{dr})^{1/2} $$

* LAN$^*$ (28) obtained from SPA relation in present article can also be given by Relation of Riquelme de Gozy [2,3] as seen in following article

Finally, simple study of $ER_o$ and $ER_{dr}$ effects on LAN is included in annex.

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ANNEX

Energetic changes effect on LAN

LAN has 2 energetic terms (1): Destiny energy of excitable electron that uses reference data [9] \((E_{dR})\) and born, initial or first electron energy (1s Energy) that is represented by \(E_o\).

\[
(1) - \text{LAN} \approx -\text{LAN}_r = \left( \frac{z^2 E_o}{z^2 E_{dR}} \right)^{1/2} - n = \left( \frac{z^2 E_o}{z^2 (E_k + IE)} \right)^{1/2} - n
\]

(1) can be simplified in (2):

\[
(2) - \text{LAN} \approx -\text{LAN}_r = \left( \frac{-E_o}{z} \right)^{1/2} - n
\]

Jump energy \((E_k)\) [9] and Ionization energy [8] \((IE)\) provides \(E_{dR}\) (3):

\[
(3) E_{dR} = IE + E_k
\]

The energy changes effect on LAN is also applicable on ground state of LAN for \(n_s \rightarrow ns\) jump [3] (4):

\[
(4) - \text{LAN}(P50) = -\text{LAN}_{ns \rightarrow ns} = \left( \frac{-E_o}{z} \right)^{1/2} - n_{\text{initial}}
\]

Relative Change in percentage is given by (5) where LAN is calculation with (2) and \(\text{LAN}_M\) is LAN modified. \(\text{LAN}_M\) also represents actual LAN including Excess Relativistic \((ER_o\) and \(ER_{dR})\) represented by \(\text{LAN}'\) (28) and for this reason (5) is thus formulated:

\[
(5) \% \text{RC}_{M}(\text{LAN}) = \frac{\text{LAN} - \text{LAN}_M}{|\text{LAN}_M|} \cdot 100
\]

(6) implies that energy destiny \((E_d)\) is multiplied by factor \(F\) to provide \(E_{dM}\). \(E_d\) is generally used and includes possibility of using \(E_{dR}\) and \(E_{dRM}\) in formulas.

\[
(6) E_{dM} = E_d F
\]

\(\uparrow n \rightarrow \downarrow /E_d/ \rightarrow \downarrow /E_d - E_{dM}/\) if \(F=\text{constant}\) (7). That is, Actual change in absolute value decreases as \(n\) increases when \(F=\text{constant}\). Therefore, if Actual change in absolute value is constant or increases with \(n\) is because \(F\) also grows with \(n\). This fact is related with two relativistic excess \((ER_o\) and \(ER_{dR})\).

\[
(7) /E_d - E_{dR}/ = /E_d((1-F)/
\]
LANM with EdM and LAN with general Ed are in (8) and (9) respectively:

\[
(8) \quad \text{LANM} = \frac{(-E_d)^{1/2}z_o}{(-E_{bm})^{1/2}z_o} - n
\]

\[
(9) \quad \text{LAN} = \frac{(-E_d)^{1/2}z_o}{(-E_d)^{1/2}z_o} - n
\]

K_{LAN} is inserted into (8) and (9) to reach (11) by applying (5). /LANM/ is considered LAN because in most cases LAN is positive.

\[
(10) K_{LAN} = \frac{(-E_d)^{1/2}z_o}{z_o}
\]

\[
(11) \%RC_m(LAN) = \frac{\frac{K_{LAN}}{(-FE_d)^{1/2}} - n - \frac{K_{LAN}}{(-E_d)^{1/2}} + n}{n - \frac{K_{LAN}}{(-FE_d)^{1/2}}} \times 100
\]

Sum of terms allows transition from (11) to (12):

\[
(12) \%RC_m(LAN) = \frac{K_{LAN} - F_d^{1/2}K_{LAN}}{-K_{LAN} + n(-FE_d)^{1/2}} \times 100
\]

