Cosmic Background Radiation: Origin and Temperature

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1 The Cosmic Sector

One of the outstanding achievements of the Reciprocal System of theory is the discovery of the fact that the physical universe is not limited to our familiar world of three dimensions of space and one dimension of time, the *material* sector as Larson calls it. By virtue of the symmetry between the intrinsic natures of space and time, brought to light by Larson, he demonstrates the existence of a *cosmic* sector of the physical universe, wherein space-time relations are inverse of those germane to the material sector.

The normal features of the cosmic sector could be represented in a fixed three-dimensional temporal reference frame, just as those of the material sector could be represented in a fixed, three-dimensional spatial reference frame. In the universe of motion, the natural datum on which the physical universe is built is the outward progressional motion of space-time at unit speed (which is identified as the speed of light). The entities of the material sector are the result of downward displacement from the background speed of unity (speeds less than unity), while those of the cosmic sector are the result of upward displacement from unit (speeds greater than unity). But entities—like radiation—that move at the unit speed, being thereby at the boundary between the two sectors, are phenomena that are common to both these sectors.

Gravitation, being always in opposition to the outward space-time progression, is inward in scalar direction in the three-dimensional spatial or temporal reference frames. Since independent motion in the material sector (three-dimensional space) is motion in space, gravitation in our sector acts inward in space and results in large-scale aggregates of matter. Gravitation in the cosmic sector acts still inward but it is inward in three-dimensional time rather than in space. Consequently the cosmic sector equivalents of our stars and galaxies are aggregates in time rather than in space.

Further, as Larson points out, "…the various physical processes to which matter is subject alter positions in space independently of positions in time, and vice versa. As a result, the atoms of a material aggregate, which are contiguous in space, are widely dispersed in time, while the atoms of a cosmic aggregate, which are contiguous in time, are widely dispersed in space…

> "Radiation moves at unit speed relative to both types of fixed reference systems, and can therefore be detected in both sectors regardless of where it originates. Thus we receive radiation from cosmic stars and other cosmic objects just as we do from the corresponding material aggregates. But these cosmic objects are not aggregates in space. They are randomly distributed in the spatial reference system. Their radiation is therefore received in space at a low intensity and in an isotropic distribution. Such a background radiation is actually being received."[1]

1 Dewey B. Larson, *The Neglected Facts of Science*, North Pacific Pub., Oregon, U.S.A, 1982, pp. 72-73.

2 The Radiation Temperature

An approach to the derivation of the temperature of this cosmic background radiation is described now. This can be seen to involve the consideration of several other previously derived items like the relative cosmic abundances of the elements and their thermal destructive limits. To this extent, therefore, the present analysis has to be treated as provisional—a revision in the derivation of these items would entail a corresponding modification in the present derivation. Notwithstanding this, the general approach to the derivation described herein continues to be valid as far as it goes.

The basis for a quantitative inquiry into the properties of the phenomena of the cosmic sector, in general, is the fact that the space-time relations are inverted at the unit level. For instance, "…the cosmic property of inverse mass is observed in the material sector as a mass of inverse magnitude. Where a material atom has a mass of Z units on the atomic number scale, the corresponding cosmic atom has an *inverse mass* of Z units which is observed in the material sector as if it were a mass of 1/Z units.[2]

"Because of the inversion of space and time at the unit level, the frequencies of the cosmic radiation are the inverse of those of the radiation in the material sector. Cosmic stars emit radiation mainly in the infrared, rather than mainly at the optical frequencies .. and so on."[3] Therefore, we expect the background radiation to be at a low temperature (that is, high inverse temperature).

2.1 Averaged Energy Density

We shall attempt to calculate the temperature of the background radiation by adopting the energy density approach. The energy density in space of blackbody radiation at a temperature of T Kelvin is given by

$$U = b \times T^4 \frac{erg}{cm^3} \tag{1}$$

where b = 7.5643×10^{-15} erg-cm^{-3} K^{-4}.

The major contribution to the background radiation is from the cosmic stars. As such, we shall attempt to arrive at the average energy density of the cosmic star radiation by finding the lumped average of the energy density of the radiation from all the stars in the material sector and then taking its inverse. At this juncture we should recognize a point of crucial importance which renders the analysis simple: to an observer in the cosmic sector the atoms at the center of a material sector star are as much exposed as the ones at its periphery, and the radiation from the interior atoms is as much observable as that from the outer atoms. This is because, as already mentioned, the locations of the atoms of a spatial aggregate are randomly and widely dispersed in the three-dimensional temporal reference frame. Analogously, to an observer in the material sector all the atoms of the cosmic sector star are observable. Since (i) the temperatures in the stellar core are larger by many orders of magnitude—nearly a billion times—than the temperatures in the outer regions of a star and (ii) energy density is proportional to the fourth power of temperature (Equation (1)), no appreciable error would be introduced if the energy density of the stellar radiation, originated in one sector but as observed in the opposite sector, is calculated on the basis of the central temperature alone.

