The Origin of the Halton Arp "Quantized" Inherent Redshift

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Abstract: The Scale-Symmetric Theory (SST) shows that the Halton Arp "quantized" inherent redshift results from shifted luminosity of quasars with some redshifts, not from higher abundances of quasars with such redshifts. The two functions describing dependence of the cosmological and inherent light travel time (LTT) on redshift are continuous but for the inherent LTT there are some increases in luminosity for 15 different redshifts: 0.061, 0.30, 0.60, 0.96, 1.41, 1.96, 2.63, 3.46, 4.48, 5.73, and so on - we obtained perfect consistency with observational facts. It leads to an illusion that the quasars with shifted luminosity are more numerous. SST shows that the quasars are the very distant objects because due to the inherent LTT, even quasars with very low redshift are already in LTT equal to 6.8 Gyr. Here we described the mechanism leading to the shifted luminosities. The cosmological and inherent LTTs result from different mechanisms of emission of photons by cosmic objects because of annihilation of particle-antiparticle pairs into two photons. The inherent LTT is produced by accretion discs whereas the cosmological LTT concerns the supernovae. Contrary to SST, within the General Theory of Relativity (GR) we cannot explain the origin of the shifted luminosity of quasars with strictly defined redshifts so the GR cosmology is only an approximate description of the expanding Universe.

1. The foundations of the Scale-Symmetric-Theory (SST) cosmology

The expansion of the Universe was separated in time from the inflation [1].

Initially, the maximum radius of the region filled with the dark matter (DM) was about $C_1 = 0.287$ Gyr [1]. The Milky-Way (MW) galaxy is close to the centre of the expanding Universe i.e. is practically in the rest in relation to the non-expanding Einstein spacetime (ES) (there expands the dark energy) [2]. The front of baryonic matter (BM) expands with the recessional velocity $z_{Front,BM}\, c$, where $z_{Front,BM} = 0.6415$ [1] and c is the speed of light in "vacuum". But at the beginning of the expansion of the Universe there appeared at the BM front protuberances of the DM that carried the quasars – it produced the inherent light travel time (inherent LTT) associated with quasars. On the other hand, the non-turbulent expansion of the Universe produced the cosmological light travel time (cosmological LTT) associated with supernovae [2].

In the SST cosmology we use three different distances.

The spatial distance is the time a photon moving with relative speed c covers a distance. For example, the present-day spatial distance between MW and the front of BM is

$L_{Spatial,now,MW\text{-}BM(front)} = 13.866 \pm 0.096$ Gyr [1].

The present-day spatial distance to the front of the cosmic microwave background (CMB), which is in a very good approximation equal to the age of the Universe, is

$T_{Age} = 21.614 \pm 0.096$ Gyr [1].

The spatial distance to the BM front when the photons detected now on Earth were by the BM front emitted was

$L_{Spatial,then,MW\text{-}BM(front)} = 4.971$ Gyr [1].

The time distance is the time a photon emitted by excited atom needs to cover the distance between the atom and Earth. Due to the duality of relativity (the speed c is the speed of photon in relation to its source or the last-interaction object so it can be a detector), the relative speed of a photon emitted by an atom in the rest in some galaxy in relation to Earth is $(1 - z)c$.

For example, the time distance between the BM front and MW is

$L_{Time,MW\text{-}BM(front)} = L_{Spatial,then,MW\text{-}BM(front)} / (1 - z_{Front,BM}) = 13.866 \pm 0.096$ Gyr [1].

Due to the duality of relativity, we cannot see the initial period 7.75 Gyr of evolution of galaxies associated with the time distance [1]. On the other hand, the SST shows that we can see the CMB and the whole evolution of the quasars associated with the SST inherent light travel time (inherent LTT) (it is described below) because of the relativistic-electron vortices produced by the accretion discs. The squared spin speed of a relativistic electron in a vortex (for smaller vortices, the spin speeds are higher) plus the squared recessional velocity of the vortex must be close to the squared speed of light in "vacuum". The photons are scattered on such vortices. Since their recessional velocities change from about 0 up to about c so we can see the quasars all the time.

The light travel time (LTT) is the time a photon (the first photon) from decay of a particle-antiparticle pair, created by a quasar or supernova, covers the distance between the second photon and Earth i.e. the second photon is the frame of reference – it means that there is an increase in space for the first photon!

