Unfinished suite for the Universe … (History of a way in cosmology)

Michael H. Shulman, © 2015
(March 17, 2015)

(shulman@dol.ru, www.timeorigin21.narod.ru)

1 Introduction

In 1993 I had read just published the collection of selected papers of the remarkable Russian astrophysicist Nikolay A. Kozyrev whose ideas I met before in the popular magazines only. His "causal mechanics" does not impress me, but two important ideas turned out very interesting.

The first one consisted in the prediction that "time transforms to energy". Of course, from the standard viewpoint such the statement seems to be a heresy. However, several heresies may be crazy enough to be transformed into the truth.

The second idea introduced into science a new conception – the time "course". Before that I did not reflect about the time nature and especially about the time course. Earlier I believed that the time notion was beyond physics. However, after reading the Kozyrev's work I understood that we had to include this notion into our cosmological model. Also I understood that we have to *relate the time course with the Universe global expansion process* (all other process are secondary ones). In other words, time turned out to be similar to annual rings that appear during a tree evolution.

After I postulated the a-priori (i.e., by definition) proportionality between the (non-empty) Universe age and its size, I met at least two fundamental contradictions. Firstly, such the proportionality does not correspond to the standard condition of energy conservation. Secondly, in the new Universe model its mass increases linearly with time (contrary to the standard model). The both contradictions can be eliminated using the single assumption: our Universe is a "black hole" that absorbs energy/matter from some external hyper-world.

Initially I was afraid to pronounce such the idea. However, later it turned out that the idea "was in the air" at least since 1972.

2 Who was the first …

Just in 1972 two very different oracular papers were published synchronously and independently. The Indian physicist-theorist R. K. Pathria wrote the article [1] "The Universe as a Black Hole", and the British mathematician I. J. Good his article [2] named: "Chinese Universes".

The Pathria's article is written as a strongly scientific one; I am in full agreement with his words. At the beginning of this work he writes:

> *"… the universe may not only be a closed structure (as perceived by its inhabitants at the present epoch), but may also be a black hole, confined to a localized region of space which cannot expand without limit… for the universe as a whole, its Schwarzshild radius would woulb of the order of 10^{28} cm. Because the linear dimensions associated with the universe are also of the order of 10^{28} cm, the question arises: Is the universe itself a black hole? To investigate this question, the customary view of the universe, which is necessarily internal, is not sufficient; it has to be supplemented with an external view – I assume that there*

exists, outside our universe, an external world from which one may take a 'detached' look at our universe. "

He formulates the "internal" view using the Einstein's Equation and deducing from it the specific inequalities for the Universe radius. Then he very elegantly describes our Universe "from outside" considering it as a black hole satisfying to the Schwarzshild's metrics. He deduced the similar inequalities in this case too. Finally he uses the Hubble constant value $H_0 \approx 75$ km s^{-1} Mpc^{-1} and deceleration parameter $q_0=1$ in oreder to estimate the our Universe radius as 1.1 x 1028 cm. In conclusion he writes:

"… we are now faced with several questions: How did the universe come to be a black hole – through a gravitational collapse, followed by a phase of expansion? In the cosmos, which includes the exterior as well as the interior of the universe, can our universe be unique? If not, what would its status be vis-à-vis other such structure in the cosmos? Investigation of these and other related questions, including the possible existence of any hierarchy of black holes, is clearly a matter of some importance."

The Good's article is written in the very different (not scientific) style, without any formula. Good remembers the Greek with whom he is fully concordant:

"From the unreasonable assumption that change is impossible, Parmenides inferred about 500 BC that the universe had no beginning, in itself a reasonable belief. In fact the notion that that the universe came into existence either with a big bang or with a whimper might one day seem as absurd as that the earth rests on an elephant that stands on a tortoise. Any evidence that the universe had a beginning can be more reasonably interpreted by saying that some cataclysmic event occurred, perhaps some ten billion years ago, which completely transformed the observable universe. … I shall argue here that the whole of our observable universe is probably a black hole. "

At the end of his "poetic" work Good came to the following conclusion:

"… we are inside an infinite sequence of holes, one within the other, like carved Chinese spheres, consisting alternately of ivory and ebony … the present theory interprets collapsed galaxies … as subuniverses, and it is intended to resolve the conflict between the big-bang and steady-state theories of the origin of the universe. Although the theory seems grandiose, as far as I can see it is the only possible consistent interpretation of the steady-state concept ".

Later the American physicist-theorist Lee Smolin wrote in [3] after referring to the famous scientist Jh. A. Weeler:

"It may … be conjectured that each black hole of our universe leads to such a creation of a new universe and that, correspondingly, the big bang in our past is the result of the formation of a black hole in another universe."

