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By Polygonal Path to Exact Inverse Fine Structure Constant

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Abstract: *The polygonal path was proposed instead of circulation to calculate the exact inverse fine structure constant on Bohr orbit.*

Keywords: *Circulation, polygonal path, double surface, inverse fine structure constant*

1. INTRODUCTION

Following the double surface concept [1] the elliptic length n expressed in Compton wavelengths of the matter can be deduced from the average elliptic-hyperbolic length $s(n)$ given by the next formula:

$$s(n) = n\left(2 - \frac{1}{\sqrt{1+\frac{\pi^2}{n^2}}}\right). \quad (1)$$

In the case of the electron orbiting the nucleus in the ground state of Bohr atom the natural elliptic length $n = 137$ is expected to belong to the average elliptic-hyperbolic length $s(n)$ which at the same time expresses the inverse fine structure constant α^{-1}. Unfortunately, the calculated value $s(n) = 137{,}036\ 006\ 254$ is somehow too high compared to the recommended or recently measured values of the inverse fine structure constant α^{-1} as presented in Table1.

Table1. *Some recommended and recently measured values compared to the calculated inverse fine structure constant α^{-1}on Bohr orbit.*

Inverse fine structure constant α^{-1}	Elliptic length n	Average elliptic-hyperbolic length s(n)
$\alpha^{-1}_{Bohr\ orbit}(1)$	137	137.036 006 254
$\alpha^{-1}_{CODATA\ 2014}$[2]	< 137	137.035 999 139
$\alpha^{-1}_{CODATA\ 2022}$[3]	< 137	137.035 999 177
$\alpha^{-1}_{measured}$[4]	< 137	137.035 999 206

Let us find some possible explanation for a noticed discrepancy between the offered values and calculated value on Bohr orbit.

2. POSSIBLE EXPLANATION

It can be assumed that matter does not orbit in a circle but travels along a polygonal path of *N*-sided polygon around the center. Then pseudo π^*replaces π in equation (1) as follows:

$$\pi^* = N sin\frac{\pi}{N}. \quad (2a)$$

Here N is number of polygon sides. And

$$s(n) = n\left(2 - \frac{1}{\sqrt{1+\frac{\pi^{*2}}{n^2}}}\right). \quad (2b)$$

If the number of polygon sides *N* is somehow proportional to the elliptic length *n* then the difference between π and pseudo π^* can be perceived only at the enough short elliptic length *n*. Such, for instance, could be the elliptic length *n* of Bohr orbit.

3. CALCULATION

Let's imagine that the 129-sided polygon replaces a circle. Then consequently with the help of (2a) the next pseudo π^* replaces π:

$$\pi^* = N sin\frac{\pi}{N} = 129 sin\frac{\pi}{129} = 3.141\ 282\ 121\ 798\ 650\ \ldots \qquad (3)$$

And the next inverse fine structure constant $\alpha^{-1}$is calculated applying the elliptic length $n = 137$ and pseudo $\pi^* = 3.141\ 282\ 121\ 798\ 650$ in the equation (2b):

$$\alpha^{-1} = s(n) = 137\left(2 - \frac{1}{\sqrt{1 + \frac{3.141\ 282\ 121\ 798\ 650^2}{137^2}}}\right) = 137.035\ 999\ 139\ 387\ \ldots \qquad (4)$$

4. RESULT

The calculated inverse fine structure **constant** α^{-1} given with the help of speculated 129-polygonal path around nucleus in Bohr orbit equals the recommended $\alpha^{-1}_{CODATA\ 2014}$ value [2]:

$$\alpha^{-1} = 137.035\ 999\ \mathbf{139}\ \ldots = \alpha^{-1}_{CODATA\ 2014}. \qquad (5a)$$

And the last recommended $\alpha^{-1}_{CODATA\ 2022}$ value [3] is very close to the concerned number:

$$\alpha^{-1} = 137.035\ 999\ \mathbf{139}\ \ldots \approx \alpha^{-1}_{CODATA\ 2022} = 137.035\ 999\ \mathbf{177}. \qquad (5b)$$

5. CONCLUSION

The question arises as to whether the up to date value of $\alpha^{-1}_{CODATA\ 2022}$ has moved away from the truth or from the apparent truth.

DEDICATION

To Saint Nicholas and subtlety

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