Notice that the electron-positron pairs can be created on the atomic shells as well.

Consider such a phenomenon for a supernova (Fig. 1). The charged positively atomic nuclei have higher inertia than the electrons so very strong explosion causes that the core of a supernova is charged positively whereas the outer region negatively. A particle-antiparticle pair created in the Einstein spacetime (ES) (it is in the rest in relation to the ES) near the front of the expanding supernova is polarized in such a way that the positively charged particle is closer to the core of the supernova whereas the negatively one is further away and is entangled with the positively charged core of the supernova. It means that the second photon (the frame of reference) is moving away from the Earth with speed $1c$ whereas the first photon that is entangled with the core is moving with speed $(1 - z)c$ in relation to Earth. Since the two photons are entangled so the space of the first photon in relation to the frame of reference increases as $1 + (1 - z) = (2 - z)$. It causes that in the formula for the SST cosmological LTT appears the expression $(2 - z)$ [2]. Such expression causes that for redshift up to 0.6415, the SST cosmological LTT is about $14 - 17\%$ longer than it follows from the General Relativity (GR) LTT [2]. We can see that the GR, which only approximately

describes the expansion of the Universe, leads to an illusion of acceleration of the expansion of the Universe [2].

For example, the SST cosmological LTT for the BM front is

$L_{LTT,cosmological,BM(front)} = 6.753$ Gyr [2].

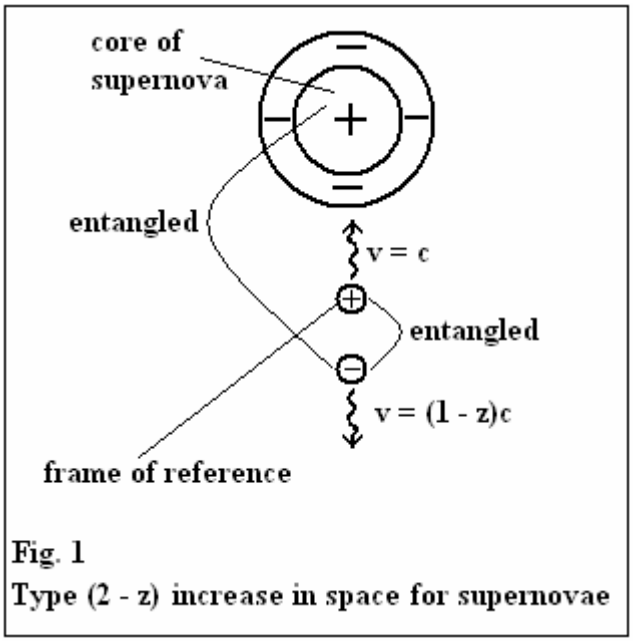

Fig. 1
Type (2 - z) increase in space for supernovae

Consider such a phenomenon for an accretion disc in a quasar (Fig. 2).

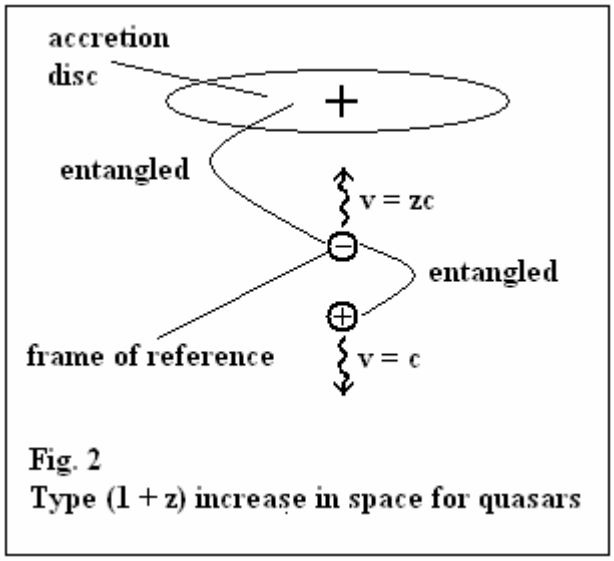

Fig. 2
Type (1 + z) increase in space for quasars

Consider a particle-antiparticle pair created near the positively charged accretion disc. The pair is created in ES (it is in the rest in relation to the ES) and is polarized in such a way that the negatively charged particle is closer to the disc and is entangled with it whereas the positively one is further away. The second photon (the frame of reference) is absorbed by the disc so the frame of reference is moving away from the Earth with speed zc whereas the first photon is moving with speed $1c$ in relation to Earth. Since the two photons are entangled so the space of the first photon in relation to the frame of reference increases as $(1 + z)$. It causes that in the formula for the SST inherent LTT appears the expression $(1 + z)$ (see this