(13) is (12) with both denominators simplified:

\[
(13) \%RC_m(LAN) = \frac{K_{LAN} - F_d^{1/2}K_{LAN}}{-K_{LAN} + n(-FE_d)^{1/2}} \times 100
\]

(14) is (13) divided numerator and denominator by K_{LAN}:

\[
(14) \%RC_m(LAN) = \frac{1 - F_d^{1/2}}{-1 + \frac{n(-FE_d)^{1/2}}{K_{LAN}}} \times 100
\]

(15) is obtained from (9) and (10). (15) use causes (16) to be achieved from (14):

\[
(15) n - \text{LAN} = \frac{K_{LAN}}{(-E_d)^{1/2}}
\]
\[(16)\%RC_M(LAN) = \frac{1 - F^{\frac{z}{2}}}{nF^{\frac{z}{2}}} \cdot 100 \]

\[(17)\%RC_M(LAN) = \frac{1 - F^{\frac{z}{2}}}{n - LAN_M} \cdot 100 \]

(17) is (16), but considering \(LAN_M\) instead of \(LAN\).

Three interesting situations are:

a) \(\%RC_M(LAN) \to 100\%\) when \(n \to \infty\) (18). (16) with \(n \to \infty\) is transformed into (18) and \(\%RC_M(LAN) \to 100\%\) because infinite terms are simplified each other and cause numerator and denominator to be identical:

\[(18)\%RC_M(LAN)_{n \to \infty} = \frac{1 - F^{\frac{z}{2}}}{1 + \frac{nF^{\frac{z}{2}}}{\infty}} \cdot 100 = -100\% \]

b) \(\%RC_M(LAN) \to 100\%\) when \(LAN \to 0\) (19). (16) with \(LAN \to 0\) is transformed into (19) and \(\%RC_M(LAN) \to 100\%\) because LAN is negligible compared to \(n\) value and consequently situation is identical to previous one: numerator and denominator are identical:

\[(19)\%RC_M(LAN)_{LAN \to 0} = \frac{1 - F^{\frac{z}{2}}}{n} \cdot 100 = -100\% \]

(18) and (19) occur because (5) is changed to (5.B.) when \(n \to \infty\) or \(LAN \to 0\):

\[(5.B.)\%RC_M(LAN)_{LAN \to 0} = \%RC_M(LAN)_{n \to \infty} = \frac{LAN - LAN_M}{LAN_{sd}} \cdot 100 = -\frac{LAN_M}{LAN_{sd}} \cdot 100 = -100\% \]

-100\% has been indicated because LAN (and \(LAN_M\)) is mostly positive.

Therefore, both higher \(n\) and lower LAN imply an increase in deviation between both LAN. Lower LAN has been observed with \(z_s\) is increased [2,7]. All this leads to work with data from \(n\)\(\uparrow\) and \(LAN\)\(\downarrow\) (or \(z_s\)\(\uparrow\)) is less accurate in SPA or RG relations. In addition, is necessary to add own experimental difficulties that present LAN value when \(n\)\(\uparrow\) and \(z_s\)\(\uparrow\).

c) \(\%RC_M(LAN) \to \pm \infty\)

This discontinuity is produced when (16) denominator is cancelled and is called discontinuity condition (33). n discontinuity condition (34) is obtained from (33) and is
positive with physical sense if $0 < F < 1$ since LAN is positive. This discontinuity causes that $\%R_{CM}(LAN)$ vs. $n$ curve to be different with $0 < F < 1$ or $F > 1$.

$$\text{(33) Discontinuity condition} = -1 + \frac{nF^{1/2}}{n - LAN} = 0$$

$$\text{(34) Discontinuity condition} = \frac{LAN}{1 - F^{1/2}}$$

a) and b) interesting situations discussed and high LAN sensibility to energetic variations can be verified with Figure 29. Figure 29 is $\%R_{CM}(LAN)$ vs. $\log(n)$ curve with (16). X-axis is $\log(n)$ is for better visualization up to high $n$. LAN plain [2] is considered approximately constant. LAN value of third $n$ destiny is selected so that approximation is more correct for high $n$ destiny. These LAN value of third $n$ destiny are as follows for indicated samples:

