LESYA UKRAINKA
VOLYN NATIONAL UNIVERSITY

4th international conference

ACTUAL PROBLEMS OF FUNDAMENTAL SCIENCE

proceedings

2021

June 01-05
Lutsk - Lake «Svityaz'»

Міністерство освіти і науки України
Волинський національний університет
імені Лесі Українки

АКТУАЛЬНІ ПРОБЛЕМИ ФУНДАМЕНТАЛЬНИХ НАУК

Матеріали
IV міжнародної наукової конференції

(Луцьк – Світязь, 01 – 05 червня 2021 року)

Присвячено пам'яті Рене Декарта

ACTUAL PROBLEMS OF FUNDAMENTAL SCIENCE

Fourth international conference

(Lutsk – Svityaz', 01 – 05.06.2021)

Dedicated by memory of Rene Descartes

Луцьк
Вежа-Друк
2021

УДК 535+544
А36

Рекомендовано до друку вченою радою
Волинського національного університету імені Лесі Українки
(протокол №5 від 28 квітня 2021 року)

Proceedings of IV-th International Conference «Actual problems of fundamental science» – APFS'2021 are represented. These results were reported on this conference.

Edition of materials are made from author texts and prepared to printing the Program Committee and Editorial Board of conference.

А36 **Актуальні проблеми фундаментальних наук** : матеріали IV Міжнар. наук. конф. – (Луцьк – Світязь, 01 – 05 черв. 2021 р.) – Луцьк: Вежа - Друк, 2021. – 216 с.

ISBN 978-966-940-362-9

Подано праці IV Міжнародної конференції "Актуальні проблеми фундаментальних наук" – АПФН-2021. Матеріали було заслухано на конференції.

УДК 535+544

ISBN 978-966-940-362-9

ETHERINGTON'S PARALOGISM

Danylchenko, Pavlo[1]

It was shown that Etherington's identity is paralogism. Etherington's identity is based on the imaginary relativistic dilation of intrinsic time of the galaxy by $(1+z)$ times, but the presence of a relativistic anisotropy of luminosity of stars quickly moving away from it is ignored in the frame of reference of spatial coordinates and time (FR) of the observer. Etherington did not take into account the fact that the Universe is homogeneous only in the comoving FR in the expanding Universe, and recklessly made a "mix" of the phenomena and features inherent in two different FRs.

Key words: Etherington's identity, GR, Hubble's constant H, luminosity distance, redshift z.

Доведено, що тотожність Етерінгтона є паралогізмом. Ця тотожність ґрунтується на уявному релятивістському уповільненні плину власного часу галактики в $(1+z)$ разів у системі відліку просторових координат та часу (СВ) спостерігача, в якій тотожністю фактично ігнорується наявність релятивістської анізотропії світності зірок, що швидко віддаляються від нього. Етерінгтон не взяв до уваги той факт, що Всесвіт є однорідним лише в супутній в розширному Всесвіті СВ. І, отже, він необачно зробив «суміш» з явищ і особливостей, що є властивими двом різним СВ.

Ключові слова: тотожність Етерінгтона, Загальна Теорія Відносності, стала Хаббла H, світимісна відстань, червоний зсув z.

Introduction

The concept of Universe homogeneity may be applied only to comoving FR in the expanding Universe (CFREU). In CFREU the radial distancing of galaxies from the observer is absent. Mutually proportional evolutional shrinkage of length standard and of all macro and micro objects of matter takes place in CFREU instead. All infinite fundamental space of CFREU is covered by the event horizon (pseudo-horizon of the past) in the gravithermodynamic FR (GT-FR) [Danylchenko, 2020: 5] of evolutionally self-contracting matter. Relativistic failure to comply with simultaneity of simultaneous in CFREU events takes place in GT-FR. As a result, only infinitely far cosmological past is simultaneous with any event in people's world (in GT-FR) on this pseudo-horizon [Danylchenko, 2004: 33; 62]. Thus, concentration of astronomical objects in GT-FR inevitably increases while approaching this pseudo-horizon of the past and, consequently, while deepening into cosmological past. Therefore, the Universe can not be homogeneous in GT-FR's intrinsic space in principle. Only two known solutions of equations of GR gravitational field can be juxtaposed to expanding Universe. Those are: Schwarzschild solution [Schwarzschild, 1916: 189] when the value of cosmological constant is $\Lambda=3H^2/c^2$ [Danylchenko, 2004: 62], which corresponds to the local representation of the process of Universe expansion, and Friedman solution when $\Lambda=0$ [Friedman, 1922: 377], which corresponds to the global representation of the pro-cess of Universe expansion.