In the 21-st century this grandiose idea sometimes attracted the attention of physicists. For example, a number of papers was published [4] by American physicist N. J. Poplawski. Even the stable orbits existence inside of black holes was discussed [5]. However, I believe that such the works are beyond of the main way to whom my publication is devoted.

The main question, in my opinion, is: could our Universe *not be a black hole?* The answer is clear for me [6]. In fact, we know the averaged density of the Universe (~10^{-29} g/cm^3). But the Universe having a finite averaged density cannot have an infinite size! Really, the geometrical Universe radius is proportional to the cube root from the mass, while the gravitational Universe radius is proportional to the mass itself, these dependences will necessarily cross at some critical radius value (it just is equal ~10^{28} cm) that limits the Universe size. Furthermore, when we estimate a ratio real/critical mass for such the objects as Earth, Sun, Milky Way, and the Universe as whole, we see clearly that such the ratio changes from 10^{-26} up to ~ 1.

3 Is there something "inside" of a black hole?

The common accepted paradigm of black hole consists in two parts: the external one and the internal one.

For an external observer in our 3D space black hole is exactly described by the "membrane approach" that was proposed in 70s of last century. With this approach the BH event horizon is seen as *2D physical membrane of a viscous liquid having several mechanical, electrical and thermodynamic features* [7].

But what about of the BH interior? To present day the astrophysicists accept the very power and elegant mathematical Newman-Kerr theory, that prolongs the external solution to the interior BH region. When I tried to describe my idea that the Universe is BH to the known Russian cosmologist, he replied: *"Your idea to use the Schwarzshild's solution in cosmology is unable to help the problems that you mentioned because this solution is not consistent with isotropy of the comoving space"* (private correspondence, June 14, 2008).

Of course, if we accept a *physical* solution inside of black hole, then my opponent is wright: such the solution should at least depend on the distance from the center of BH. However, our Universe, as it is well known, is uniform and isotropic on large scales. May be, we need change the BH picture that leads to singularities?

Here I would like mention the remarkable paper [8], where the very interesting idea of "gravastar" is proposed. The gravastar is a black hole with empty interior and a small but finite thickness (near to the Planck's length) of a fluid replacing both the Schwarzschild and de Sitter classical horizons. It is very interesting that last time a similar model with closed horizon, think massive shell, and without singularity was proposed by such known author in BH area as V.P. Frolov [9].

Many articles and books propose to a reader the same popular picture where the Universe is modeled by expanded 2D sphere *surface* without bounds. Because of that I came to the analogous 3D uniform and isotropic Universe geometry, and I tried to talk about this with Dr. Chernin and other scientists, but they won't even hear of it. Meanwhile, in Canada the group of prof. Afshordi [10] develops and publishes the models in which our the Universe is 3D brane due to the collapse of a 4D star into black hole.

But maybe the Universe model as 3D surface of a 4D ball in some external world (see above cited papers of Pathria and Good) cannot be *physically* consistent with the shell model? It turns out, it's not the case. My own investigation [11] based on the known results of General Relativity revealed the intriguing picture of BH formation from a body of finite size (not point-like one). Far from the collapse state pressure is positive and decreases continuously from the center of the body toward its bound. However, it turned out that during the object contraction (but before the collapse event) a new situation appears: The pressure distribution inside of the object is fully changing. An infinite bipolar pressure break point in the center appears which is forced out to the

bound while the collapse is approaching. So, I came to the inevitable conclusion: the horizon is really a *membrane* even if one looks at it inside of BH!

All this allowed me to formulate the clear and consistent enough (as I hope) model and to verify its conclusions: I compared them with the observational data and standard model predictions. The exact results are described in my concluding publication [12] (see also my private web-site www.timeorigin21.narod.ru that I support regularly since 2007).

4 Is really the time course uniform?

As was noted above, the proposed model states the exact proportionality between the Universe age and size. Hence, any accelerated Universe expansion is impossible in such the model in spite of the 2011 Nobel Prize. I think that this conclusion was incorrect however the main discovery of the Supernovae lower luminosity was very substantial.

Interestingly, a number of theorists [13-16] independently came to the different cosmological models where (contrary to the standard model) the expanding Universe age also was proportional to its size. In each of these works their authors give near or equal calculation results that demonstrate that the model is close to observations.

The works [17] of the prof. Fulvio Melia group from Arizona University play the most important role. He just called his model: "The R_h = ct Universe", i.e., the model where by definition the Universe radius is proportional to its age. The main contribution of Melia consists in hard and careful analysis of numerous different astrophysical data; as result, he came to the robust conclusion: such the model corresponds better to the observational data than Standard Cosmological Model.

