Mathematical Confirmation for the Nuclear Properties $K(O) = K(Ca) = \frac{1}{2} K(Si) = \frac{1}{2} K(Fe)$

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Abstract

Oxygen isotopes have one complete hexagonal floor, composing one magnet whose rotation in oxygen-15 induces the induction-factor $K(O15) = 1.3715$, calculated in [1]. Calcium isotopes have three complete hexagonal floors, but two of them cancel each other their induction power, resulting that calcium has one magnet either. As both them are composed by one magnet, one has to expect that $K(Ca39)$ converted to $K(O15)$ needs to give a value near to 1.3715. Such expectation was confirmed in [1]. On another hand, silicon isotopes have two hexagonal floors, but the second floor rotates by 180°, and the two floors compose two magnets. Thereby, one has to expect to be required that $K(exSi28)$, which is induced by two magnets, must be twice of $K(O15)$ and $K(Ca39)$, both tem induced by only one magnet. This prediction is confirmed in the present paper. But iron isotopes have four hexagonal floors, and two of them cancel each other their induction power, and so $exFe53$ also composes two magnets. Thereby one has to expect that induction-factor for $exSi28$ and $exFe53$ must be the same. In resume, one has to expect that $K(exSi28) = 2K(O15) = 2K(Ca39)$. This conclusion is also confirmed in the present paper. And herein continues being successfully tested the equation.

\[ \Phi_{6THK} (X) = 1.37176 \times \frac{PwR(X).R(X)}{PwR(015).R(015)} \]

The success of the test implies that oxygen and calcium isotopes, as silicon& iron isotopes, are connected through physical laws, linked to the existence of hexagonal floors in the real atomic nuclei existing in the nature. The paper also shows that quantum tunneling is not required nor for the occurrence of stellar nucleosynthesis, and neither to explain how U238 emits alpha particles with 4,2 MeV, which cross a Coulomb barrier with 8,8 MeV, a puzzle that Gamow solved with an unacceptable Theory.

Keywords

Nuclear Magnetic Moments; Theoretical and Empirical Induction-Factors; New Equations Replacing Gamow’s quantum Tunneling in U238 Alpha Decay; New Equations Replacing Quantum Tunneling in Stellar nucleosynthesis; Cold Fusion; Rossi’s Ecat

Introduction

1. Conversion $K_{EMP} (O15) \Rightarrow K_{TH} (exSi28)$

As seen in the paper [1], for the isotopes with incomplete hexagonal floors (3Li, 4Be, 5B, 6C, and 7N), and the isotopes with odd number of complete hexagonal floors, as oxygen and calcium, the fundamental equation for the calculation their induction factor is.
In that paper it was shown that in silicon isotopes the second floor rotates by 180° regarding to the first floor, and thanks to such rotation, the two floors prevent the repulsion of their magnetic poles, which would exist before the rotation.

Then there is a question to be responded: how the induction-factor $K(Si)$ of the silicon isotopes is influenced by such rotation?

With the sake of responding such question, let us calculate the value of the oxygen induction-factor $K_{EMP}(O15) = 1,37176$, by considering the following condition: the oxygen-15 would have a radius $R(O15)=R(Si28)$ and a power-rotation $PwR(O15)=PwR(exSi28,i=2)$. In another words, what would be the value of $K_{EMP}(O15)$ if oxygen-15 would be rotating with the same conditions under which the excited silicon-28 rotates?

The structure of excited silicon-28 with spin 2 is seen in the Figure 1.

**Figure 1:** Structure of exSi28, i=2, Seen in the Figure 14 of paper [1]

\[
R(Si28) = 1,25 \times 28^{1/3} = 3,7957362
\]  

\[
PwR(exSi28,i=2) \text{ is calculated in the equation 49 of the paper [1], which is the following:}
\]

\[
PwR(exSi28) = \frac{2 \times 1,663}{28 \times 3,7957^2} = 0,057822
\]  

The empirical $K_{EMP}(exSi28)$ is calculated in the eq. 46 of the paper [1]:

\[
K_{EMP}(exSi28) = \frac{1,1}{2 \times 0,857} = 0,6414
\]
If the isotope oxygen-15 had a radius $R(O_{15}) = R(Si_{28}) = 3.795736$ and a power-rotation $PwR(O_{15}) = PwR(exSi_{28}) = 0.00578219$, then the value of its $K_{E M P}(O_{15})$ would be:

$$K_{E M P}(O_{15}) = 1.371761193 \times 0.0057822 \times 3.795736 / (0.03108 \times 0.08276) = 0.31422782 \quad (5)$$

The result obtained in eq. 5 shows that, if oxygen-15 was working with the same conditions of exSi28, the ratio $K(exSi_{28})/K(O_{15})$ would be:

$$0.6414 / 0.31422782 = 2.041 \quad (6)$$

Therefore, exSi28 has a power for magnetic induction twice stronger than oxygen-15, and so silicon isotopes do not follow the equation (1). For the silicon and iron isotopes, the equation for the theoretical induction-factor is

$$K_{TH}(X) = \left(\frac{\Phi}{6}\right) 1.37176 \times \frac{PwR(X).R(X)}{PwR(O_{15}).R(O_{15})} \quad (7)$$

where $\Phi = 12$, because there are twelve deuterons in each pair formed by two hexagonal floors, and oxygen-15 has only six deuterons in its floor. Equation (7) can also be put either as

$$K_{TH}(X) = 2.K_{E M P}(O_{15}) \times \frac{PwR(X).R(X)}{PwR(O_{15}).R(O_{15})} \quad (7.1)$$

Or

$$K_{TH}(X) = 2 \times 1.37176 \times \frac{PwR(X).R(X)}{PwR(O_{15}).R(O_{15})} \quad (7.2)$$

**Figure 2:** Oxygen and Calcium Isotopes have one Magnet. Silicon and Iron Isotopes have Two Magnets
The origin of this anomalous power of the magnetic induction in silicon isotopes is seen in Figure 2: in silicon, due to the rotation of the second floor by 180°, the two hexagonal floors form a magnet composed by to magnets working together (each one of the magnets has induction-factor \( K(\text{Si}) = 1.37176 \), and the total \( \sum K(\text{Si}) \) in silicon isotopes is twice of that existing in oxygen isotopes, which has only one magnet). The same occurs with iron isotopes and all the atomic nuclei with pair number of floors.

From such behavior of silicon isotopes, we may understand the mechanism responsible for the induction-factor, as follows:

A) In oxygen isotopes, where there is only one magnet working alone, the rotation of each proton charges promotes a growth of the induction-factor. Each proton of a deuteron contributes with the portion of growth \( \delta = 1.37176^{\frac{1}{6}} = 1.0541 \).

In silicon isotopes two magnets work together. If a third magnet is added (the third hexagonal floor in calcium), two magnets cancel each other their contribution, and only one magnet remains working alone. This occurs because a sandwich is formed by three magnets, where the central magnet has magnetic line fluxes in the contrary direction of the other two magnets. In the Figure 2, the sandwich is shown in the calcium isotopes (the green line fluxes are contrary to the red ones). That’s why calcium and oxygen isotopes have very close nuclear magnetic properties.

B) When a fourth floor is added, as in the case of iron isotopes, the sandwich again cancels two magnets, in order that only two magnets remain working, and therefore we may expect that iron and silicon isotopes have close nuclear magnetic properties.

Having been understood the mechanism responsible for the induction-factor, and how it plays a fundamental role in the equations 1 and 7, the next step is to verify whether the eq. 7 is applied to all silicon isotopes. And we may do it simply by applying the equation, as follows: by starting from \( K_{\text{EMP}}(\text{O15}) = 1.37176 \) and \( \Phi = 12 \), we will verify whether we reach to a value for \( K_{\text{TH}}(\text{exSi28}) \) close to the empirical \( K_{\text{EMP}}(\text{exSi28}) \).

\[
F_{\text{or} \Phi = 12}
\]

\[
K_{\text{TH}}(\text{exSi28}) = \left( \frac{\Phi}{6} \right) \times 1.37176. PwR(\text{exSi28}).R(\text{Si28}) / [PwR(\text{O15}).R(\text{O15})] \quad (8)
\]

The structure of exSi28,\( i=2 \) is seen in Figure 14 of the paper [1], here seen in the Figure 1.

\[
K_{\text{TH}}(\text{exSi28}) = 2 \times 1.37176x0,005782x3,7957 / (0,03108x3,0828) \quad (9)
\]

\[
K_{\text{TH}}(\text{exSi28}) = 0,6284556 \quad (10)
\]

