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THE EVIDENCE OF ABSENCE OF THE ACCELERATING EXPANSION OF THE UNIVERSE

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It is shown that, according to the General Relativity (GR), only the transverse metric distances – the transverse comoving distance and the angular diameter distance similar to it – can obey the Hubble linear dependence. The transverse comoving distance belongs to the comoving reference of spatial coordinates and time (FR) in the expanding Universe (CFREU) and is determined by the redshift of the emission wavelength. The angular diameter distance belongs to the FR of observer of an expanding Universe and is determined by the redshift of the frequency of the emission wave. The luminosity distance is not the transverse metric distance and therefore its dependence on redshift is nonlinear. It is taken into account that the Hubble constant, like the length standards and the constant of the velocity of light, is a fundamentally unchangeable quantity in the rigid FRs. Its exact value is empirically found.

Key words: dark energy, Etherington's identity, General Relativity, Hubble's law, redshift.

1. Imaginary Etherington's Paradigm

The Etherington's identity [Etherington, 1933] is only the imaginary Paradigm [Danylchenko, 2020; 2021]. 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 in the gravithermodynamic reference of spatial coordinates and time (GT-FR) [Danylchenko, 2020] $r=D_A$. This photometric distance is used in Schwarzschild solution of GR gravitational field equations. According to imaginary Etherington's identity (paralogism) only imaginary (wrong) value of transverse comoving distance ${}^{i}D_M$. to the galaxy is determined nowadays in astronomical photometric calculations. It is $(1+z)^{1/2}$ times smaller than the right (real) value of transverse comoving distance to the galaxy: ${}^{r}D_M=D_L(1+z)^{-1/2}$. And, therefore, it is $(1+z)^{1/2}$ times smaller than the radial coordinate $R={}^{r}D_M$ of the galaxy in Euclidean space of CFREU in the moment of registration of its radiation [Danylchenko, 2004: 33; 2004: 62]. And it is also $(1+z)^{1/2}$ times bigger that the Schwarzschild radius of the galaxy in GT-FR: $r=R_0={}^{r}D_A={}^{i}D_A\sqrt{1+z}=D_L(1+z)^{-3/2}$.

This radius is equal to radial coordinate R_0 of the galaxy in CFREU in the moment of radiation emission. And, therefore, it is identical to corrected photometric distance to the galaxy and is equal to the real value of angular diameter distance ${}^{r}D_A$. That is because of: ${}^{r}D_M/{}^{r}D_A=R/r=R/R_0=1+z$.

2. Imaginary Dark energy

Equations of GR gravitational field, in fact, describe the isolated from outer world states of matter and of its space-time continuum (STC). Spatial distribution of the mass of matter in those equations specifies how the STC should be curved, while the STC specifies in what spatially inhomogeneous thermodynamic state matter should be. Consequently, the external gravitational influence on that isolated matter and on its STC is not taken into account in those equations. That external influence can be reflected in the tensor of energy-momentum due to the normalization (calibration) of gravitational constant that is the part of the expression for the Einstein's constant: $\kappa=8\pi c^{-2}({}^{u}v_{\cos}^{-2})G$, where: ${}^{u}v_{cos}$ is the coordinate velocity of light in the outer space of Universe.

It can be reflected in the tensor of space-time curvature only using the normalization of cosmological Λ-part. That is because in contrast to coordinate velocities of light that are defined by the tensor of energy-momentum: $v_c=c\sqrt{1+2z}/(1+z)$ the constant of the velocity of light c (which is used in the space-time curvature tensor) cannot be normalized. It is the spatially-temporal invariant.

Dependencies of luminosity distance D_L to supernovas of type Ia on the redshift z of their radiation spectrum have been modeled [Riess, Adam G. et al, 1998: 1009; Semiz and Çamlibel, 2015; Dempsey, 2016] based on the results of astronomical observations of supernovas of type Ia [Perlmutter, et al, 1999: 565; Riess, Adam G. et al, 1998: 1009]. According to graphs of that dependencies (q.v. Fig.) evolutionary change of Hubble's parameter is almost not observed. That is because in case we use the most suitable values of Hubble constant the values of luminosity distance ${}^{g}D_L$ shown on graphs (q.v. Table) are very slightly different from their calculated values: $D_L={}^{r}D_M\sqrt{1+z}=(c/H)z\sqrt{1+z}$.