- Li $2s \rightarrow ns$: 0.40062309
- Li $2s \rightarrow np$: 0.04602786
- Li $2s \rightarrow nd$: 0.0008053
- Na $3s \rightarrow ns$: 1.34737865

Figure 29 shows that both higher $n$ and lower LAN imply an increase in deviation between both LAN (point a) and b) commented previously).
High sensitivity is also checked. \(E_d\) is multiplied by factor \(F\) to provide \(E_{dM}\) (6) and \(F\) selected is 1.001, i.e. variation of 0.1 %. LAN sensibility to energetic variations is corroborated because variations are much higher that 0.1 \%(\%RC_{M}(LAN)>>0.1\%)

Even jumps with higher LAN (Li \(2s\rightarrow ns\) and Na \(3s\rightarrow ns\)) and lower \(n\) show \(\%RC_{M}(LAN)>0.1\%\). (Figure 30). Figure 30 is \(\%RC_{M}(LAN)\) vs. \(n\) curve with (16). X-axis is \(n\) and not \(\log(n)\) to focus study at low \(n\).

\[
(20) \quad E_{dM} = E_d + x
\]

\[
(21) \quad E_d F = E_d + x
\]

\(F\) (22) is obtained from (21) as \(x\) function and this \(F\) expression is included in (16) to arrive at (23):

\[
(22) \quad F = \frac{E_d + x}{E_d}
\]
(23)%RC_m(LAN) = \frac{1 - \left(\frac{E_d + x}{E_d}\right)^{1/2}}{n - \text{LAN}} \cdot 100

(23) application with x=0.001 eV is performed on same jumps of Figures 29 and 30. x=0.001 eV because provides similar deviation as with F=1.001 for first jump shown. Figure 31 represents %RC_m(LAN) vs. Log(n) curve with x=0.001 eV. Main conclusion is that %RC_m(LAN) increases faster with x=0.001 than with F=1.001 because E_d is decreasing and x=constant=0.001 eV is summed, and not multiplied as F, to E_d. x=constant provides growing F as n increases (22):

\[ n \uparrow \rightarrow \downarrow / E_d / \rightarrow \uparrow F \text{ (if x=constant)} \rightarrow \uparrow / \%RC_m(LAN)/ \]

%RC_m(LAN) has more dramatic variations if situation is reverse: F<1 or x<0. Discontinuity pointed out in c) %RC_m(LAN)→±∞ provokes said variability increase. n discontinuity condition applied to F (34) is extended to x (35).

(35)n discontinuity condition = \frac{\text{LAN}}{1 - F^{1/2}} = \frac{\text{LAN}}{1 - \left(\frac{E_d+x}{E_d}\right)^{1/2}}

E_d (36) is obtained from (15) and inserted into (35) to provide (37):
(36) \[ E_d = \left( \frac{K_{LAN}}{n - LAN} \right)^2 \]

(37) \[ \text{n discontinuity condition} = \frac{LAN}{1 - F^{1/2}} = \frac{LAN}{1 - \left( \frac{K_{LAN}}{n - LAN} \right)^{1/2} + x} \]

(37) calculation for jumps with x can be obtained after calculating resulting third degree equation.

Jumps with elevated LAN may appear to have lower \( \%RC_M(LAN) \) considering what is seen in Figure 29 and 31, but one element of capital importance is missing: increasing LAN (for same jump and \( z_o \)) requires raising \( n_s \) and this implies increasing \( z_o \) (i.e. atomic number) and its associated \( ER_o \) (Excess Relativistic of 1s ionization energy \( (E_o) \) in the vision of said 1s ER).