As \( K_{\text{EMP}}(\text{exSi28}) = 0,64144 \), the difference is \( \Delta = 0,013 \), and so \( K_{\text{TH}} \) and \( K_{\text{EMP}} \) are close for the excited Si28. However, in the Stone’s nuclear table the magnetic moments for oxygen-15 and excited silicon-28 are quoted with their margin of error, as follows:

\[
\iota(O15) = 0,71951(12) \quad (11)
\]

\[
\mu(\text{exSi28}) = +1,1(2) \quad (12)
\]

In Figure 3 are calculated again the values for \( K_{\text{TH}}(\text{exSi28}) \) and \( K_{\text{EMP}}(\text{exSi28}) \), shown in the cells P7 and P8, with the following values:
Figure 3: Conversions: $K_{EMP}(O15)\Rightarrow K_{TH}(exSi28)$ and $K_{EMP}(O15)\Rightarrow K_{TH}(Si27)$

<table>
<thead>
<tr>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C(p)=</td>
<td>3,798757</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>C(n)=</td>
<td>2,60207</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>C(d)=</td>
<td>1,166265</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$\mu[p]=$</td>
<td>2,792847</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$\mu[n]=$</td>
<td>1,9130427</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>$\mu[d]=$</td>
<td>0,8574382</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3,082765093</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0,031078965</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>$K(O15)=2K(O15)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1,371761193</td>
<td>2,743522</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1,371823195</td>
<td>2,743646</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results are the following:

\[ \mu(O15) = 0,71963 \] (13)
\[ \mu(exSi28) = +1,08 \] (14)

The difference is shown in the cell P9: it fell to $\Delta = 0,0013$. As seen in the Figure 3, the conversion $K_{EMP}(O15)\Rightarrow K_{TH}(Si27)$ also achieves good results.

First of all, note that there is no any mathematical connection between 2x1,37176 and the experimental value $\mu(exSi28)=0,62978$ (considering the error in nuclear tables). And as from the equation 7 a theoretical value $K_{TH}(exSi28)=0,62847$ was obtained, that means that the success of the equation 7 implies in the existence of a physical connection between $K_{EMP}(O15)=1,37176$ and $K_{EMP}(exSi28)=0,62978$, and such physical connection lies on the identity existing between the theoretical structure formed by hexagonal floors and the real structure of atomic nuclei existing in the nature.

Calcium and oxygen isotopes have very close nuclear magnetic properties because:

1. In calcium isotopes the first floor has rotation $R=+2$, and the second floor has $R=-2$, and so they cancel each other their contribution for the $PWR(Ca)$ in the calcium isotopes, in order that they do not influence in the magnetic properties of the calcium.

2. As the calcium and oxygen isotopes have only one magnet (as shown in the Figure 2), that’s why the induction factors K(O) and K(Ca) own very close nuclear magnetic behavior.

3. With the growth of the radius $R(Ca)$, there is a tendency of growth of the magnetic moments $\mu(Ca)$ of the calcium isotopes, regarding the oxygen isotopes. However, as the growth of $R(Ca)$ also imply in the growth of the inertia momentum (and by consequence in the reduction of the power-rotation of calcium isotopes), then the growth of the two phenomena cancel each other their effects, and calcium and oxygen isotopes keep the tendency of having magnetic nuclear properties very close.
2. Conversion $K_{EMP}(O15)\rightarrow K_{TH}(Si27)$

The structure of Si27 is seen in the Figure 4. Instead of repeating here the equations for the conversion $K_{EMP}(O15)\rightarrow K_{TH}(Si27)$, we will exhibit here the equations from which were obtained the results exhibited in the Figure 3, used for the conversions for exSi28 and Si27.

The equations are shown in the Figure 7. In the Stone’s nuclear table, the magnetic moment for Si27 is quoted as $(-)0.8554(4)$, that’s why in the cell S7 it is typed the value 0,855.

**Figure 4:** Silicon-27, seen in the Figure 15 of the paper [1]
3. Conversions $K_{\text{EMP}}^{\text{O15}} \Rightarrow K_{\text{Tl}}^{\text{Si29}}, K_{\text{EMP}}^{\text{O15}} \Rightarrow K_{\text{Tl}}^{\text{exSi30}}, \text{and} K_{\text{EMP}}^{\text{O15}} \Rightarrow K_{\text{Tl}}^{\text{Si33}}$

The structures of silicon-29, excited silicon-30, and silicon-33, are seen respectively in the Figure 6, Figure 9, and Figure 10. Their PwR are calculated in the cells P.2, S.2, and V.2 of the Figure 7, where the three conversions are calculated. The equations are exhibited in the Figure 8. It is seen that values of $K_{\text{Tl}}^{\text{Si}}$ are close to $K_{\text{EMP}}^{\text{Si}}$.

Figure 6: Si29, seen in the Figure 16 of the paper [1]
Figure 8: Equations used for the Calculation of the Conversions Calculated in the Figure 7. It is Well to Remember that, as Si29 and exSi30 have Negative Rotation, the Sign of their $\mu(Si29)=-0.55529$ and $\mu(exSi30)=0.8$ are Changed for the Calculation of their Respective $K_{\text{EMP}}$, seen in the Cells P4 and S4.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Cr</th>
<th>Si</th>
<th>exSi30, i=2</th>
<th>Si33</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C(p)=3.798757</td>
<td>Si29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>C(n)=2.60207</td>
<td>O2/(29<em>P3</em>P2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>C(d)=1.166265</td>
<td>1.25<em>29</em>(1/3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$\mu$(S)=0.2792847</td>
<td>(0.55529-05)/(1-05)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$\mu$(R)=1.9130427</td>
<td>010<em>P2</em>P3/(N7^N8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>$\mu$(d)=0.8574382</td>
<td>P4-P5</td>
<td>S5-S4</td>
<td>V5-V4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>$\mu$(x)=3.082765</td>
<td>R(O1S5)</td>
<td>(0.55532-05)/(1-05)</td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>$\mu$(O)=0.310799</td>
<td>=PwK(O1S5)</td>
<td>011<em>P2</em>P3/(N7^-N8)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>K(O1S5)=1.371761</td>
<td>2K(O1S5)</td>
<td>P7-P8</td>
<td>S8-S7</td>
<td>V8-V7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>$\mu$(Si29)=-0.55529+P2</td>
<td>P3-P5</td>
<td>03-P8</td>
<td>O5-V5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>$\mu$(Si30)=1.171823</td>
<td>2K(O1S5)</td>
<td>2.743522</td>
<td>0.84510</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 9: Ex. Si30, i=2, seen in Figure 17 of paper [1]

Figure 10: Si33, seen in Figure 18 of paper [1]
4. Conversion $K_{EMP}(O15) \rightarrow K_{TH}(exFe53, i=3/2)$

Excited iron-53, spin 3/2, is shown in Figure 11, from which is calculated its $PwR(exFe53,i=2)$, seen in the cell P2 of the Figure 12. It has negative rotation, and therefore where the calculus gets “+”, it must be read as “-”.

**Figure 11:** Excited Iron-53, $i=3/2$, $\mu = -0.386(15)$, $Q(b)$ not Quoted. Note that $exFe53$ has Negative Rotation, that’s why the Calculus gives $\mu = +0.386$ in the Figure 12, and $K_{emp}(exFe53) = (+0.386 - 1.913)/(-1.913)$

**Figure 12:** Conversion $K_{EMP}(O15) \rightarrow K_{TH}(exFe53)$

<table>
<thead>
<tr>
<th>( # )</th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C(p)</td>
<td>3.798757</td>
<td>exFe53, ( i=3/2 )</td>
<td>exFe53, ( i=3/2 )</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>C(n)</td>
<td>2.60207</td>
<td>0.00519437 = $PwR(Fe53)$</td>
<td>0.00519437</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>C(d)</td>
<td>1.166265</td>
<td>4.69535719 = $R(Fe53)$</td>
<td>4.69535719</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>$\mu(p)$</td>
<td>2.792847</td>
<td>0.63370836 = $K_{emp}(Fe53)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>$\mu(n)$</td>
<td>1.9130427</td>
<td>0.69839827 = $K_{emp}(Fe53)$</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>$\mu(d)$</td>
<td>0.8574382</td>
<td>0.06468991 = $\Delta$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3.082765</td>
<td>$R(O15)$</td>
<td>0.63756732 = $K_{emp}(Fe53)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>0.031079</td>
<td>$PwR(O15)$</td>
<td>0.69842984 = $K_{emp}(Fe53)$</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>9</td>
<td>$K(O15)$</td>
<td>0.058086252</td>
<td>$\Delta$</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>1.371761</td>
<td>2.738352</td>
<td>0.620804292</td>
<td>$\mu(Fe53)$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1.371829</td>
<td>2.7343646</td>
<td>0.220804292</td>
<td>$\Delta$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The magnetic moment measured in the experiments is \( \mu(\text{exFe}53,i=2) = -0.386 \text{ } \mu\text{N} \). The calculus of the empirical \( K_{\text{EMP}}(\text{exFe}53,i=2) \), with the value -0.386\( \mu\text{N} \), is made in the column “P”. The conversion was successful only partially, because:

- In the cells P4 and P5 it is seen that \( K_{\text{TH}}(\text{exFe}53) \) is not close to \( K_{\text{EMP}}(\text{exFe}53) \).
- In the cell P10 the theoretical \( \mu(\text{exFe}53)=0.62 \text{ } \mu\text{N} \) is not close to the experimental 0.386 \( \mu\text{N} \).

