PART 2:

FINAL EVALUATOR'S comments on revised paper (if any)	**Authors' response to final evaluator's comments**
1) Most of the corrections seem to be done. **2) Cf. (3.9), alpha is a positive constant multiplied by a positive power of (c barred) (pxi). Therefore, the monotony of alpha is the same to that of (c barred). The derivation of c barred is a little bit simpler.** **3) P 32, the first formula: what is the provenience of the power 253/260 and of the coefficient 7/260? See also 2).**	**1) Thank you** **2) See below** **3) See below**

Authors' response to final evaluator's comments

2) Cf. (3.9), alpha is a positive constant multiplied by a positive power of (c barred) (pxi). Therefore, the monotony of alpha is the same to that of (c barred). The derivation of c barred is a little bit simpler.

Answer 1

Kosinov's formula [24] has a form:

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

As it follows from [24], the fine-structure constant α can be represented as follows:

$$\alpha = 10^{-\frac{43}{20}} \times \pi^{\frac{1}{260}} \times \Phi^{\frac{14}{20\bullet 13}} = 10^{-\frac{43}{20}} \times \pi^{\frac{1}{260}} \times \Phi^{\frac{7}{130}}$$

Hence, as indicated Kosinov in [24], the value of the α is equal:

$$\alpha = \frac{1}{137.036009823756683675307 5....} = 0.0072973519973773 62$$

By using the well-known formula (3.1), we can calculate the following value of α:

$$\alpha = \frac{e^2}{2\varepsilon_0 c \bullet \bar{h}} = \frac{1}{137.035999679} = 0.0072973525376$$

According to the data of CODATA-2014 (http://www.codata.org), it is recommended now to use the following refined value of α:

$$\alpha = \frac{1}{137.035999139} = 0.0072973525664$$

In our article, we used the value α, recommended by CODATA-2014. By using this value of α (the formulas (3.7) and (3.8)), we estimated the absolute and relative error for the α, calculated according to Kosinov's formula:

$$\Delta\alpha = \left|7.2973525664\times10^{-3} - 7.2973519973\times10^{-3}\right|$$
$$= 5.691\times10^{-10} = 0.0000000005691$$

$$\frac{\Delta\alpha}{\alpha} = \frac{5.691\times10^{-10}}{7.2973525376\times10^{-3}} = 7.779872\times10^{-8} = 0.0000000779872$$

Indeed, the value of α, calculated by Kosinov's formula, on the value $\Delta\alpha = 0.0000000779872$ is lesser than the value of α, recommended by CODATA-2014. This affects insignificantly on the value of the speed of light in vacuum ***c*** for the modern age of the Universe.

For the model of the Fibonacci special theory of relativity, proposed by the authors of this article, we supposed that the speed of light in a vacuum is variable, which is determined by the formula:

$$c = \bar{c}(\psi) \bullet c_0,$$

where $c_0 = \frac{c*}{\Phi}$, $c*$ is the speed of light in a vacuum for the modern period of the Universe.

Regarding the value $\bar{c}(\psi)$ of the normalized Fibonacci speed of light in a vacuum, we have proved the following formula for it:

$$\bar{c}(\psi) = \sqrt{\frac{sF(\psi)}{sF(\psi-2)}}, \text{ were } \psi = \lambda_0 \bullet T.$$

Here, $\lambda_0 = \frac{2}{0.55} = 3.63636363$ **[***billion years***]$^{-1}$** , $\psi = 2$ is the bifurcation point, which corresponds the transition from the *Dark Ages* to the *Light Ages***,** 0.55**[***billion years***]** is the time from the moment of the *Big Bang* until the appearance of the first proto-stars, enlightened the Universe (according to the chronological table 3.7) T [*billion years*] is the current time from the moment of the *Big Bang*.

As for $\psi \to +\infty$, the time $T \to +\infty$, we have $\bar{c}(\psi) = \sqrt{\dfrac{sF(\psi)}{sF(\psi-2)}} \to \Phi + 0$**,** wherein when changing ψ in the interval $(2,+\infty$**),** the function $\bar{c}(\psi)$ decreases monotonically from $+\infty$ до Φ, then in Kosinov's formula $\alpha = 10^{-\frac{43}{20}} \times \pi^{\frac{1}{260}} \times \Phi^{\frac{7}{130}}$ we changed Φ on $|\bar{c}(\psi)|$ and got the formula (3.9):

$$\alpha = 10^{-\frac{43}{20}} \times \pi^{\frac{1}{260}} \times \left|\bar{c}(\psi)\right|^{\frac{7}{130}}, \quad \psi = \lambda_0 \bullet T$$

We deliberately in (3.9) used $|\bar{c}(\psi)|$, but not $\bar{c}(\psi)$, because for the cases of the *Black Hole* ($-\infty < \psi < 0$) and the *Light Ages* ($2 < \psi < +\infty$) the function $\bar{c}(\psi) = |\bar{c}(\psi)|$ is a real and positive function, and for the *Dark Ages* ($0 < \psi < 2$), the function $\bar{c}(\psi)$ is **imaginary**, that is, $\bar{c}(\psi) = i|\bar{c}(\psi)|$. What we need that for any $\psi \neq 0, \psi \neq 2$, the function $\alpha = \alpha(\psi)$ was **real.**

In this situation, we have twice used the experimental data:

1) For the case $\psi = 2$, the value T_0=0.55[*billion years*], what it allows to select the unit of scale $\Delta\psi = 1 \Leftrightarrow \Delta T = \dfrac{0.55}{2} = 0.275$, from whence we have:

$$\psi = \lambda_0 \bullet T, \quad \lambda_0 = \frac{\Delta\psi}{\Delta T} = \frac{1}{0.275} = 3.636363...$$

2) According to the Paranal Observatory (Chile), **10 million years ago**, the fine-structure constant α increased all the time, but not more than on $0 < \psi < 6 \times 10^{-7}$ from α. These experimental data are coordinated with a high accuracy to our model:

$$\alpha_{\min} = 0.0072973519973773362 < \alpha_0 = 0.007297354733194072 <$$
$$< \alpha_{\max} = 0.0072973563757885605$$

That is, the difference of slowly increasing α with decreasing of the time *T* was in the ninth decimal place, that is, on two orders of magnitude better than it was expected.

Even more striking coincidences of our model with the experimental data was found in 2010 by Australian physicists.

. According to RIA NEWS (http://focus.ua/lifestyle/141792), John Webb Victor Flambaum and their colleagues from the Australian University of New South Wales analyzed 153 quasars in the southern sky by using VLT telescope at the European Southern Observatory (Chile). The result proved to be even more impressive: **it turned out that the fine-structure constant in the southern sky 10 billion years ago there was on a one-hundred-thousandth more than today.** This result is also performed in our above inequality.

Let us quote the words by John Webb:

"To say that this discovery is a sensation, means to downplay its significance. This means a revision of the entire cosmology, including the theory of relativity. Now it is impossible to say that the Universe is homogeneous and the result of any experiment on the Earth is the same as in the other parts of the Universe. This suggests that our theories and ideas about the Universe are wrong. But even more extensive and even frightening is the assumption that mankind originated in the moment, in which it is possible its existence, and for us it is allotted only a small time of our existence, and only a tiny part of the Universe, which is actually much larger and looks quite in another way. Perhaps, we do not see the whole picture of the Universe, but only our tiny corner, and understanding of this will make in our minds a greater upheaval than Copernicus' discovery."

3) P 32, the first formula: what is the provenience of the power 253/260 and of the coefficient 7/260? See also 2).

Answer 2

Let us consider the formula (3.9):

$$\alpha = 10^{-\frac{43}{20}} \times \pi^{\frac{1}{260}} \times \left| \bar{c}(\psi) \right|^{\frac{7}{130}},$$

The derivative $\frac{d\alpha}{d\psi}$ for the interval $\{2 < \psi < +\infty\}$ is calculated as follows. Let us introduce the following designations:

$$\kappa = 10^{-\frac{43}{20}} \bullet \pi^{\frac{1}{260}};\ \Phi = \frac{1+\sqrt{5}}{2};\ \alpha = k \bullet \left|\overline{c}(\psi)\right|^{\frac{7}{130}};\ \left|\overline{c}(\psi)\right| = \sqrt{\frac{\Phi^{\psi} - \Phi^{-\psi}}{\Phi^{\psi-2} - \Phi^{2-\psi}}}$$

Then, we have:

$$\frac{da}{d\psi} = k \bullet \left|\overline{c}(\psi)\right|^{\frac{7}{130}} = k \bullet \frac{d}{d\psi}\left[\sqrt{\frac{\Phi^{\psi} - \Phi^{-\psi}}{\Phi^{\psi-2} - \Phi^{2-\psi}}}\right]^{\frac{7}{130}} =$$

$$= \frac{7k \bullet \ln\Phi\left[-\frac{\left(\Phi^{\psi}-\Phi^{-\psi}\right)\bullet\left(\Phi^{\psi-2}+\Phi^{2-\psi}\right)}{\left(\Phi^{\psi-2}-\Phi^{2-\psi}\right)^{2}} + \frac{\Phi^{\psi}+\Phi^{-\psi}}{\Phi^{\psi-2}-\Phi^{2-\psi}}\right]}{260\left(\frac{\Phi^{\psi}-\Phi^{-\psi}}{\Phi^{\psi-2}-\Phi^{2-\psi}}\right)^{\frac{253}{260}}} = =$$

$$= \frac{7}{260} \bullet \frac{k \bullet \ln\Phi\left[-\frac{\left(\Phi^{\psi}-\Phi^{-\psi}\right)\bullet\left(\Phi^{\psi-2}+\Phi^{2-\psi}\right)}{\left(\Phi^{\psi-2}-\Phi^{2-\psi}\right)^{2}} + \frac{\Phi^{\psi}+\Phi^{-\psi}}{\Phi^{\psi-2}-\Phi^{2-\psi}}\right]}{\left(\frac{\Phi^{\psi}-\Phi^{-\psi}}{\Phi^{\psi-2}-\Phi^{2-\psi}}\right)^{\frac{253}{260}}}$$

The numbers $\frac{7}{260}, \frac{253}{260}$ obtained, when we take the derivative $\frac{d\alpha}{d\psi}$ of the function

функции $\alpha = k \bullet \left|\overline{c}(\psi)\right|^{\frac{7}{130}} = k \bullet \left[\sqrt{\frac{\Phi^{\psi} - \Phi^{-\psi}}{\Phi^{\psi-2} - \Phi^{2-\psi}}}\right]^{\frac{7}{130}}$

If we use computer program Wolfram Mathematica 10 and calculate the derivative $\frac{d\alpha}{d\psi}$, we obtained the above result.