Relative Abundance of the Elements

Prof. K.V.K. Nehru, Ph.D.

A general physical theory, like the Reciprocal System, should satisfy two types of criteria in order to establish its truth. Firstly, it should be able to explain completely those physical phenomena that remained recalcitrant without explanation in the previous theories. More desirably, it should lead to predictions which are definitely in conflict with those of the preceding theories but can be validated by observation or experimentation. The second type of requirement to be satisfied by the general theory is that it is not inconsistent with any of the definitely established physical facts. This may be called the negative criterion, whereas the previous one may be called the positive criterion.

It can be seen that the positive criterion, being more powerful in establishing the new theory, demands greater attention (and challenge) from the point of view of its proponents. The negative criterion, on the other hand, is a rather weak condition for positively establishing the new theory. Further, in view of the extremely vast number of genuine physical facts that were recognized, it is neither possible nor worthwhile to bestow more than a limited amount of consideration—especially in the early stages of the development of the new theory—to showing that the theory is not inconsistent with any of these facts. However, the negative criterion, though a weak one in establishing the new theory, is all-powerful in invalidating it if a single instance of inconsistency is found. For this reason the adherents of the conventional theory not infrequently, tend to invoke the negative criterion, having already armed themselves with some sort of explanations for some of these facts. They often ask how the new theory accounts for some of such recognized facts. In such instances—especially when information of a quantitative nature is involved—it is incumbent on the proponents of the new theory to pay more consideration and work out the details to demonstrate that the negative criterion is well satisfied.

I wish to bring to your attention two such questions which lectures on the astronomical aspects of the Reciprocal System invariably seem to elicit. The first one of these is about the genesis of the elements and their relative cosmic abundance. The second concerns the background microwave radiation and the value of its temperature. These, therefore, seem to warrant greater consideration in working out the details in the context of the Reciprocal System. The detailed study of the cosmic abundance problem is also important from the point of view of stellar evolution and energy generation processes.

In the following I attempt a cursory analysis of the cosmic abundance problem, giving nothing more than a general outline of the argument.

According to the Reciprocal System (i) the element building process starts with the formation of hydrogen from the decay products of cosmic matter—namely, the massless neutrons and their equivalents—ejected into the material sector;[1] (ii) the assembling of the elements with higher atomic numbers then continues by the successive additions of the positive rotational displacement units (PDU).[2] Let:

N_d = the total number of PDU in the material sector of the universe, locked up in the material atoms

N_t = the total number of atoms in the material sector

1 Larson, Dewey B., *Nothing But Motion*, (Portland, OR, North Pacific Publishers, 1979), p. 215.

2 Larson, Dewey B., *The Structure, of the Physical Universe*, (Portland, OR, North Pacific Publishers, 1959), pp. 105-108.

N_e = the number of rotational displacement units ejected into the cosmic sector from the material sector

= the number of rotational displacement units ejected into the material sector from the cosmic sector (under steady state conditions)

N_n = the number of free PDU in the material universe involved in transmuting the elements

N_z = the number of atoms of the element with atomic number Z

a_z = the relative cosmic abundance of the element Z = N_z/N_t

We will consider the element with atomic number Z. We find that its population, N_z, is being increased by the atoms that get transmuted to element Z from lower Z values. At the same time N_z is being decreased by those atoms that get transmuted to atomic numbers higher than Z. In addition, some atoms of element Z are lost through Type II explosions. Since the universe as a whole is under steady state, the number N_z can be taken as constant. This means that the inflow must be equal to the outflow.

1 Total PDU

The total number of the positive rotational displacement units contained in all the atoms in the material sector is given by

$$N_d = \sum_z Z\,N_z = N_t \sum Z\,a_z \tag{1}$$

2 Transmutation, Outgoing

O_z, the number of atoms of element Z that are outgoing by getting transmuted to element(s) of higher atomic number by combining with the free PDU can be arrived at as follows:

Let D_z be the number of PDU captured by the atoms of element Z, out of N_n, the total number of PDU available for transmutation. Then, the ratio D_z/N_n must be equal to the ratio of the PDU locked up in all the atoms of element Z to the total number of PDU in the material sector. That is,

$$\frac{D_z}{N_n} = \frac{Z\,N_z}{N_d}\,, \quad or \quad D_z = Z(N_t\,a_z)\frac{N_n}{N_d} \tag{2}$$

Now, the major portion of the outgoing atoms from element Z end up as atoms of element Z+1. This involves the capture of a single PDU by each atom. Let this number of atoms be ${}_1O_z$. In addition, it is also probable that a small fraction of the atoms capture simultaneously two PDU, resulting in transmutation to element Z+2. Let this number be ${}_2O_z$. Thus O_z is made up of two parts, ${}_1O_z$ and ${}_2O_z$, such that

$${}_1O_z = k\,O_z \quad and \quad {}_2O_z = (1-k)\,O_z \tag{3}$$

where *k* is a distribution fraction.