The reason of the poor accuracy probably must be credited to a margin of error larger than that quoted in the Stone’s nuclear table, where it is quoted as -0.386(15).

In the column “S” it is calculated the \( K_{\text{EMP}}(\text{exFe}53) \) by supposing that, instead of -0.386\( \mu\text{N} \), the experimental value must be in the vicinity of -0.60 \( \mu\text{N} \). It is seen in the cells S7 and S8 that \( K_{\text{TH}}(\text{exFe}53) \) and \( K_{\text{EMP}}(\text{exFe}53) \) are very close, and the value of \( \mu(\text{exFe}53) \) in the cell S10 is 0.6208, very close to the value 0.60 adopted for the calculation of \( K_{\text{EMP}}(\text{exFe}53) \).

**Figure 13:** Equations used for the Calculation of the Conversions Calculated in the Figure 12

5. Conversion \( K_{\text{EMP}}(O15) \Rightarrow K_{\text{TH}}(\text{exFe}54, i=2) \)

Excited Fe54 is seen in Figure 14.

**Figure 14:** Excited iron-54, \( i=2, \mu=+3.4(8) \), Q(b) not Quoted. As exFe53 has Negative Rotation, the Calculus gives a Negative \( \mu=-3.36 \), in Figure 15. And for Calculation of the Empirical Induction Factor it’s used the Negative Value “-3, 36”. 
As seen in Figure 14 excited Fe54 with spin 2 has negative rotation, and so where the calculus gets “+”, there is need to read “−”. The conversion is plenty successful. The value quoted in Stone’s nuclear table is +3,4 (8). As seen in the cell P7 of the Figure 16, using the value -3,366 for the calculation of the $K_{EMP}$(Fe54), the difference between $K_{TH}$ and $K_{EMP}$ is $Δ = 0,0064904$, seen in the cell P9 of the Figure 15 (the value -3,366 is negative because exFe54 has negative rotation). The difference between the value -3,366, used for the calculation of the $K_{EMP}$(Fe54), and the magnetic moment calculated from $K_{TH}$(Fe54), is $Δ = -0,01113$, seen in the cell P11 of the Figure 15.

**Figure 15:** Conversion $K_{EMP}$(O15)$\Rightarrow$ $K_{TH}$(exFe54)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C(p)=</td>
<td>3,798757</td>
<td>exFe54, i=2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>C(n)=</td>
<td>2,60207</td>
<td>=PWR</td>
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<tr>
<td>3</td>
<td>C(d)=</td>
<td>1,166265</td>
<td>0,00193501</td>
<td>=R</td>
</tr>
<tr>
<td>4</td>
<td>$μ$(p)=</td>
<td>2,792847</td>
<td>4,72470394</td>
<td>=KEMP</td>
</tr>
<tr>
<td>5</td>
<td>$μ$(n)=</td>
<td>1,9130427</td>
<td>0,26179438</td>
<td>=KTH</td>
</tr>
<tr>
<td>6</td>
<td>$μ$(d)=</td>
<td>0,8574382</td>
<td>0,01333019</td>
<td>=Δ</td>
</tr>
<tr>
<td>7</td>
<td>3,082765</td>
<td>=R(O15)</td>
<td>0,2682907</td>
<td>=KEMP</td>
</tr>
<tr>
<td>8</td>
<td>0,031079</td>
<td>=PWR(O15)</td>
<td>0,2618003</td>
<td>=KTH</td>
</tr>
<tr>
<td>9</td>
<td>$K$(O15)</td>
<td>2.$K$(O15)</td>
<td>-0,0064904</td>
<td>=Δ</td>
</tr>
<tr>
<td>10</td>
<td>1,371761</td>
<td>2,743522</td>
<td>-3,366+2<em>O5)/(0</em>O5+2*O6)</td>
<td>=μ(exFe54)</td>
</tr>
<tr>
<td>11</td>
<td>1,371792</td>
<td>2,743584</td>
<td>-0,011130231</td>
<td>=Δ</td>
</tr>
</tbody>
</table>

**Figure 16:** Equations used for the Calculation of the Conversions Calculated in Figure 15

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C(p)=</td>
<td>3,798757</td>
<td>exFe54, i=2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>C(n)=</td>
<td>2,60207</td>
<td>2<em>O3/(54</em>P3^2)</td>
<td>=PWR</td>
</tr>
<tr>
<td>3</td>
<td>C(d)=</td>
<td>1,166265</td>
<td>1,25*54^4(1/3)</td>
<td>=R</td>
</tr>
<tr>
<td>4</td>
<td>$μ$(p)=</td>
<td>2,792847</td>
<td>(-3,4+2<em>O5)/(0</em>O5+2*O6)</td>
<td>=KEMP</td>
</tr>
<tr>
<td>5</td>
<td>$μ$(n)=</td>
<td>1,9130427</td>
<td>O10<em>P3</em>P2/(N8*N7)</td>
<td>=KTH</td>
</tr>
<tr>
<td>6</td>
<td>$μ$(d)=</td>
<td>0,8574382</td>
<td>P5-P4</td>
<td>=Δ</td>
</tr>
<tr>
<td>7</td>
<td>3,082765</td>
<td>=R(O15)</td>
<td>(-3,366+2<em>O5)/(0</em>O5+2*O6)</td>
<td>=KEMP</td>
</tr>
<tr>
<td>8</td>
<td>0,031079</td>
<td>=PWR(O15)</td>
<td>O11<em>P3</em>P2/(N8*N7)</td>
<td>=KTH</td>
</tr>
<tr>
<td>9</td>
<td>$K$(O15)</td>
<td>2.$K$(O15)</td>
<td>P8-P7</td>
<td>=Δ</td>
</tr>
<tr>
<td>10</td>
<td>1,371761</td>
<td>2,743522</td>
<td>-2<em>O5+P8</em>(0<em>O5+2</em>O6)</td>
<td>=μ(exFe54)</td>
</tr>
<tr>
<td>11</td>
<td>1,371792</td>
<td>2,743584</td>
<td>(3,366+P10)</td>
<td>=Δ</td>
</tr>
</tbody>
</table>
6. Conversion $K_{EMP}(O15)=K_{TH}(exFe55, i=2.5)$

Figure 17 shows the structure of the excited Fe55 with spin 5/2, whose magnetic moment is $\mu = +2.7(12)$. The first floor has rotation $R=+2$, the second floor has $R=0$, and the contribution of deuterons in the third floor is $R= -4$, in order that the total rotation due to deuterons in $exFe55, i=2.5$ is $R= -2$. The rotation of the neutrons of the third floor is $R= +1$, and therefore $exFe55, i=2/5$ has positive rotation, because $2.60207/(2\times1.16626)>1$

Figure 17: Excited iron-55, $i=2.5$, $\mu= +2.7(12)$, Q(b) not quoted
Figure 18 shows the results of the calculations, and Figure 19 shows the equations. Note that, instead of considering $\mu = +2.7$, if we consider, inasmuch the error is (12), the calculation gives values very close for $K_{\text{EMF}}$ and $K_{\text{TH}}$ (seen in the cells P7 and P8 of the Figure 18), with a difference $\Delta = 0.005088$ between them (seen in the cell P9), and a difference $\Delta = 0.00377\mu N$ for the magnetic moment (seen in the cell P11).

Figure 18: Conversion $K_{\text{EMF}}(O15)\Rightarrow K_{\text{TH}}(\text{exFe55},i=5/2)$

Figure 19: Equations used for the Calculation of the Conversions Calculated in the Figure 18

7. Strong Evidences Invalidate the Hypothesis that Proton and Neutrons are Bound Via Strong Force Inside Atomic Nuclei

After 2009 the foundations of the SNP have been invalidated by several experimental findings, as shown in [2]. Nevertheless, even along the development of the Nuclear Theory, in the 20th Century, several evidences were pointing out to the nuclear theorists that they were wrong in their conjecture that protons and neutrons are bound via strong force inside the atomic nuclei. Ahead we mention three of them.