Friedman solution due to negligibly small values of average density of mass in the Universe (comparing to $3H^2/4\pi G$) and pressure in the outer space (comparing to $3H^2c^2/4\pi G$) is the special case of the Schwarzschild solution in the background Euclidean space of the Universe: namely in the FR of physical vacuum [Danylchenko, 2004: 33; 62] of identical CFREU when the value of gravitational radius of astronomical object, from which the observation of Universe expansion is performed, is negligibly small. In contrast to Schwarzschild solution that includes pseudohorizon of events in the equations of Friedman solutions (as well as in the equations of Schwarzschild solution in background Euclidean space) event horizon (on which the speed of light is equal to zero) is absent. This denotes the absence of the Hubble radial motion of galaxies and, thus, the absence of relativistic effects in the space of Friedman solution. Galaxies in this space perform only small peculiar moves while distances

[1] © Danylchenko, Pavlo, 2021, E-mail: pavlo@vingeo.com

between them are increasing in this space due to mutually proportional decreasing of the dimensions of both length standards and all material objects in this space. Thus, there fundamentally cannot be any radial motion of objects in Friedman solution because of the absence of singular surface of event horizon in this solution. Therefore, Doppler Effect and other relativistic effects related to motion are not applicable for this solution.

Imaginary Etherington's paradigm

Luminosity of fast moving galaxies is isotropic only in their intrinsic FRs. However, this luminosity is also considered as isotropic in the GT-FR of any far observer during the astronomical photometric calculations. Therefore, relativistic transformations of angular coordinates are ignored in those calculations [Weisskopf, 1972]. Thereby, distances to galaxies are not determined by those calculations in the GT-FRs of observer. They are, in fact, determined in CFREU. Only in CFREU the luminosity of all galaxies is isotropic and the Universe itself is uniform. However, the imaginary Etherington's identity [Etherington, 1933: 761] for uncorrected luminosity distance D_L and for imaginary value of angular diameter distance ${}^iD_A$, that corresponds to it, in the calculations is also taken into account: $D_L={}^iD_A(1+z)^2$.

Etherington's identity is based on the imaginary relativistic dilation of intrinsic time of the galaxy by $(1+z)$ times [Hogg, 2000]. That time dilation (inherent to GT-FR) is actually absent in CFREU when using the metrically homogeneous scale of cosmological time (CTMHS). The primary frequency of radiation of the galaxy is the same as the frequency of identic to it radiation in nearby vicinity of observer in CFREU by CTMHS. That frequency is only progressively decreasing in "ontogenesis" (in the process of propagation of that radiation) together with decreasing of velocity of light in CFREU in accordance with CTMHS [Danylchenko, 2004: 62].

Thus, we are dealing with the Etherington's paralogism. This paralogism is caused by the mixing of observations in two different FRs – in CFREU and in GT-FR. The Universe is observed in CFREU as uniform (monotonous), with the single for all its objects cosmological time and without the presence of global relativistic effects. Consequently, the relativistic time dilation on the astronomical objects moving away from each other in the expanding Universe, which is observed in the GT-FR of each of the objects, is imaginary (fictive) for CFREU (and, therefore, for the global perception) [Danylchenko, 2009: 47; 2020: 85]. The Universe is non-uniform (not monotonous) in GT-FR. And not only imaginary relativistic time dilation on far astronomical objects, but also relativistic anisotropy of their luminosity is observed in the GT-FR. That relativistic anisotropy of luminosity was ignored by Etherington in contrast to relativistic time dilation. Of course, Etherington could consider these relativistic effects (inherent to Schwarzschild solution only) as applicable for Friedman solution without understanding that the Hubble radial motion of objects of matter is absent in this solution.

Moreover in any observer's FR the coordinate sizes of these objects (in the moment when they emit the radiation) are conformally reduced in their cross-section more than it is required for the absence of dilatation of their intrinsic time. According to General Relativity their transverse scale factor N_Λ formally exceeds its limit value, beyond which there should be not a deceleration but acceleration of the rate of intrinsic time of moving body [Danylchenko, 2008: 106]:

$$N_\Lambda=D_M/D_A=1+z=1/(1-v_g/v_c)>N_0=c(v_c^2-v_g^2)^{-1/2}=1/(1-v_g^2v_c^{-2}),$$

where: $v_c=c(1-v_g^2v_c^{-2})^{1/2}$; v_g is the velocity of radial motion of distant galaxy; D_M is the transverse comoving distance to the galaxy in CFREU.