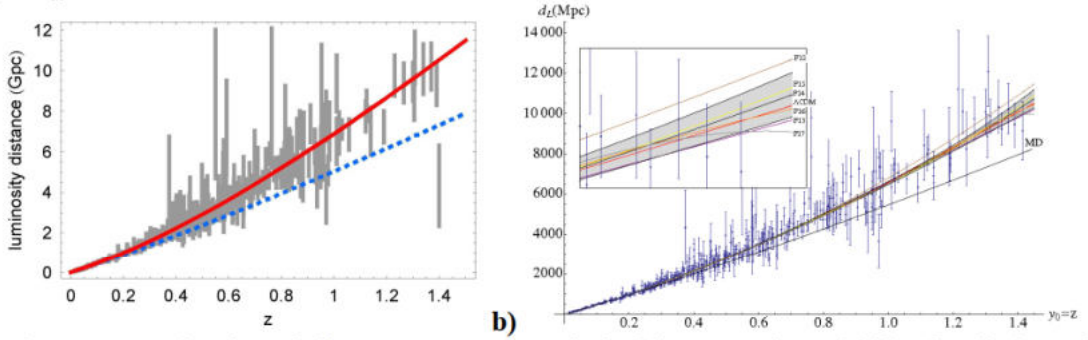

Figure: Dependencies of distances to astronomical objects on the redshift of radiation of astronomical objects z: ***a)*** *luminosity distance D_L (solid line) to those objects* [Soloviev, 2016] *and metrical transverse comoving distance ${}^{r}D_M$ (dotted line) to astronomical objects in CFREU, as it is justified here;* ***b)*** *graphical MD (straight) and ΛCDM (curve) models, and the one-sigma confidence-levels. The inset shows the right end, magnified* [Semiz and Çamlibel, 2015].

Table

H, km/ sMpc	*D, Gpc*	Z						
		0,2	0,4	0,6	0,8	1,0	1,2	1,4
62,164	${}^{r}D_M$	0,96	1,93	2,89	3,86	4,82	5,79	6,75
	${}^{r}D_A$	0,80	1,38	1,81	2,14	2,41	2,63	2,81
	D_L	1,06	2,28	3,66	5,18	6,82	8,58	10,46
62,295	${}^{r}D_M$	0,96	1,92	2,89	3,85	4,81	5,77	6,74
	${}^{r}D_A$	0,80	1,37	1,80	2,14	2,41	2,62	2,81
	D_L	1,05	2,28	3,65	5,17	6,81	8,57	10,44
	a) ${}^{g}D_L$	1,03	2,25	3,65	5,2	6,9	8,65	10,5
65	${}^{r}D_M$	0,93	1,85	2,77	3,69	4,62	5,54	6,46
	${}^{r}D_A$	0,77	1,33	1,73	2,05	2,31	2,52	2,69
	D_L	1,01	2,18	3,50	4,95	6,52	8,21	10,01
	b) ${}^{g}D_L$	1,00	2,16	3,50	4,95-5,0	6,4-6,8	8,2-8,8	9,9-11,0

Thus, teams of astronomers leaded by Perlmutter and Riess indeed confirmed (with high precision) the linearity of the dependence of redshift of radiation wavelength of distant galaxies on transverse commoving distance to them. And this their achievement is not at all less than attributed to them "discovery" (in reality – false one) of accelerated expansion of the Universe.

It is taken into account that the Hubble constant, like the length standards and the constant of the velocity of light, is a fundamentally unchangeable quantity in the rigid FRs. And this follows from the condition of continuity of spatial continuum in rigid FRs. [Danylchenko, 1994: 22]. The most corresponding to astronomical observations value of Hubble constant is the value determined by the following empiric dependencies of it on the well known physical constants and characteristics:

$$H=c\sqrt{\Lambda/3}=\pi^4\alpha\nu_{Bn}/8N_{Dn}=(2/3)\pi\alpha t_p^2(\pi\nu_{Bn}/2)^3=(2/3)\pi Ge^2(m_n/4\hbar)^3=2{,}01886\cdot10^{-18}[s^{-1}]=62{,}2955[km/sMpc],$$

where: Λ is the cosmological constant, $N_{Dn}=1,5(t_p\nu_{Bn})^2=3\pi chm_n^{-2}/G=0,999885\cdot10^{40}$ is the neutron large Dirac number, $\alpha=e^2/c\hbar$ is the fine structure constant, $\nu_{Bn}=m_nc^2/2\pi\hbar$ is the de Broglie wave frequency of the neutron, $t_p=(c^5\hbar G)^{1/2}$ is the Planck time, $\hbar=h/2\pi$ is the Dirac-Planck constant, G is the Newton's gravitational constant, e is the electric charge of the proton and electron, m_n is the mass of neutron. However, the value of Hubble constant $H=(\pi^4\alpha/8N_{DH})\nu_{BH}=62,16420$ $[km/sMpc]$ ($\Lambda=1,35457\cdot10^{-52}$ $[m^{-2}]$), that corresponds to the de Broglie wave frequency of hydrogen atom $\nu_{BH}=m_Hc^2/2\pi\hbar=2,270262\cdot10^{23}$ $[s^{-1}]$ ($m_H=1,67375\cdot10^{-27}$ $[kg]$, $N_{DH}=1,5(t_p\nu_{BH})^{-2}=1,001292\cdot10^{40}$), only for small distances guarantees slightly worse correspondence to the data of graphical extrapolation of the results of astronomical observations. It is possible that Hubble constant took "hydrogen" value only after spontaneous transformation of quark or neutron medium of the Universe into hydrogen medium. However, of course, it was impossible before that to metrically characterize its continuous protomatter and, therefore, it is senseless to characterize it by "neutron" Hubble constant. Therefore, the final choice of one of these two close values of Hubble constant can be done based on the more precise results of astronomical observations.