Consequently, Cs I 6s→ns with respect to Na I 3s→ns has two opposite effects:

Positive: ↑LAN → ↓\( \%RC_M(LAN) \)

Negative: ↑Z (or \( z_o \)) → ↑\( /E_o\) → ↑\( ER_o \) → ↑\( \%RC_M(LAN) \)

Negative effect wins and, for example in this Cs I 6s→ns, Relation of Riquelme de Gozy without \( ER_o \) considerations has much greater curvature than Na I 3s→ns.

\( G \) is \( E_o \) deviation factor (24) in analogy to \( F \) with \( E_d \) (6). (24) implies that 1s ionization energy \( (E_o) \) is multiplied by factor \( G \) to provide \( E_oM \). (16) remains as (25) with \( E_oM \) inclusion:

\[ (24)E_{oM} = E \cdot G \]

\[ (25)\%RC_{oM}(LAN) = \frac{1 - \left( \frac{F}{G} \right)^{1/2}}{n \left( \frac{F}{G} \right)^{1/2}} \cdot 100 \]

\[ -1 + \frac{n \left( \frac{F}{G} \right)^{1/2}}{n - LAN} \]

(8.B) expresses LANM with modification in both energies. \( \%RC_{oM}(LAN) = 0 \) when \( F = G \) because LANM=LAN and can also be seen as (25) is changed to (26)
(8.B) \(-\text{LAN}_M = \left(\frac{-E_M}{\sqrt{\text{LAN}}\cdot z_e}\right)^2 z_e - n = \left(\frac{-E_G}{\sqrt{\text{LAN}}\cdot z_e}\right)^2 z_e - n = \left(\frac{-E_o - y}{\sqrt{\text{LAN}}\cdot z_o}\right)^2 z_e - n \)

\[
\frac{(26)\% \text{RC}_M(\text{LAN})_F - G}{= \frac{1 - 1}{n} \cdot 100 = \frac{0}{n - \text{LAN}} \cdot 100 = 0}
\]

G and y (27)(28)(29) play the same role as F and x (20)(21)(22):

\[
(27) E_{oM} = E_o + y
\]

\[
(28) E_G = E_o + y
\]

\[
(29) G = \frac{E_o + y}{E_o}
\]

\(\text{LAN}^* (30)\) (seen as (28) in article) is specific case in which relativistic effects on \(\text{LAN}\) are calculated and where x is (31) and y is (32):

\[
(30) -\text{LAN}^* \approx -\text{LAN}_R^* = \left(\frac{-E^*}{\sqrt{\text{LAN}_R}}\cdot z_e\right)^2 z_e - n = \left(\frac{-E_o - \text{ER}_o}{\sqrt{\text{LAN}_R}}\cdot z_o\right)^2 z_o - n
\]

\[
(31) x = \text{ER}_R
\]

\[
(32) y = \text{ER}_o
\]
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<td>17</td>
<td>SPA IV: Silpovgar IV with Piepflui. Excess Relativistic: influence in LAN and SPA</td>
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<td>18</td>
<td>Feliz Theory of Eo vision - Relativistic II: influence in Riquelme de Gozy</td>
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<td>19</td>
<td>Pepliz LAN Empire I: $LAN_{n-&gt;\infty}$ vs. $LAN(P50)$</td>
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<td>20</td>
<td>Pepliz LAN Empire II: $LAN_{n-&gt;\infty}$ vs. $LAN(P50)$</td>
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<td>Part III - NIN: $C_{PEP}$ &amp; $C_{POTI}$</td>
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<td>Electron Probability: PUB $C_{PEP}$ I (Probability Union Between $C_{PEP}$) - Necessary NIN relationships</td>
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<td>22</td>
<td>Electron Probability: PUB $C_{PEP}$ II in &quot;Flui BAR&quot; (Flui (BES A (Global Advance) Region)</td>
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<td>23</td>
<td>Orbital capacity by advancement of numbers - Electron Probability: PUB $C_{PEP}$ III: &quot;Flui BAR&quot; II and $C_{PEP-3}$</td>
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<td>24</td>
<td>Electron Probability: 1s electron birth: The last diligence to Poti Rock &amp; Snow Hill Victoria</td>
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24 hours of new day