Double Surface and Fine Structure

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Previously [1], one concluded that the atomic world should be elliptic and therefore the present universe which on the macro level looks like Euclidean is obviously to be heterogeneous. In this paper, one tries to solve the enigma proposing the double elliptic-hyperbolic surface. As a result of the effort, a new candidate for the exact inverse fine structure constant is given: $\alpha^{-1} = 137\left(2 - 1/\sqrt{1+\pi^2/137^2}\right) = 137.0360062543\ldots$.

1 Theoretical background

Let us consider our experience of the world is not what that world in reality is but rather how it is observed and measured. The distinction between to observe and to measure is made in this paper. The former means to count the units in the image, denoted as the average $\overline{x}$. The latter means to count the units in the inverse image, denoted as the average $\overline{x^{-1}}$. For the different values of x_i we have to deal with the next inequality:

$$\overline{x} \times \overline{x^{-1}} \neq 1. \tag{1}$$

Then the surface we live on is not, for instance, the Euclidean plane or the sphere very close to it [1], but could be, instead of it, the double elliptic-hyperbolic surface which is observed as the Euclidean plane. The average sphere is not proposed to be the triple elliptic-Euclidean-hyperbolic surface unless the Euclidean plane is not assigned to have its own identity. Let us propose that this leaves a footprint in the inverse fine structure constant α^{-1} which is in some way observed. Actually in the observation we count the number of the length units λ which are correlated with the inverse fine structure α^{-1}:

$$\alpha^{-1}_{observed} = \alpha^{-1}_{euclidean} = \frac{\alpha^{-1}_{elliptic} + \alpha^{-1}_{hyperbolic}}{2}. \tag{2}$$

And the measured elliptic fine structure constant on the atom level does not reflect exclusively the elliptic sphere, since it is the mirror of the hyperbolic sphere, too. Let us propose that this leaves a footprint in the fine structure constant α which is in some way measured. Actually in the measurement we count the number of the inverse length units $\lambda^{-1} = mv/h$ which are correlated with the fine structure α:

$$\alpha_{measured} = \frac{\alpha_{elliptic} + \alpha_{hyperbolic}}{2}. \tag{3}$$

Consequently the different inverse fine structure constants are explicitly expressed as

$$\alpha^{-1}_{measured} = \alpha^{-1}_{elliptic}\left(2 - \frac{\alpha^{-1}_{elliptic}}{\alpha^{-1}_{euclidean}}\right), \tag{4a}$$

$$\alpha^{-1}_{elliptic} = \alpha^{-1}_{euclidean} - \sqrt{\alpha^{-1}_{euclidean}\left(\alpha^{-1}_{euclidean} - \alpha^{-1}_{measured}\right)}, \tag{4b}$$

$$\alpha^{-1}_{hyperbolic} = \alpha^{-1}_{euclidean} + \sqrt{\alpha^{-1}_{euclidean}\left(\alpha^{-1}_{euclidean} - \alpha^{-1}_{measured}\right)}, \tag{4c}$$

$$\alpha^{-1}_{sphere} = \alpha^{-1}_{euclidean} \mp \sqrt{\alpha^{-1}_{euclidean}\left(\alpha^{-1}_{euclidean} - \alpha^{-1}_{measured}\right)}. \tag{4d}$$

It is easily seen that if the measured inverse fine structure constant equals the observed Euclidean one, the elliptic and hyperbolic inverse fine structure constant are identical and no average makes sense. Only in that case what is observed and measured is also real.

Let us also recall the value of the hypothetical Euclidean inverse fine structure constant [1]:

$$\alpha^{-1}_{euclidean} = \sqrt{\pi^2 + 137^2}. \tag{5}$$

2 The fine structure constant and the Hydrogen atom

The elliptic sphere of the radius of about 3679 Compton wavelengths of the electron was proposed in the Hydrogen atom previously [1], based on the assumption that only one type of the sphere is possible. If the elliptic and hyperbolic sphere coexists, the fine structure constant is a mirror of their average geometry, and what results is a different sphere picture. Without going into the details of how it looks like, some calculations can be made.

2.1 Calculation of the sphere paths

Taking into account the equation (5) and inserting in the equations (4b) and (4c), the CODATA 2012 recommended $\alpha^{-1} = 137.035999074$ for the $\alpha_{measured}$, the elliptic and hyperbolic path s in the Hydrogen atom are given in units of Compton wavelengths of the electron as:

$$\begin{aligned} s_{elliptic}(\alpha^{-1}_{elliptic}) &= 136.988254898\cdots < n = 137 \\ s_{hyperbolic}(\alpha^{-1}_{hyperbolic}) &= 137.083776540\cdots \end{aligned} \tag{6}$$

The path on the elliptic sphere being smaller than the translation component n is not plausible and leads one to the conclusion that the recommended empirical value of α^{-1} should be of a little greater size.

2.2 Calculation of the inverse fine structure constants

The translation component $n = 137$ Compton wavelengths of the electron equals the elliptic circular path s and the latter expresses the elliptic inverse fine structure constant [1]

$$\begin{aligned}&\alpha^{-1}_{elliptic} = 137, \text{ since:}\\&n = s = 137 \text{ Compton wavelengths of the electron.}\end{aligned} \tag{7}$$

The theoretical inverse fine structure constant deduced from the average path on the double elliptic-hyperbolic surface is given with the equations (4a) and (5):

$$\begin{aligned}\alpha^{-1}_{theoretical} &= 137\left(2 - 1/\sqrt{1+\pi^2/137^2}\right)\\&= 137.0360062543\cdots < \alpha^{-1}_{euclidean}\end{aligned} \tag{8}$$

The calculated constant is a little greater than the recommended CODATA 2012 α^{-1} but smaller than the hypothetical Euclidean one given by (5). The hyperbolic inverse fine structure is given by (4c):

$$\alpha^{-1}_{hyperbolic} = 137.0720314399\cdots \tag{9}$$

3 Conclusion

According to the proposed model, the electron in the Hydrogen atom moves on the elliptic-hyperbolic double surface, since the measured inverse fine structure constant is smaller than the hypothetical Euclidean one. And we live in the apparent Euclidean macro-world, since the observed inverse fine structure constant does not seem to differ from the hypothetical Euclidean one. The difference between what is observed on the macro level and what is measured in the atom world implies that neither what is observed nor what is measured is real. If the elliptic and hyperbolic sphere can coexist in the present world, a new candidate for the exact inverse fine structure constant is given by

$$\alpha^{-1}_{theoretical} = 137\left(2 - 1/\sqrt{1+\pi^2/137^2}\right) = 137.0360062543\cdots$$

Dedication

This fragment is dedicated to my granddaughters Urša and Špela.

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References

1. Špringer J. Fine Structure Constant as a Mirror of Sphere Geometry. *Progress in Physics*, 2013, v. 1, 12–14.