A) Proton-Neutron Puzzle

There is not Coulomb repulsion between a proton and a neutron. Then suppose that a number X of hydrogen atoms and the same X number of neutrons are stored into a bottle. As there is no repulsion between the neutrons and the protons of the hydrogen atoms, and as they interact via strong nuclear force (as the nuclear theorists believe) then after some time inside the bottle all the neutrons and the protons would have to fuse, and all the hydrogen atoms would
transmute to deuterium. If the foundations of the current SNP were correct that would be wonderful, because we would not have to waste a lot of money extracting deuterium from the molecules of heavy water in the sea.

B) Neutron–Neutron Puzzle

The same would have to occur when neutrons are stored inside bottles, as occurs for the neutrons used for the measurement of the neutron life time. As there is no repulsion between two neutrons, but they interact via strong force, then dineutrons would have to be formed. As already mentioned in prior papers, Heisenberg proposed to solve this puzzle with a mathematical solution, the isospin concept, as sometimes the theorists use to solve a puzzle impossible to be solved by the foundations of the current foundations of physics.

C) Gamow’s First Paradox

Rutherford discovered, from scattering experiments [4], that the red curve in the Figure 20 is according to Coulomb’s Law. And, regarding the dot line (between r’ and r’’),the physicists had supposed that the potential continued to be according to Coulomb’s Law. When a puzzle defies the principles of the current theories, there is need to adopt conjectures, as Gamow did, proposing a theory so that to explain how a particle $^\alpha$ with 4.2 MeV is able to leave out a nucleus crossing a barrier of 23 MeV. However, Gamow solved the puzzle but by introducing another puzzle, as explained in “Gamow’s Paradox”, at the page 130 of the book [5].

Figure 20: The V Potential Energy which Acts on a Particle $^\alpha$ at a distance “r” from the Center of a U238 Nucleus, and the Total Energy E of the Particle $^\alpha$ Emitted by this Radioactive Nucleus. A Particle $^\alpha$ Emitted with 4,2 MeV by the Radioactive Nucleus must Penetrate into the Potential Barrier from the Radius r’ up to the Point of a Distance r” from the Center, where its Potential Energy V becomes Weaker than the Total Energy E

D) Gamow’s Second Paradox

A Coulomb barrier preventing the alpha particle to leave the nucleus makes no sense, and the reason is simple. Suppose that protons and neutrons are bound inside nuclei via strong force. When the alpha particle is inside the U238, the Coulomb repulsion on it is 23 MeV, which is equilibrated by the strong nuclear force (as interpreted nowadays). Then what prevents the alpha particle from leaving the nucleus is the strong nuclear force, and not the Coulomb repulsion, because what the repulsion is doing is actually trying to expel the alpha particle from the core of the U238, and therefore the repulsion does not create a Coulomb barrier which prevents the alpha particle to leave the nucleus. Therefore, there no exist any Coulomb barrier preventing the alpha particle to leave the U238. The Coulomb barrier was a fable invented by Gamow, with the aim to explain a phenomenon impossible to be explained if we keep the hypothesis that the alpha particle is bound via strong force inside the U238. Then suppose that, for some reason (shown in page 86 of [5]), in some instant the Coulomb repulsion becomes stronger than the strong nuclear force, and the alpha particle leaves the core of the U238. So, being out of the core, there is no need any quantum tunneling, because there is not any barrier to be perforated, insasmuch the strong force has very short range of actuation, and outside the nucleus the alpha particle is submitted to Coulomb repulsion only. And in that position outside of the U238 core, where the potential energy is 23 MeV in the V(r) potential with r = 1fm, the particleis accelerated by converting potential energy to kinetic. And as its
potential energy was 23 MeV in the V(r) potential with \( r = 1 \text{fm} \), then when its potential energy ends (for \( r > 10^{-11} \text{fm} \)) its kinetic energy must be 23 MeV. The hypothesis of quantum tunneling does not explain why the particle arrives to the point \( r = 10^{-11} \text{fm} \) with 4.2 MeV. And therefore the alpha particle emission by U238 cannot be caused by the quantum tunneling. There is need to have other phenomenon responsible for the emission of alpha particles with 4.2 MeV.

A reasonable explanation for the physical cause of the quantum tunneling must be through the zitterbewegung (helical trajectory of the particle). The energy stored by the zbw can be used by the particle, so that to cross the barrier. But in the stellar nucleosynthesis the barrier to be crossed is thousands times stronger, and so it seems impossible to explain the nucleosynthesis by considering the quantum tunneling. But there is not other way to explain the stellar nucleosynthesis, from the current foundations of the SNR, and that’s why Gamow had not other choice than to propose the conjecture of quantum tunneling.

8. Influence of Electric Field Composed by Electricitons in Emission of Alpha Particle by U238

The basic mechanisms that rules the electric interactions through the New Coulomb’s Law was proposed in [3], shown here in the Figure 21. Ahead is explained how the motion of the particle influences the behavior of the electricitons which compose the electric field.

**Figure 21:** There are Four Types of Coulomb’s Interaction between Two Protons A and B, as Proposed in [3], from which, as shown ahead, Gamow’s Paradox can be solved without Introduction of any New Paradox.
As proposed in [3], the velocity of electricitons in the strings of the electric field of the elementary particles is the velocity c of light. For a distance \( d \geq 10^{-11} \text{ m} \), the interaction between two particles occur through the old Coulomb’s Law, because the volume of the weak electric interactions in the Figure 20 is despicable face to volume of strong electric interactions. Ahead is proposed the parameter \( \Delta(sw) \), which relates the energy interaction between electricitons of the electric fields of two particles, when the distance between them \( d \leq 10^{-11} \text{ m} \) as follows.

**a) Two Particles at Rest**
For two particles A and B at rest, the intensity of interaction between electricitons of the strings \( A_{\text{RIGHT}} \) and \( B_{\text{LEFT}} \), seen in Figure 21, given by the parameter \( \Delta(ws) \), is:

\[
\Delta(sw) = c^{(\frac{1}{2} - \frac{d}{\Phi})}
\]

(17)
where
- \( c \) is the speed of light
- \( 10^{-15} < d < 10^{-11} \), \( d \) is the distance between the particles
- \( \Phi = 10^{-11} \)

\[
\Delta(sw) = c^{(\frac{1}{2} - \frac{d}{\Phi})}
\]

(17.1)
where
- \( 10^{-16} < d \leq 10^{-15} \)
- \( \Phi = 10^{-11} \)
- \( \Psi=1-a \), where:
  - \( a=0.1 \) for \( d=0.9 \times 10^{-15} \); \( a=0.2 \) for \( d=0.8 \times 10^{-15} \); \( ...a=0.9 \) for \( d=0.1 \times 10^{-15} \)

**b) One Particle Moving with Speed V toward Other Particle at Rest**
For a particle A moving with velocity \( V \) toward a particle B at rest, as occurs for the alpha particle emitted by Po212 interacting with the U238, the intensity of interaction between electricitons of the strings \( A_{\text{RIGHT}} \) and \( B_{\text{LEFT}} \), given by the parameter \( \Delta(ws) \), is

\[
\Delta(sw) = [(c + \frac{Q}{e})V]^2 [\frac{1}{2} - \frac{d}{\Phi}]
\]

(18)

\( Q \) is the charge of the particle, in Coulomb, and \( e=1.6 \times 10^{-19} \text{ C} \)

**c) One Particle Moving with Speed V Leaving a Nucleus**
For a particle leaving with velocity \( V \) a nucleus at rest, as occurs in the U238 beta-decay, the intensity of interaction between electricitons of the strings \( A_{\text{RIGHT}} \) and \( B_{\text{LEFT}} \), given by the parameter \( \Delta(ws) \), is:

\[
\Delta(sw) = [(c - \frac{Q}{e})V]^2 [\frac{1}{2} - \frac{d}{\Phi}]
\]

(19)

**d) Two Particles Moving with Speed V and v in Scattering Experiments**
For a proton A moving with velocity \( V \) toward a particle B with velocity \( v \) in scattering experiments, the intensity of interaction between electricitons of the strings \( A_{\text{RIGHT}} \) and \( B_{\text{LEFT}} \), given by the parameter \( \Delta(ws) \), is:

\[
\Delta(sw) = [(c + \frac{Q+q}{e})(V + v)]^2 [\frac{1}{2} - \frac{d}{\Phi}]
\]

(20)

\( Q \) and \( q \) are the charges of the particles, in Coulomb, and \( e=1.6 \times 10^{-19} \text{ C} \)
Rise of Cross-Section in Four Type of Scattering

Experimental data on proton-proton interactions in high energy collisions show quite a special and unexpected behavior of the share of elastic scattering compared to inelastic processes with increasing energy. It decreases at the beginning (at comparatively low energies) but then starts to increase. From Intersecting Storage Rings (ISR) energies of 20–60 GeV up to higher energies 7–13 TeV at the Large Hadron Collider (LHC) it increases by more than a factor 1,5 [6]. So, it seems something is wrong with the asymptotic freedom, and each day new surprises appear suggesting that the foundations of the current Modern Physics cannot be right. In 2005 Frank Wilczek published a paper in arXiv.org, saying about the asymptotic freedom: “It resolved these paradoxes, and catalyzed the development of several modern paradigms: the hard reality of quarks and gluons, the origin of mass from energy, the simplicity of the early universe, and the power of symmetry as a guide to physical law” [7]. But the LHC did not find anything about symmetry guiding the laws of physics.