2 Dewey B. Larson, *Nothing but Motion*, North Pacific Pub., 1979, p. 190
3 Dewey B. Larson, *The Universe of Motion*, North Pacific Pub., 1984, p. 387

The temperature prevailing at the center of a star is determined by the destructive temperature T_d of the heaviest element in it that is currently getting converted to radiation by the thermal neutralization process. On theoretical grounds we expect stars "burning"—that is, undergoing thermal neutralization—elements with atomic numbers ranging all the way from 117 down to a limiting value, Z_s, to occur. Z_s is the atomic number of the element which, as explained in detail elsewhere[4], when it arrives at the center of the star, leads to a chain of events culminating in the thermal destruction of the Co/Fe group of elements, in other words, in Type I supernova explosions. No star burning an element with atomic number less than Z_s is possible because it would have disintegrated in the supernova explosions. Theoretical considerations suggest that Z_s could be between 30 and 26.[4] The relevant energy density of the radiation of a star burning element Z at its center is

$$U_z = b \times (T_{d,z})^4 \frac{erg}{cm^3} \tag{2}$$

where $T_{d,z}$ is the thermal destructive limit of element Z, in kelvin.

Now it becomes necessary to estimate the proportion each of the stars with central temperature are the same as the destructive limit of the element Z, for Z = 117 to Z_s. Since the more abundant an element happens to be, the larger would be the number of stars burning it, on the basis of the cosmic abundance of the elements that is taken to be uniform throughout the universe, we can deduce the ratio of the number of stars burning element Z to the total number of stars as

$$f_z = \frac{a_z}{S(a_z)} \tag{3}$$

where a_z is the relative cosmic abundance of element Z and S( ) stands for,

$$\sum_{Z=Z_s}^{117} ()$$

Hence the expected energy density of the radiation from all the stars can be given by

$$\begin{aligned} U &= S(f_z U_z) \\ &= \left[\frac{b}{S}(a_z)\right] S(a_z (T_{d,z})^4) \frac{erg}{cm^3} \end{aligned} \tag{4}$$

2.2 The Inverse Energy Density

Because of the reciprocal relationship between corresponding quantities of the material and cosmic sectors, the energy density of the radiation from the cosmic stars would be the inverse of this quantity. But before taking the inverse we must convert the concerned quantities into the natural units from the conventional units. Thus the energy density in natural units is

$$u = \frac{U}{(E_n S_n^{-3})} \tag{5}$$

4 K.V.K. Nehru, *Intrinsic Variables, Supernovae and the Thermal Limit*, *Reciprocity*, XVII № 1, Spring 1988, p. 20.

Where $_{En}$ = natural unit of energy expressed in conventional units[5] = 1.49175×10-3 erg

and S_n = natural unit of space expressed in conventional units[5] = 4.558816×10-6 cm

We need to recognize now that radiation in the cosmic sector is dispersed in three-dimensional time whereas the material sector progresses linearly in one-dimensional time. A one-dimensional progression in the cosmic sector has two mutually opposite "directions" in time (say, AB and BA), only one of which is coincident with the "direction" of the time progression of the material sector. The total radiation from the cosmic sector is distributed equally between the two temporal directions and consequently the energy density apparent to us would be only half of the total. That is

$$u_{app}=\frac{u}{2} \tag{6}$$

Larson brings out this point of the relationship between the actual and the apparent luminosities while discussing the quasar radiation.[6] Finally, the energy density of the radiation from the cosmic stars as observed by us is in the inverse of this quantity

$$u_c=\frac{1}{u_{app}}=\frac{2}{u} \quad \text{in natural units} \tag{7}$$

2.3 Thermal versus Inverse Thermal Distribution

At this juncture a question that naturally arises is that whether the nature of this radiation from the cosmic sector would be thermal or not. Especially, recalling what has been quoted from Reference 3 earlier, it is clear that this radiation is of the *inverse* thermal type. Under these circumstances the adoption of Equation (1) is questionable since it pertains only to thermal radiation.