References

[1] R.K. Pathria. The Universe as a Black Hole (Вселенная как черная дыра) (Nature **240** (5379): 298–299). DOI:10.1038/240298a0.
[2] I.J. Good. Chinese universes. Physics Today **25** (7). DOI:10.1063/1.3070923.
[3] Lee Smolin. The fate of black hole singularities and the parameters of the standard models of particle physics and cosmology. ArXiv:gr-qc/9404011v1 7 Apr 1994.
[4] Popławski, N. J. (2010). Radial motion into an Einstein-Rosen bridge. Physics Letters B**687** (2–3): 110–113. DOI:10.1016/j.physletb.2010.03.029.
Popławski, N. J. (2010). Cosmology with torsion: An alternative to cosmic inflation. Physics Letters B **694** (3): 181–185. DOI:10.1016/j.physletb.2010.09.056.
Popławski, N. (2012). Nonsingular, big-bounce cosmology from spinor-torsion coupling. Physical Review D **85** (10): 107502.DOI:10.1103/PhysRevD.85.107502.
[5] V. I. Dokuchaev. Life inside black holes. Grav. Cosmol., vol. 18, pp. 65-69, 2012, http://arxiv.org/pdf/1203.0878.pdf.
[6] Yu. A. Lebedev, M. H. Shulman. MultiWorlds as the conscious choice of the super-World. "Nauka i zhizn ", №7, 2011, Moscow (in Russian).
http://www.timeorigin21.narod.ru//rus_time/Lebedev_Shulman.pdf
[7] I. D. Novikov, V.P.Frolov. Black hole in the Universe. Uspehi, vol. 171, № 3. March of 2001.
[8] Pawel O. Mazur and Emil Mottola. Gravitational Condensate Stars: An Alternative to Black Holes. ArXiv:gr-qc/0109035v5 27 Feb 2002.
[9] Valeri P. Frolov. "Do Black Holes Exist?" ArXiv:1411.6981v1 [hep-th] 25 Nov 2014
[10] Razieh Pourhasan, Niayesh Afshordi, and Robert B. Mann. "Out of the White Hole: A Holographic Origin for the Big Bang." ArXiv:1309.1487v2 [hep-th] 22 Sep 2013

[11] Michael H. Shulman. Usual collapse and unusual one.
http://www.timeorigin21.narod.ru/eng_time/Collapse.pdf
[12] Michael H. Shulman. “Time origin and universe uniform expanding”. American Journal of Modern Physics 2015; 4(2-1): 9-14 Published online January 28, 2015 (http://www.sciencepublishinggroup.com/j/ajmp) doi: 10.11648/j.ajmp.s.2015040201.12 ISSN: 2326-8867 (Print) ; ISSN: 2326-8891 (Online)
http://www.timeorigin21.narod.ru//eng_time/Universe_expansion_eng.pdf
[13] Shlomo Barak and Elia M Leibowitz. Cosmology and Astrophysics without Dark Energy and Dark Matter” (arXiv: astro-ph 0909.2581).
[14] A.Benoit-Lévy and Gabriel Chardin. Do we live in a Dirac-Milne Universe? **(**arXiv:0903.2446v1).
[15] A.Benoit-Lévy and Gabriel Chardin. Introducing the Dirac-Milne Universe. (arXiv:1110.3054v1)
[16] F.J.M. Farley. Does gravity operate between galaxies? Observational evidence re-examined (arXiv:1005.5052v1)
[17] Melia F. The Cosmic Spacetime. Is The Universe Much Simpler Than we Thought? (arXiv: 1205.2713v1);
Melia F., Shevchuk A. S. H., 2012, MNRAS, 419, 2579;
F. Melia and A.S.H. Shevchuk. The R_h = ct Universe. ArXiv:1109.5189v1 [astro-ph.CO] 23 Sep 2011;
F. Melia. The Gravitational Horizon for a Universe with Phantom Energy ArXiv:1206.6192v1 [astro-ph.CO] 27 Jun 2012;
F. Melia. Fitting the Union 2.1 SN Sample with the Rh = ct Universe.
ArXiv:1206.6289v1 [astro-ph.CO] 26 Jun 2012;
F. Melia. The Rh = ct Universe Without Inflation.
ArXiv:1206.6527v1 [astro-ph.CO] 27 Jun 2012;
F. Melia. Angular Correlation of the CMB in the Rh = ct Universe.
ArXiv:1207.0015v1 [astro-ph.CO] 28 Jun 2012;
F. Melia. CMB Multipole Alignment in the Rh = ct Universe.
ArXiv:1207.0734v1 [astro-ph.CO] 2 Jul 2012;
F. Melia. Proper Size of the Visible Universe in FRW Metrics with Constant Spacetime Curvature. ArXiv:1207.1332v1 [astro-ph.CO] 3 Jul 2012;
F. Melia. High-z quasars in the R_h = ct Universe. ArXiv:1301.0017v1 [astro-ph.CO] 23 Dec 2012.