In [8] is mentioned that according to Nassif’s Symmetric Special Relativity-SSR [9], the mass of the elementary particles is generated from the interaction of their electric charges with the structure of the aether filling the space. Then the origin of the mass of elementary particles probably is consequence of the mechanism involving the equations (17), (18), (19), and (20), and it is related to the velocity of electricitons in the strings that compose the electric fields of the elementary particles. And probably Einstein’s postulate on the growth of mass, \( m = m_0 \sqrt{1 - \frac{v^2}{c^2}} \), is also related to those equations. In a paper to be published soon, it is shown why the neutron and other neutral particles have mass, in spite of they have no electric charge.

Anomalies in Coulomb interactions were noted soon in the beginning of the development of Nuclear Physics. In the page 266 of [4] is written: “Also was known, from the scattering of alpha particles by nuclei of light atoms, that \( V(r) \) eventually is not proportional to \( 1/r \), when \( r < r' \), the nuclear radius”. As conclusion, this experimental finding reinforces the hypothesis that \( X \) (whose value is \( X=2 \) in the old Coulomb’s Law \( F = K q_1 q_2 / d^X \)) decreases drastically when “d” is shorter than 1,0fm.

Note: for an electron moving radially in the hydrogen atom, the value of \( X \) in the new Coulomb Law \( F = K q_1 q_2 / d^X \) depends on the direction of the motion (if toward the proton, or if moving far away the proton), and therefore the point where \( X \) begins to be less than 2 depends on the direction of the motion. So, \( X \) can get the value \( X=1 \) for \( 10^{-14} m < R < 10^{-11} m \), where \( R \) is the distance between the electron and the proton (and not only because the direction of the motion changes, but also because the density of the aether in the atom changes with the radius, \( \rho = \rho_0 \cdot (d-R)^2 \), where “d” is the distance between the proton and the place where the isotropic aether begins, as proposed in [3]).

9. Solution for the Gamow’s First Paradox, in Alpha Decay of U238

Let us compare Rutherford’s experiment with the alpha decay in U238.

a) Rutherford Scattering Experiment

Alpha particles with 8,8 MeV move with 2,91x10^7 m/s, when exit Po212.

Rutherford discovered from his experiment that up to the distance \( d=3x10^{-14}m \) the interaction of the alpha particle with the nucleus U238 was according to Coulomb’s law, and for his calculation obviously he did not consider the velocity of the alpha particle regarding the nucleus U238, because in the current theories the Coulomb’s law does not take in consideration the velocity of the particles.

From the equation (17), the \( \Delta(sw) \) factor, in the distance 3x10^{-14}m, is

\[
\Delta(sw) = c^{1+\frac{d}{\varphi}} = [3\times10^{-8}]^{1+\left\lfloor \frac{10^{11}}{10^{14}} \right\rfloor} = 9\times10^{16}
\]

This result is seen in the cell B3 of the calculus made by Excel, in the Figure 22, and the obtained value \( 9\times10^{16} \) concerns to the new Coulomb law. In the cell E3 it is seen that the distance considered is \( d = 1\times10^{-11}m \) (and
not \( d = 3 \times 10^{-14} \text{m} \), which was considered by Rutherford in his calculations. Actually eq. (17) cannot be applied, to be compared with the Rutherford calculus, because he used the old Coulomb law, and equation (17) is referred to the new law.

The correct equation to be compared to his calculus is the eq. (22), where it is considered the same \( d = 3 \times 10^{-14} \text{m} \) used by Rutherford.

\[
\Delta (sw) = c \left[ 1 + \frac{d}{\Phi} \right] \left[ \left( \frac{3 \times 10^8}{1} \right)^2 \right] = 1,012 \times 10^{17}
\]

In eq. (22) the distance \( d=3 \times 10^{-14} \text{m} \) is seen in the cell E9 of Figure 22.

**Figure 22:** Rutherford Scattering Experiment and Alpha Particle Emission by U238 both Interpreted from the New Coulomb Law

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C9^((1+(E3/D3)))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>NEW COULOMB LAW</td>
<td>( \Delta (sw) )</td>
<td>c</td>
<td>( \Phi )</td>
<td>d</td>
<td>V</td>
</tr>
<tr>
<td>3</td>
<td>particles at rest</td>
<td>9E+16</td>
<td>3E+08</td>
<td>1E-11</td>
<td>1E-11</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>one particle moving toward target</td>
<td>1,444E+17</td>
<td>3E+08</td>
<td>1E-11</td>
<td>3E-14</td>
<td>2E+07</td>
</tr>
<tr>
<td>5</td>
<td>one particle leaving a nucleus</td>
<td>7,593E+16</td>
<td>3E+08</td>
<td>1E-11</td>
<td>3E-14</td>
<td>2E+07</td>
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<tr>
<td>6</td>
<td>scattering experiments</td>
<td>7,61E+17</td>
<td>3E+08</td>
<td>1E-11</td>
<td>3E-14</td>
<td>2E+08</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>OLD COULOMB LAW used by Rutherford</td>
<td>1,012E+17</td>
<td>3E+08</td>
<td>1E-11</td>
<td>3E-14</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>particles at rest</td>
<td></td>
<td>1E-11</td>
<td>3E-14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In the Rutherford experiment we have to calculate the value of the \( \Delta (sw) \) factor from the equation (18), and to compare it with the result of equation (22), as follows. For the alpha particle, \( Q= 2.e \), and then:

\[
\Delta (sw) = \left[ c + \left( \frac{Q}{e} \right) \right]^2 \left[ \frac{d}{\Phi} \right]^2 = \left[ \frac{3 \times 10^8 + 2 \times 2,91 \times 10^7}{1 \times 10^{-14}} \right]^2 = 1,44 \times 10^{17}
\]

As seen, the value \( 1,44 \times 10^{17} \) is close to \( 1,012 \times 10^{17} \), justifying the Rutherford interpretation that the alpha particle emitted by the Po212 followed the Coulomb’s law up to the distance \( d = 3 \times 10^{-14} \text{m} \) in the scattering with the U238.

According to equation (18), the curve for the Rutherford experiment is shown in the Figure 23.

**Figure 23:** Repulsion between U238 and Alpha Particle emitted by Po212, in Rutherford Experiment, According to the New Coulomb Law
b) U238 Alpha Decay

Alpha particles with 4.2MeV move with \(2 \times 10^7 \text{ m/s}\).

We will use the equation (19) with the aim to discover what was the interaction between the particle alpha and the potential \(V(r)\) in the distance \(d = 3 \times 10^{-14} \text{ m}\), because once at that point, the particle should exit U238 with the potential energy in that point.

\[
\Delta(sw) = \left(\frac{Q}{e}\right) \delta \cdot \left(\frac{d}{\Phi}\right) = \left(\frac{3 \times 10^8 \times 2 \times 10^{-7}}{7.59 \times 10^{16}}\right) = 7.59 \times 10^{16}
\]

\(\text{(24)}\)

c) Comparison of the Potentials \(V(r)\) in Rutherford Experiment and in U238 Alpha Decay

From equation (23) and (24), the ratio between the two \(\Delta(sw)\) factors is:

\[
\frac{\Delta(sw)_{RUT}}{\Delta(sw)_{U238}} = \frac{1.44 \times 10^{17}}{7.59 \times 10^{16}} = 1.902
\]

\(\text{(25)}\)

As the potential energy \(E_{RUT}\) in the distance \(d = 3 \times 10^{-14} \text{ m}\) is 8.8MeV, then the potential energy \(E(sw)_{U238}\) in the alpha decay is:

\[
E_{U238} = \frac{8.8}{1.902} = 4.63 \text{MeV}
\]

very close to 4.2MeV to the kinetic energy of the alpha particle leaving the U238, measured by experiments. As the alpha particle is accelerated by the potential energy, possibly the difference between 4.63 and 4.2 MeV is due to the irradiation of energy by the accelerated motion.

Well… finally we know (without the need of to suppose speculations which do not survive to an accurate analysis) why the alpha particle leaves the U238 with 4.2 MeV, because the potential energy crossed by a particle leaving the U238 is 4.2 MeV, whereas it is 8.8 MeV for the particle going toward the U238.

10) Why a Deuteron is not Formed Spontaneously from Proton-Neutron Fusion?