On examining the values of the thermal destructive limits of the elements, we find them all larger than the unit temperature, that is, the temperature corresponding to unit speed.[4] If we remember that the demarcations of the speed ranges of the material sector are as much applicable to the linear vibratory speeds (thermal motion) as to the linear translational speeds, it becomes apparent that the central temperatures of the material sector stars are in the intermediate range, that is, on the time-zero side of the one-dimensional range.[7]

Quoting from Larson: "…ordinary thermal radiation is… produced by matter at temperatures below that corresponding to unit speed. Matter at temperatures above this level produces *inverse thermal radiation* by the same process,… with an energy distribution that is the inverse of the normal distribution applicable to thermal radiation."[8]

From the foregoing the following syllogism suggests itself:

1. The energy distribution of a cosmic sector phenomenon would be the inverse of the energy distribution of the corresponding material sector phenomenon.
2. The phenomenon under consideration is the distribution of radiation from the core of a cosmic sector star.

5 Dewey B. Larson, *Nothing But Motion*, *op. cit.*, p. 160.
6 Dewey B. Larson, *The Universe of Motion*, *op. cit.*, p. 341.
7 *Ibid.*, Figure 8, p. 72.
8 *Ibid.*, p. 246.

3. The distribution of the radiation from the core of a material sector star is inverse thermal, since it originates in the intermediate temperature range.
4. Hence the distribution of the radiation from the core of a cosmic sector star would be the inverse of inverse thermal, that is, thermal.

2.4 Comparison with Observations

Reverting to the conventional units, we have the apparent energy density of the background radiation as

$$U_c = u_c \left(E_n S_n^{-3} \right) erg\text{-}cm^{-3} \tag{8}$$

Finally the derived temperature of the background radiation, with the energy density given by Equation (8) is (adopting Equation (1))

$$T_c = \left(\frac{U_c}{b} \right)^{1/4} K \tag{9}$$

Substituting from Equations (4), (5), (7) and (8) in Equation (9) and simplifying

$$T_c = 5.4257 \times 10^{13} \left[\frac{S(a_z)}{S(a_z T_{d,z}^4)} \right]^{1/4} K \tag{10}$$

Adopting the theoretically calculated values of a_z, the relative cosmic abundance[9] and $T_{d,z}$, the thermal destructive limits[4] of the elements, the background temperature T_c are worked out for Z_s = 117, 116,… , 26. The listing of a Pascal program for this calculation is given in the Appendix. Some of the computed values of T_c are listed in Table 1 for Z_s values ranging from 31 to 26.

Table 1: Computed Values of the Cosmic Background Radiation Temperature

Z_s	T_c (Kelvin)
31	2.989
30	2.798
29	2.614
28	2.435
27	2.587
26	2.739

The most probable candidate for Z_s, either from the theoretical considerations[4] or from the empirical cosmic abundance data turns out to be 30. The expected temperature of the background radiation corresponding to Z_s = 30 can be seen to be 2.798 Kelvin. The observed values reported in the literature range from 23.74 to 2.9 Kelvin. It is instructive to note that the value of this temperature calculated on the basis of the element Fe (that is, Z_s = 26) which according to Larson is the element responsible for

9 K.V.K. Nehru, *Relative Abundance of the Elements*, *Reciprocity*, XII № 3, Winter 1985, p. 28.

the supernova explosion, turns out to be 2.74 Kelvin. This is in fair agreement with the recently published value of 2.75 Kelvin estimated from accurate observations.[10] Even though the derivation of the temperature of the background radiation described herein is cursory, if suffices to demonstrate that it could be derived from theory alone in the context of the Reciprocal System.

3 Conclusions

To highlight some of the important points brought out:

3.1 The stars of the cosmic sector of the physical universe are aggregates in time and are observed atom by atom, being randomly distributed in the three-dimensional space.

3.2 The radiation from these is observable as the cosmic background radiation: its absolute uniformity and isotropy resulting from item 3.1 above.

3.3 The distribution pattern of this radiation is inverse of inverse thermal, that is, thermal.

3.4 Since the radiation originating from the cosmic stars gets equally divided between the two opposite "directions" of any single time dimension, the apparent luminosity as observed from the spatial reference system of our material sector (which progresses "unidirectionally" in time) is half of the actual luminosity.

3.5 The energy density of the background radiation is the apparent energy density of the cosmic star radiation, which is the reciprocal of the energy density of the material star radiation after accounting for item 3.4 above.

3.6 The temperature of the background radiation computed for $Z_s = 30$ is 2.798 Kelvin and for $Z_s = 26$ is 2.739 Kelvin (where Z_s is the atomic number of the element at stellar core responsible for Type I supernova). These are in close agreement with the observational value of 2.75 Kelvin.

10 David T. Wilkinson, *Anisotropy of the Cosmic Blackbody Radiation*, *Science*, Vol. 232, 20 June 1986, pp. 1517-1522.