According to the increment of the interval:

$$(ds)^2=c^2(dt')^2-(dx'_m)^2-(dy'_m)^2-(dz'_m)^2=N_\Lambda^2[c^2(dt)^2-(dx_m)^2-(dy_m)^2-(dz_m)^2],$$

when: $dx'_m=0$, $dy'_m=0$ and $dz'_m=0$ the $dx_m=v_g d\hat{t}=(v_g/v_c)cdt$, $dy_m=0$, $dz_m=0$, will take place, and:

$$c^2(dt')^2=N_\Lambda^2(1-v_g^2v_c^{-2})(dt)^2=N_\Lambda^2(1-v_g^2v_c^{-2})v_c^2(d\hat{t})^2=c^2(1+v_g/v_c)^2(d\hat{t})^2=c^2[(v_c+v_g)/(v_c-v_g)](dt)^2.$$

And, consequently, the dilatation of intrinsic time of astronomical objects of far galaxies that are distancing from observer is absent in conformally transformed time t of the observer FR and all the more so by its real clock that counts universal astronomical time $\hat{t}$. So, according to GR formalism not the dilatation but vice versa the fastening of the rate of intrinsic time of distant galaxies takes place by the observer's clock: $d\,t'=(1+v_g/v_c)d\,\hat{t}>d\,\hat{t}$. However, if just the gravitational dilatation of the rate of time of distant galaxies is completely compensated by the free fall of distant galaxies on the pseudo-horizon of events, then indeed there fundamentally cannot be any contraction or dilatation of the unified gravithermodynamic (not coordinate) time of matter of these galaxies. And this can take place in the case of the conformal gravitationally-Lorentz transformations of increments of space coordinates and time, which guarantee the relativistic invariance of Hamiltonian of inertially moving body as well as of all thermodynamic potentials and parameters of its matter.

Conclusions

So, nowadays Etherington's identity is only the imaginary paradigm. The real astronomic identity should, of course, be taken instead of it: $D_L=D_A(1+z)^{3/2}$. This identity, in fact, connects the luminosity distance D_L with corrected photometric distance в GT-FR $r=D_A$. This photometric distance is used in Schwarzschild solution of GR gravitational field equations.

References

Danylchenko, Pavlo: 2004, About possibilities of physical unrealizability of cosmological and gravitational singularities in General relativity. *Gauge-evolutional interpretation of special and general relativities* (*G-E S&GR*), Vinnytsia: O.Vlasuk, 33-61; Nova knyga (Nk), 2008a: 45-95. http://pavlo-danylchenko.narod.ru/docs/Possibilities_Eng.html.

Danylchenko, Pavlo: 2004, Phenomenological justification of linear element of Schwarzschild solution of GR gravitational field equations. *G-E S&GR* Vinnytsia: O.Vlasuk, 62-78; 2008a: Nk 96-112. http://pavlo-danylchenko.narod.ru/docs/Schwarzschild_Eng.html.

Danylchenko, Pavlo: 2008, Relativistic Values of radial coordinates of distant astronomical objects of expanding Universe.*Introduction to Relativistic Gravithermodynamics* (in Russian), Vinnytsia: Nova knyga, 106-128. http://pavlo-danylchenko.narod.ru/docs/RelativisticValues.html.

Danylchenko, Pavlo: 2009, Is Universe eternal? *Philosophy & Cosmology*, **8**, Poltava: Poltavskiy literator, 47-56. (in Russian). https://cyberleninka.ru/article/n/vechna-li-vselennaya, http://ispcjournal.org/journals/2009/2009-3.pdf.

Danylchenko, Pavlo: 2020, Foundations of Relativistic Gravithermodynamics. *Foundations and consequences of Relativistic Gravithermodynamics* (*F&C of RGTD*), Vinnytsia: Nova knyga, 5-84. http://pavlo-danylchenko.narod.ru/docs/FoundationRGTDUkr.pdf (in Ukrainian).

Danylchenko, Pavlo: 2020, Theoretical misconceptions and imaginary entities in astronomy, cosmology and physics. *F&C of RGTD*, Vinnytsia: Nova knyga, 85-128. http://pavlo-danylchenko.narod.ru/docs/FoundationRGTDUkr.pdf (in Ukrainian).

Etherington, Ivor: 1933, LX. On the Definition of Distance in General Relativity. *Philosophical Magazine*, **15**, S. 7, 761-773. https://era.ed.ac.uk/handle/1842/32130.

Friedman, Alexander: 1922, *Z. Phys.*, **10**, 377.

Hogg, David W.: 2000, Distance measures in cosmology. December 2000. https://arxiv.org/pdf/astro-ph/9905116v4.pdf.

Schwarzschild, Karl: 1916, Über das Gravitationsfeld eines Massenpunktes nach der Einstein'schen Theorie. *Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften,* **1**, 189-196. https://arxiv.org/abs/physics/9905030.

Weisskopf, Victor: 1972, Physics in the twentieth century: Selected Essays. Cambridge, Massachusetts, and London, England: The MIT Press.