And why a dineutron is not formed from the fusion of two neutrons?

The physical causes are proposed ahead.

The electric field of a proton is shown in the Figure 24. Electric strings are induced only by electricitons whose spin vector is orthogonal to the vector \(\vec{\omega}\) (which is coincident with the z-axis). Therefore, the shape of the proton electric field remembers the Saturn ring. The n(o)-flux composed by gravitons g(+), of the principal Sp(p) field, attracts positive electricitons e(+), which form a cloud around the flux of gravitons g(+).

In the case of a nucleus, the structure is the same, being the n(o)-flux composed by gravitons g(+) generated by the central \(^3\text{He}^+\). And in the case of the electron, the structure is the similar, with the n(o)-flux composed by gravitons g(-), of the principal Sp(e) field, attracting electricitons e(-).

Figure 25 shows two shapes of the proton electric field (and also of the electron, or the atomic nuclei).

Special Saturn Ring Condition

In Figure 25(A) it is shown that the shape of Saturn ring of the proton electric strings occurs when the magnetic field of the proton is aligned toward the direction of an external magnetic field B, and the z-axis is always pointing out to the direction of the vector \(\vec{B}\).

Ordinary Spherical Condition

In Figure 25(B) it is shown the shape of the proton electric field when its magnetic moment is not aligned with an external magnetic field. Inside the structure of the proton, there is repulsion between the up quarks, and therefore
Figure 24: Electric Strings of the Proton Electric Field. The Electricitons A, B, C, D, E, F, and H do not Induce Electric Strings, because in their Rotation around the z-axis their Vector Spins are not Orthogonal to the Vector $\boldsymbol{\omega}$. Electricitons 1, 2, 3, 4, 5, and 6 induce electric strings, because their vector spins are orthogonal to $\boldsymbol{\omega}$.

Figure 25: In (A), the Z-axis of the Principal Field $Sp(p)$ of a Proton is Aligned toward the Direction of an External Magnetic Field $B$, and the Strings that Compose the Electric Secondary $Sn(p)$ Field take the Shape of Rings, as those of Saturn. In (B), the Principal Field $Sp(p)$ Gyrates Chaotically, and the Secondary Electric Field $Sn(p)$ is Induced having a Spherical Shape.
they oscillate toward the z-axis direction. Such oscillation causes a chaotic rotation, with z-axis pointing out randomly to all directions. Because of the chaotic rotation, the “Saturn rings” of the proton take a shape a spherical electric field around the proton. This is seen in the Figure 25(B). The same occurs with the electric field of the electron, the deuteron, the neutron, and atomic nuclei. As will be seen in Chapter 11, the electric field induced randomly is not perfectly spherical.

If two protons A and B are under very strong pressure, and the principal Sp(p)A field of A penetrates into the secondary Sn(p)B field of B, so that their principal fields Sp(p)A and Sp(p)B touch one each other, the repulsion between the positive electricitons e(+) which surrounds the n(o)-flux in each of them prevents the fusion of the two protons. An additional energy is required for the fusion.

Proton-Neutron Puzzle

There is no repulsion Coulomb between them, and therefore there is overlap between their secondary Sn(p) and Sn(n) electric fields. However, energy is required so that to perforate the principal fields Sp(p) and Sp(n), in a way to put the two nucleons as shown in the Figure 26.

Figure 26: Proton-Neutron Interaction in the Deuteron and Neutron-Neutron Interaction in the Dineutron

In the deuteron the proton and the neutron take both them up spin, because the proton positive $\mu = +2.793$ has attraction with the negative $\mu = -1.913$ of the neutron, as seen in Figure 26.

There are three binding forces between the proton and the neutron. The first force is the magnetic attraction, which contributes partially to bind the proton and the neutron. The second force is due to the n(o)-flux. And the third force is due to the spin-interaction between the proton and the neutron. These three forces keep the proton and the neutron spinning together, chaotically, with spin 1.

Neutron-Neutron Puzzle

If in the dineutron the two neutrons would have parallel spins, there would be repulsion between the two negative magnetic fields due to their magnetic moments $\mu = -1.913$. Then due to the repulsion the two neutrons in the dineutron have contrary spins, as seen in the Figure 26.

As proposed in [8], the neutron is formed by proton+electron. The induction of the n(o)-flux formed by gravitons depends on the charge of the quarks. As the proton has two quarks with charge +2/3 and one quark with -1/3, then in the proton the percentage of gravitons g(+) is 80%, and gravitons g(-) is 20%. In the neutron the total charge (due to two quarks up, one quark down, and one electron) is zero, and therefore in the neutron the n(o)-flux is composed by 50% of gravitons g(+) and 50% of gravitons g(-). Therefore, in the structure of the dineutron, seen in Figure 26, there is not interaction between the two neutrons via n(o)-flux. In the dineutron also there is not spin-interaction between the two neutrons, because they have contrary spins.
There is only one force trying to bind the two neutrons, the force due to the magnetic attraction between the two magnetic poles due to $\mu = -1.913$ and $\mu = +1.913$. But it is a weak force, unable to keep the two neutrons spinning together chaotically. Each one of them has an independent chaotic spin, with each vector spin pointing out in a different direction for each instant of time. So the magnetic attraction exists in a fraction of second only, and dineutron decomposes in two neutrons.

The dineutron was unambiguously observed in 2012 in the decay of beryllium-16 [10, 11]. This experimental finding contradicts Heisenberg’s isospin, because as according to the current Nuclear Physics the neutrons have interaction via strong force, then the dineutron had to be a strongly bound particle existing in the nature. The fact that two neutrons do not form a stable dineutron is one among the stronger evidences testifying against the hypothesis of the strong nuclear force. The attempt to solve this puzzle through the isospin concept is a big fallacy that Heisenberg had been forced to propose, because the wrong assumption that protons and neutrons are bound via strong force inside atomic nuclei introduced several paradoxes impossible to be solved with acceptable and reasonable solutions. Then, for Heisenberg, there was no other alternative but to adopt a nonsensical solution.

11. Nuclear Fusion in the Stars

The temperature in the Sun’s nucleus is about 15 million K, and for more massive stars in the order of 500 million K. The average energy of the interacting particles, from 1.2 to 43 keV, is at least a thousand times smaller than the Coulomb barrier. According to Gamow, the reactions occur by the effect of quantum tunneling.

As calculated in the eq. (40), in the Sun a proton A collides with $1.55 \times 10^6$ protons by second. But in 99.99999995% of collisions the proton A does not succeed to fuse with the other proton, because their Z-axes are not aligned, as explained ahead. The electric field of particles, induced by their chaotic rotation, is not spherical. It has the shape of an apple. In the two poles where the Z-axis touches the electric field, in those two points there are “failures” in the shield of the field (like the two depressions in the apple). These two “holes” introduce a fragility in the electric field, when a special condition occurs: two particles, moving in contrary directions, with their Z-axes perfectly aligned, are able to perforate the electric field, and they fuse. Figure 27 shows the instant when they are in the eminency of fusion (their two “apple” electric fields are not shown in Figure 27). The tolerance of misalignment is minimum. This vulnerability, caused by the shape of apple, enables two protons to fuse, with energy in the range of KeV.

Figure 27: Hot Fusion Occurs when in the Instant of Collision the Two Protons are moving in Contrary Direction along the Same Rectilinear Line, with their Z-axes Perfectly Aligned
Fundamental equations for the calculation of the probability for two protons A and B, separated by a distance $d < 1 \text{ fm}$, moving in contrary directions along the same rectilinear line, to collide having their Z-axis aligned with a maximum difference of one degree in the alignment.