paper). Moreover, due to the protuberances of the DM at the front of DM, the redshift for the SST inherent LTT when it is equal to the SST cosmological LTT for the $z_{Front,BM} = 0.6415$ (i.e. for $L_{LTT,inherent,BM(front)} = 6.753$ Gyr), is equal to zero i.e. quasars placed in the inherent LTT equal to 6.753 Gyr have redshift associated with the inherent LTT equal to zero!

2. The inherent light travel time $L_{LTT,inherent}$ for quasars and the "quantization" of the inherent redshift

Above we showed that in the formula describing the dependence of the inherent LTT on redshift must appear the expression $(1 + z)$. Assume that the formula looks as follows

$$L_{LTT,inherent} = a\, ln(1 + z) + b\,. \tag{1}$$

To determine the constants a and b, we need two boundary conditions. First condition follows from the fact that the inherent LTT concerns the protuberances of dark matter at the BM front so for $L_{LTT,inherent} = L_{LTT,inherent,BM(front)} = 6.753$ Gyr we have $z = 0$. It leads to conclusion that $b = L_{LTT,inherent,BM(front)}$. Next notice that applying the cosmic calculator [3] with the SST parameters: the SST time Hubble constant $H_{SST,time} = 70.52$ km s^{-1} Mpc^{-1}, $\Omega_M = 0.3137$, flat Universe [1], we obtain for infinite redshift the SST light travel time $L_{SST,LTT} = 13.197$ Gyr. When we put this value in the cosmic calculator [3] but with the General Relativity (GR) Hubble constant: $H_o = 69.6$ km s^{-1} Mpc^{-1} [4] then we obtain the maximum redshift $z_{Maximum} = 19.890$. Since maximum cosmological redshift is $z = 1$ so the maximum inherent redshift is $z_{Maximum,inherent} = z_{Maximum} - 1 = 18.890$. Such redshift should be for $T_{Age} - C_1$. Such boundary condition leads to
$a = 4.96$ Gyr $\approx L_{Spatial,then,MW\text{-}BM(front)}$.

We can see that we can rewrite formula (1) as follows

$$L_{LTT,inherent} = L_{Spatial,then,MW\text{-}BM(front)}\, ln(1 + z) + L_{LTT,inherent,BM(front)}\,. \tag{2}$$

$$L_{LTT,inherent}\,[\text{Gyr}] = 4.971\, ln(1 + z) + 6.753\,. \tag{2a}$$

Within SST we showed that photons produced in core of typical massive galaxy with active quasar (baryonic mass is about $M \approx 10^{11}$ solar masses) need about 1 Gyr to appear on "surface" of it [5]. It causes that electromagnetic pressure inside such galaxy rapidly decreases – it activates the accretion disc once more. We can see that we should observe a cascade of the increases in luminosity of the quasars. The inherent LTT between the successive bursts of a quasar should be about 1 Gyr. This condition leads to following formula for inherent LTTs with shifted luminosity of quasars

$$L_{LTT,inherent,n} = (T_{Age} - C_1) - n\, T_o\,, \tag{3}$$

$$L_{LTT,inherent,n}\,[\text{Gyr}] = 21.327 - n\, 1.02\,, \tag{3a}$$

where $T_o = 1.02$ Gyr and $n = 14, 13, 12, \ldots, 3, 2, 1, 0$ (i.e. 15 values for "quantized" z).

In Table 1, we collected the results obtained from formula (2) and (3).

