

Additional information for FINAL EVALUATOR

Dear FINAL EVALUATOR,

We, authors of the manuscript number 2015/PSIJ/21966 Alexey Stakhov and Samuil Aranson, are appealing to the FINAL EVALUATOR to explain the course of our arguments, which led us to a possible solution to the problem of the fine structure constant, articulated by David Gross in 2000 as the MILLENNIUM PROBLEM:

1. **Modern Mathematics of Harmony**, developed by Alexey Stakhov and described in the book "The Mathematics of Harmony. From Euclid to Contemporary Mathematics and Computer Science" (World Scientific, 2009 <http://www.worldscientific.com/worldscibooks/10.1142/6635>), underlies our study. This interdisciplinary mathematical discipline goes back in its origins to the Euclidean Elements and aims to revive in modern science one of the four MATEM's (harmonics), which was laid by Pythagoreans into the foundations of mathematics. In our study, we used the following mathematical results, obtained in the framework of the Harmony Mathematics:
2. **A new class of the recursive hyperbolic Fibonacci functions**, introduced by Alexey Stakhov and Boris Rozin in 2005 article "On a new class of hyperbolic functions," published in Chaos, Solitons and Fractals (see <http://www.trinitas.ru/rus/doc/0232/004a/02321042.pdf>). These hyperbolic functions were used for the introduction of the "golden" matrices.
3. **The "golden" matrices**, introduced by Alexey Stakhov in 2007 article Stakhov A. *The "golden" matrices and a new kind of cryptography* // Chaos, Solitons & Fractals, 2007, Vol. 32, Issue 3, 1138-1146 (see <http://www.trinitas.ru/rus/doc/0232/004a/02321058.htm>). These matrices were used by Alexey Stakhov and Samuil Aranson for the introduction of **Fibonacci-Lorenz transformations**, which underlie The Fibonacci special theory of relativity
4. **The Fibonacci-Lorenz transformations and Fibonacci special theory of relativity**, introduced by Alexey Stakhov and Samuil Aranson in the 2008 article Stakhov A.P., Aranson S.Ch. *"Golden" Fibonacci Goniometry, Fibonacci-Lorentz Transformations, and Hilbert's Fourth Problem* // Congressus Numerantium, 193, 2008, 119-156.
5. **The Fibonacci special theory of relativity** underlies the original solution of the FINE-STRUCTURE CONSTANT PROBLEM described in our Manuscript number 2015/PSIJ/21966.
6. Also we use in our study the unique **Kosinov's formula** for the FINE-STRUCTURE CONSTANT, introduced by Ukrainian physicist Nikolai Kosinov in the article Kosinov, N.V. Report: Connection of three important constants, **2000** (Russian) (see <http://www.roman.by/r-25512.html>). Kosinov derived a formula, which relates the fine structure constant α with two dimensionless mathematical constants - numbers π and the golden section Φ :

$$\alpha^{20} = \sqrt[13]{\pi \Phi^{14}} \cdot 10^{-43}$$

7. Authors combined **Kosinov's formula** with the results obtained in the **Fibonacci special theory of relativity** what led us to the functional relationship of the fine-structure constant, depending on the time of Universe evolution since the Big Bang to the present time.

8. We gave a **physical interpretation of the dependence of the fine-structure constant** for all periods of the evolution of the Universe: *Light Ages*, *Dark Ages* and *the Black Hole*.
9. We have proved the **high coincidence of theoretical data for the value of the fine structure constant α with the experimental data** for the *Light Ages* of the Universe.
10. A substantiation of the coincidence between the theoretical and experimental data for the *Black Hole* and the *Dark Ages* is not possible. Such experimental data in physics and astronomy do not exist yet. However, we have pointed out both theoretical and numerical picture of the change of the fine-structure constant for the *Black Hole*, and for the *Dark Ages*.
11. **In conclusion, we would like to emphasize that our study is fully consistent with the methodology of solving physical problems used in mathematical physics. We build a mathematical model of studied physical phenomenon and then verify the theoretical results with the experimental data.**

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