From Figure 28

\begin{align*}
r &= \sin^{10} x R_p = 0.017 \times 1.0 \text{ fm} = 0.017 \text{ fm} \quad (27) \\
S &= \pi x^2 = 3.14 \times 0.017^2 = 0.0009 \text{ fm}^2 \quad (28) \\
S_p &= 4\pi R^2 = 4\pi \times (1.0 \text{ fm})^2 = 12.56 \text{ fm}^2 \quad (29)
\end{align*}

**Figure 28:** Two protons moving along a rectilinear line coincident with their Z-axis, with a maximum misalignment $\alpha = 1^\circ$

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a) Calculation of the quantity of protons inside a disk with the diameter of the Sun and thickness 1,0 fm

Mass of the Sun = $2 \times 10^{30} \text{ kg}$

Mass of the proton = $1.7 \times 10^{-27} \text{ kg}$

Quantity $Q(pS)$ of protons in the Sun

\begin{align*}
Q(pS) &= \frac{2 \times 10^{30}}{1.7 \times 10^{-27}} = 1.18 \times 10^{57} \\
\text{Radius of the Sun} &= 7 \times 10^8 \text{ m}
\end{align*}

Volume $V_s$ of the Sun

\begin{align*}
V_s &= \left(\frac{4\pi}{3}\right) R^3 = 1.44 \times 10^{27} \text{ m}^3 \quad (31)
\end{align*}

Volume $V_D$ of the disk in Figure 28.

\begin{align*}
V_D &= \pi R^2 \cdot 10^{-15} \text{ m} = 3.14 \times (7 \times 10^8)^2 \times 10^{-15} = 1538.6 \text{ m}^3 \quad (32)
\end{align*}
Quantity $Q(pd)$ of protons inside the disk.

$$Q(pd) = \frac{1.18 \times 10^{57} \times 1538.6}{1.44 \times 10^{57}} = 1.26 \times 10^{33} \quad (33)$$

The area of the disk is

$$A(d) = \pi R^2 = 3.14 \times (7 \times 10^8)^2 = 1.5 \times 10^{18} \text{ m}^2 \quad (34)$$

The quantity of protons by square meter in the disk is

$$Q\left(\frac{p}{m^2}\right) = \frac{Q(pd)}{A(d)} = \frac{1.26 \times 10^{33}}{1.5 \times 10^{18}} = 8.4 \times 10^{14} \quad (35)$$

b) Velocity of protons in the Sun

Let us consider that the protons move with energy $10,2 \text{ KeV}$. As they do not move with relativistic speed, then their velocity we get from equation (36).

$$10,2 \times 10^3 \text{ MeV} = 0.5 \times \left[\frac{938.3 \text{ MeV}}{3 \times 10^8}\right] V^2 \quad (36)$$

$$V = 14 \times 10^5 \text{ m/s} \quad (37)$$

c) Calculation of collisions by second

The quantity of protons $Q\left(\frac{p}{m^2}\right) = 8.4 \times 10^{14}$ is distributed in a square, and therefore the quantity of protons $Q(p/row)$ in row in the area of one square meter of the disk of Figure 29 is

$$Q\left(\frac{p}{\text{row}}\right) = \frac{\sqrt{8.4 \times 10^{14}}}{2} = 2.9 \times 10^7 \quad (38)$$

Consider one proton A of the quantity $Q(p/row)$ of protons in each row. Consider the Figure 28, where the angle $\alpha = 1^\circ$ was considered satisfactory, in order to put the two protons with their Z-axis aligned satisfactorily for the fusion, when they were close one each other. But for a proton B with a distance of 1.0 from the proton A in the row, the angle $\alpha = 1^\circ$ is not satisfactory. The more far away the proton B is, more acute must be the angle $\alpha$.

In the Figure 28, for a proton B touching the proton A, the total quantity of small areas S distributed along the big surface $Sp$ is $Sp/S$. Then the total of directions that each proton can take is $2xSp/S$ (the number 2 because each proton can take two contrary directions). Then if all protons in the row were also touching the proton A, the quantity of protons which take the same direction of the proton A (with them moving in contrary directions), but not with their Z-axis aligned, is

$$Q(pp) = \frac{2.9 \times 10^7}{2 \times 12.56} = 1039 \quad (39)$$

But for a proton B with distance 1m from the proton A, the size of the area S must be $S \times 10^{-15}$. For a proton C with a distance 1m/15 from the proton A, the size of the area S must be $S \times 1^{-1}$, and for a proton D, with a distance 2m/15

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**Figure 29:** Disk with 1.0fm Thickness in the Sun

![Disk with 1.0fm thickness](image)
from the proton A, the size of the area S must be $S \times 10^{-2}$, and so on. As the proton A moves with $V = 14 \times 10^5 \text{ m/s}$, by second the number of collisions is

$$Q\left(\frac{PP}{s}\right) = \left(1 + 10^{-1} + 10^{-2} + \ldots + 10^{-15}\right) \times 14 \times 10^5 = 1.55 \times 10^6 \quad (40), \quad \text{collisions by sec – row}$$

d) Introducing the probability of collision for one proton, without considering that their Z-axes are aligned.

The value obtained in equation (40) would be the number of collisions that one proton A has chance to get, by second, along a row with length 1m, if the problems of the proton A had been finished. But the problems did not finish. As the length of the row in eq. (38) is 1m, we realize that the distance between the proton A and B in the Figure 30 is $d = 1/2, 9 \times 10^7 = 3,4 \times 10^{-8} \text{m}$.

Note: in the Figure 30, the protons in the corners of the imaginary hexagons do not belong to the row where A and B are aligned, but as each one of those twelve protons can have any direction of motion, all of them have the chance to hit the proton A, or proton B, before the proton A succeed to collide with B, and therefore each of the twelve protons is able to frustrate the fusion of protons A and B.

**Figure 30:** The Hexagons are Imaginary, and were used only for Helping to the Reader to get a Better Notion of Perspective. When the Proton A (red) and B (green) are in a Distance 3.4x10^{-8}m, the Black Proton in Figure 30(A) is able to Hit the Proton A before it has Chance to Collide with B. The Same Chance has all the Other 11 Yellow Protons. In Figure 30(B), the black Proton has Chance to Hit the Protons A and B in the Instant when they will Collide, and so the Black Proton is able to Disrupt the Alignment of their Z-axis (if they have it), Frustrating the Chance of a Fusion between Proton A and B.
needs to travel the hypotenuse, whereas A and B have to travel a leg, the black proton is able to frustrate the collision A-B. And then the chance of A and B to collide decreases by 1/36 again, and thereby their total chance in the dispute with the twelve protons is

\[ P(A - B) = \frac{1}{36^2} = 7.7 \times 10^{-4} \quad (41) \]

e) Introducing the probability for the alignment of the two Z-axes

The protons A and B have to overcome this additional problem. Their fusion is possible only if the proton A is aligned with the other proton as shown in the Figure 27. From equation (28) and (29), the probability for the proton A to succeed to align its Z-axis with the direction of its motion toward the B proton, according to the Figure 28 is

\[ P = \left( \frac{0.0009}{12.56} \right) = 7.2 \times 10^{-5} \quad (42) \]

But the proton B also needs to align its Z-axis toward the direction of its motion toward the proton A, and so their total chance in this challenge is

\[ P = (7.2 \times 10^{-5})^2 = 5.2 \times 10^{-9} \quad (43) \]

From equation (40), (41), and (43) the quantity “C” of collisions, by second, by 1 row, inside the area with 1.0 square meter is

\[ C = (5.2 \times 10^{-9}) \times 1,55 \times 10^6 \times 7.7 \times 10^{-4} = 6.2 \times 10^{-6} \quad (44) \]

Eq. (44) represents Collisions by second, by row, in the area with 1.0 square meter.

f) Total quantity of proton-proton fusion in the Sun

The area of the disk is \(1.5 \times 10^8 \text{m}^2\), and the hydrogen represents 3/4 of the Sun mass, then the quantity of successful collisions is

\[ T_c = \left( \frac{3}{4} \right) \times 6.2 \times 10^{-6} \times 1.5 \times 10^{18} = 6.97 \times 10^{12} \quad (45) \]

for one disk of the Figure 29.

As the volume of the Sun and of the disk are \(1.44 \times 10^{27} \text{m}^3\) and 1538.6m³, calculated in eq. (31) and (32), then the total \(Q^{TH}_{\text{PQ}}\) theoretical quantity of fusion proton-proton by second in the Sun is

\[ Q^{TH}_{\text{PQ}} = \frac{6.97 \times 10^{12} \times 1.44 \times 10^{27}}{1538.6} = 6.52 \times 10^{36} \quad (46) \]

It is known that, by second, \(4.4 \times 10^9 \text{kg}\) of mass is converted to energy in the Sun, and therefore the measured quantity of protons, converted into energy, is

\[ Q^{\text{MEASURED}}_{\text{protons}} = \frac{4.4 \times 10^9}{1.7 \times 10^{-27}} = 2.6 \times 10^{36} \quad (47) \]

a result in the same order of the equation (46)

But repeating the procedure for an average energy \(E = 1.2 \text{KeV}\) of interaction between the particles, the calculation gives

\[ Q^{\text{TH}}_{\text{PQ}} = 2.25 \times 10^{36} \quad (48) \]

And repeating for \(E=43\text{KeV}\), the calculation gives

\[ Q^{\text{TH}}_{\text{PQ}} = 1.35 \times 10^{37} \quad (49) \]

12. Cold Fusion Successfully Replicated along Decades

1. Don Borghi Experiment

In his experiment Don Borghi [12] obtained neutrons from the fusion proton+electron at low conditions of
pressure and temperature, an impossible phenomenon according to the foundations of the SNP. In his experiment he firstly eliminated the rotation of electrons in the orbits of the hydrogen atoms. The electromagnetic field used for the conversion of hydrogen to plasma was also responsible for the creation of an oscillatory motion of the electron. His experiment was replicated several years later [13]. Other similar experiment was made by Elio Conte and Maria-Pieralice [14].