Table 1. *Redshifts of quasars with shifted luminosity*

n	$L_{LTT,inherent}$ Formula (2) [Gyr]	*Z* Formulae (2) and (3)	*Z* Observed [6]
14	**7.048**	**0.06114 ≈ 0.061**	**0.061**
13	**8.068**	**0.30282 ≈ 0.30**	**0.30**
12	**9.088**	**0.59955 ≈ 0.60**	**0.60**
11	**10.108**	**0.96387 ≈ 0.96**	**0.96**
10	**11.128**	**1.41115 ≈ 1.41**	**1.41**
9	**12.148**	**1.96031 ≈ 1.96**	**1.96**
8	**13.168**	**2.63455 ≈ 2.63**	**2.63**
7	**14.188**	**3.46235 ≈ 3.46**	**3.45**
6	**15.208**	**4.47868 ≈ 4.48**	**4.47**
5	**16.228**	**5.72650 ≈ 5.73**	
4	**17.248**	**7.25852 ≈ 7.26**	
3	**18.268**	**9.13947 ≈ 9.14**	
2	**19.288**	**11.44882 ≈ 11.45**	
1	**20.308**	**14.28414 ≈ 14.28**	
0	**21.328**	**17.76523 ≈ 17.77**	

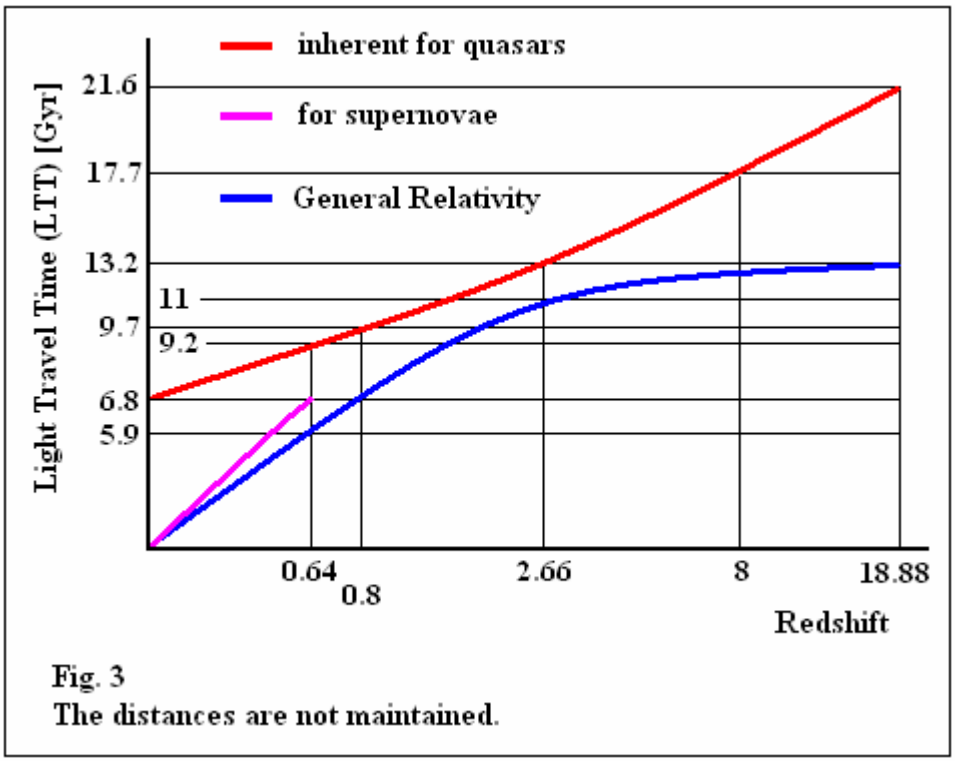

Fig. 3
The distances are not maintained.

3. Summary

It is true that quasars are the very distant rapidly moving objects in the Universe.

Halton Arp and his associates are right that the mainstream Big Bang Theory is false. Moreover, Halton Arp is right that the origin of the inherent redshift concerning quasars (according to SST, it is associated with the protuberances of dark matter at the front of the expanding baryonic matter) differs very much from the origin of the cosmological redshift (according to SST, it concerns the normal expansion of the Universe) [7].

Here, we described the mechanism which leads to the cascade of shifted luminosity of the same quasar – obtained results for distinguished redshifts are in perfect consistency with observational facts. It leads to an illusion that the Halton Arp inherent redshift associated with quasars is quantized. But we can see that intuition of Halton Arp was great.

Contrary to SST, within the General Theory of Relativity (GR) we cannot explain the origin of the shifted luminosity of quasars with strictly defined redshifts so the GR cosmology is only an approximate description of the expanding Universe.

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