It is obvious that supposed need in the presence of dark energy in The Universe is based not only on the taking into account the imaginary (fictive) dilation of the time on distant astronomical objects (postulated by Etherington's identity), but also on the wish to have the linear dependence of redshift of radiation spectrum z on luminosity distance D_L to those objects. In fact, according to GR [Danylchenko, 2004: 33; 2004: 62] the redshift is linearly dependent only on the transverse comoving distance D_M: $z=\Delta\lambda_D/\lambda_0=HR/c=HD_M/c$ and on the angular diameter distance:

$$\hat{z}=\Delta\nu_D/\nu_0=-z/(1+z)=-Hr/c=HD_A/c.$$

Moreover, the supposed dark energy could not be a certain physical entity at all. It could be just the effect of ubiquitous negative feedback. The deceleration of evolutionary self-contraction of matter in CFREU could take place in the distant past due to the presence of this negative feedback. Thus, evolutionary decrease of the velocity of light in CFREU using CTMHS in the distant past would also be decelerated. This deceleration, of the outer space course, could have been the greater the smaller the coordinate velocity of light $^{u}v_{cos}$ in the outer space in GT-FR had been in distant past.

However, it is quite probable that Hubble's parameter is indeed unchangeable in time, as we had to make sure of it here. It even can be a spatially-temporal invariant alike the proper value of the velocity of light. The value of Hubble's constant can be precised after the more accurate processing of results of astronomical observations.

Conclusion

Hubble constant is a fundamentally unchangeable quantity similar to the length standard and to the constant of the velocity of light. Therefore, the law, discovered by Hubble, is immutable. The dark energy and the Etherington's identity are paralogisms.

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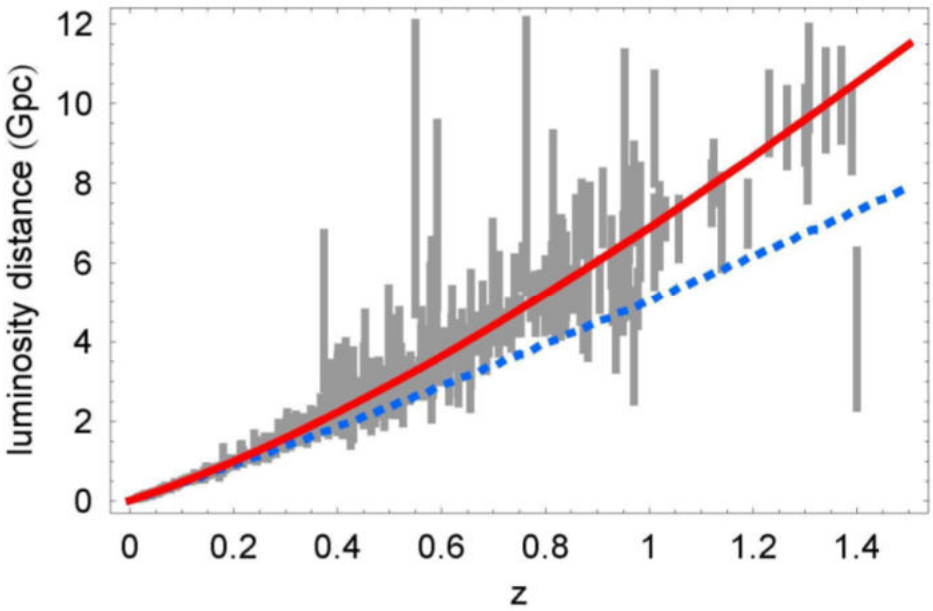
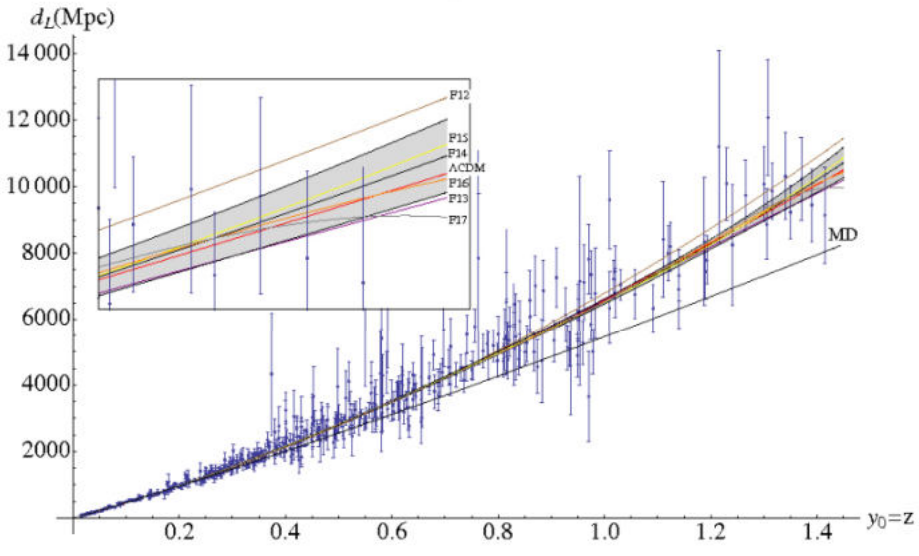


a)



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