2. Fleischmann–Pons Experiment

It was an investigation conducted in the 1980s by Martin Fleischmann of the University of Southampton and Stanley Pons of the University of Utah into whether electrolysis of heavy water on the surface of a palladium (Pd) electrode produces physical effects that defy chemical explanation. Of particular interest was evidence of “excess” (i.e. non-chemical) heat extracted from the deuterium fraction of common surface water which, if true, could have delivered the largest economic shock to the global energy industry since the Pennsylvania oil rush.

On March 23, 1989, Fleischmann (then one of the world’s leading electrochemists) and Pons reported their work via a press release from the University of Utah (who asserted ownership of the technology) claiming that the table-top apparatus had produced anomalous heat (understood as “excess” heat) of a magnitude they asserted would defy explanation except in terms of nuclear processes, which later came to be referred to as “cold fusion”. In addition to the results from calorimetry, they further reported measuring small amounts of nuclear reaction byproducts, including neutrons and tritium. The reported results received wide media attention, and raised hopes of a cheap and abundant source of energy.

Many scientists tried to replicate the experiment with the few details available. Hopes faded due to the large number of negative replications, the withdrawal of many reported positive replications, the discovery of flaws and sources of experimental error in the original experiment, and finally the discovery that Fleischmann and Pons had not actually detected nuclear reaction by products. By late 1989, most scientists considered cold fusion claims dead, and the Nobel Laureate Murray Gell-Mann wrote an epitaph on the tomb of cold fusion, when he said in a lecture in the Portland State University, in 1998: “It’s a bunch of baloney. Cold Fusion is theoretically impossible, and there are no experimental findings that indicate it exists.”

Gell-Mann’s epitaph evidences that the conspiracy by academics against cold fusion comes from their fear, because if proved definitively the cold fusion occurrence, this imply in the definitive breakdown of the current Nuclear Theory.

3. Rossi’s Ecat

Cold fusion occurrence was definitively proved in 2014 [15]. The patent of the Ecat was obtained by Leonardo Corporation in 2015, as seen in the Figure 31. Cold fusion is also successfully obtained in Russia [16]. And in July 7, 2018 at 7:49 AM Andrea Rossi announced that the heat produced by the Ecat will start to be sold probably in January 2019: “As I said, I hope we will start out industrialization within December-January, but I still do not have a certainty of this. We still have to work on the preparation of the Ecats, besides, before installing a plant, there will be the necessity to get the licenses along the laws of the sites where our Clients are. Anyway I realistically can hope we will start by January 2019.” [17].

Then, being the cold fusion Ecat device in the market, what can be the strategy to be used by the community of physicists, to support their claim that cold fusion is impossible? When Thomas Edison was showing his invention of the electric lamp to thousands of people, coming from many cities, a physicist published in Scientific American a paper claiming that Edison’s invention was a fraud. So, who knows will the scientific community adopt the same strategy, claiming that Rossi’s Ecat is a fraud, whereas his device will be being sold to many companies worldwide, and supplying them energy with prices lower than obtained from other sources?

Of course, when the scientific community finally will be forced to recognize that cold fusion is possible and it exists, since Rossi’s Ecat will be sold in all countries worldwide, a question will be opened: how to explain why cold fusion does not occur in the stars? Is Gamow’s theory of quantum tunneling a speculation very far away of the true mechanism responsible for hot fusion in the stars?
13. Explanation for Cold Fusion from the New Concept of Electric Field

Cold fusion is theoretically possible by considering the physical model of electric field for the elementary particles, as explained ahead.

The mechanism responsible for the cold fusion occurrence in the experiments performed by Borghi, Conte-Pieralice, Fleischmann-Pons, and Andrea Rossi, is basically the same, and it involves oscillatory motion of particles with an oscillatory magnetic field, and alignment of the z-axis of the atomic nuclei with the external magnetic field. Don Borghi used proton-electron, Fleishmann and Pons used palladium and heavy water, and Rossi uses nickel and lithium-7.

Let us see how occurs the fusion Li7-Ni in Rossi’s Ecat.

Looking at the Figure 25 we understand what occurs. Before the application of the external magnetic field, the electric field the atoms of Li7 and Ni, in the vessel, have spherical electric field, as shown in Figure 25(B), and cold fusion is impossible to occur. But when the chaotic rotation of the atomic nuclei (or electron and proton in the case of Borghi and Conte-Pieralice experiments) is eliminated by the application of the external magnetic field, then Li7 and Ni nuclei start to gyrate with their z-axis parallel to the external magnetic field, and the electric fields assume the shape shown in the Figure 25(A). The Li7 and Ni nuclei acquire strong oscillations along the direction of the external magnetic field (direction coincident with the z-axis of Li7 and Ni), and their oscillation get resonance. In spite of Li7 be stable, its stability is fragile, because its neutron moves in an orbit with big radius, as calculated in [1]. From the combination of the resonance and the fragility of Li7, its proton is captured by Ni, which transmutes to Cu.

14. Conclusions

Regarding the new nuclear property (unknown till now by nuclear theorists) that links oxygen to calcium and silicon to iron, as also links [oxygen-calcium] to [silicon-iron], it merits to mention the following: the isotopes oxygen-15, calcium-39, excited silicon-28, and excited iron-54, have very simple structures, from which were calculated here the induction factors for isotopes of oxygen, calcium, silicon, and iron. Being so simple structures, it is very easy to realize that there is not any mathematical “adaptation” in the calculations, because there is not way to “invent” adaptations for single structures. As the calculations confirmed (after the conversions through the angular velocities and the radii of...
those isotopes) that $K(O) = K(Ca) = \frac{1}{2} K(Si) = \frac{1}{2} K(Fe)$, this confirmation imply that oxygen and calcium isotopes really have ONE magnet, whereas silicon and iron isotopes have TWO magnets in their structures.

Regarding the evidences that defy the hypothesis that strong nuclear force is responsible for binding protons and neutrons inside the atomic nuclei, it merits to mention that many of those evidences were known along decades. But there was not any theory pointing out where was situated the origin of the puzzles, and how to solve them. Now the origin of the puzzles is pointed out, and solutions are proposed. There is need to consider them seriously, otherwise the physicists will never succeed to find an acceptable theory free of paradoxes, a theory susceptible to supply results agree to so many new experiments defying the current theories.

Finally, as soon Rossi’s Ecat be in the market, that will represent the definitive breakdown of the current Nuclear Physics. As very well emphasized by Gell-Mann, regarding to what is “possible” from the foundations of the current Nuclear Physics, “Cold Fusion is theoretically impossible.”. So, any theory (supported by the current principles of the current Nuclear Physics, with the pretention to explain cold fusion), will be a new bandage trying to explain why the impossible is possible. Along decades the physicists have failed in their attempt to get satisfactory results with tokamaks, because the theorists believe that protons have spherical electric field. But nuclear theorists are supposing that sawtooth swings can sometimes combine with other instabilities in the plasma to produce a perfect storm that halts the reactions. However, some plasmas are free of sawtooth gyrations thanks to a mechanism that has long puzzled physicists. Researchers at the U.S. Department of Energy’s (DOE) Princeton Plasma Physics Laboratory (PPPL) have recently produced complex simulations of the process that may show the physics behind this mechanism, which is called “magnetic flux pumping.” And they hope that unraveling the process could advance the development of fusion energy [18]. But obviously they will fail again, because the electric field of the proton is no spherical, as they believe.

It’s the time to throw away the bandages of Physics.Rutherford, Heisenberg, Bohr, Gamow, Gell-Mann, Bethe, and so many other great scientists, accomplished their task. At that time, when the Quantum Mechanics was crawling like baby, it was impossible to discover the solution for so many puzzles. There was need to advance the theories, closing the eyes and covering the ears. But now we are in a New Era. From the advancement of the technology in the last decade several experimental findings are pointing out that Nuclear Physics was erected in wrong foundations. Now is the time to replace them by new ones. If the nuclear theorists continue closing their eyes and covering their ears, the Theoretical Physics will continue being what it is today, quilt patches on an entire ripped bed cover.

Quantum mechanics might need an overhaul, says Nobel laureate Steven Weinberg: “Perhaps a replacement for today’s quantum theory will come together any time now. Or perhaps not. Maybe it’s just the way we express the theory is bad, and the theory itself is right. Or possibly a surprise is in store. There’s always a third possibility, that’s there’s something else entirely, that we’re going to have a revolution in science which is as much of a break with the past as quantum mechanics is a break from classical physics. That’s a possibility. It may be that a paper from a graduate student tomorrow morning will lay it out. By definition I don’t know what that would be.”

References