Of the number of D_z, we take that the number of PDU involved in the single capture event is ${}_1D_z$ and the number involved in the double capture event is ${}_2D_z$. Then ${}_1D_z = {}_1O_z$, whereas ${}_2D_z = 2 \times {}_2O_z$. Using Equation (3) we have

$$D_z = {}_1D_z + {}_2D_z = {}_1O_z + 2\times{}_2O_z = [k + 2(1-k)]\,O_z = (2-k)\,O_z$$

Substituting for D_z from Equation (2),

$$O_z = \left[N_t \frac{N_n}{N_d} (2-k) \right] Z a_z \tag{4}$$

3 Transmutation, Incoming

From what has been said above, it can be seen that the number of atoms, I, coming in by getting transmuted to element Z from elements of lower atomic number comprises two separate streams: $1_{z\text{-}1}$, the number that is coming in from element Z-l due to single capture, and $I_{z\text{-}2}$, the number coming in from element Z-2 due to double capture (see Figure 1).

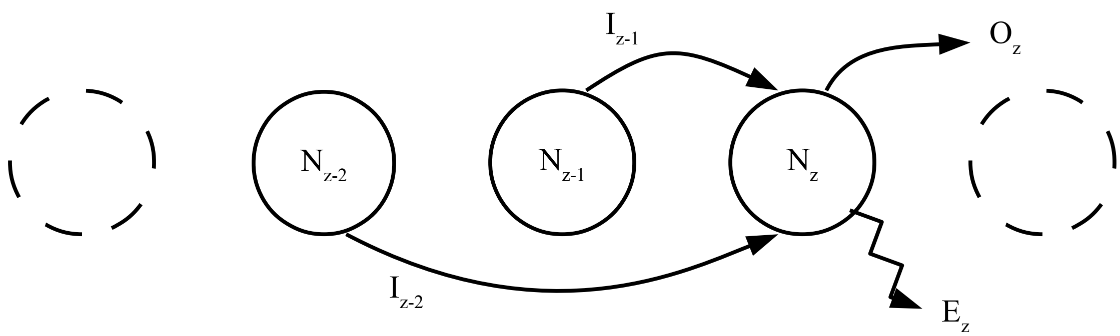

Figure 1: Population Flow to and from Element Z

From Equation (3) we note that

$$I_{z-2} = {}_2O_{z-2} = (1-k) O_{z-2} \quad \text{and}$$
$$I_{z-1} = {}_1O_{z-1} = k\, O_{z-1}$$

Thus, the total number of incoming atoms adding to the population of element Z is, (substituting Z+2 and Z+l respectively, for Z in Equation (4))

$$\begin{aligned} I &= I_{z-2} + I_{z-1} \\ &= \left[N_t \frac{N_n}{N_d} (2-k) \right] \left[(1-k)(Z-2) a_{z-2} + k(Z-1) a_{z-1} \right] \end{aligned} \tag{5}$$

4 Ejection

We will assume that the relative abundance in the matter that is ejected to the c-sector by the Type II explosions is the same as that in the material sector of the universe in general. If is the number of atoms of element Z that are ejected, we have the total number of PDU that are leaving the material sector by way of ejection as

$$N_e = \sum_z Z E_z \tag{6}$$

If the matter is uniformly distributed, we have E_z proportional to N_z; that is, $E = g \times N_z$, where g is a fraction less than 1.0. Then

$$E_z = g N_t a_z \tag{7}$$

Therefore, from Equation (6) above,

$$N_e = \sum Z(g N_t a_z) = g N_t \sum Z a_z$$

Hence, from Equation (1), $N_e = g \times N_d$, or $g = N_e/N_d$. Finally, from Equation (7),

$$\begin{aligned} E_z &= \left(N_t \frac{N_e}{N_d}\right) a_z \\ &= \left[N_t \frac{N_n}{N_d}(2-k)\right]\left[N_e \frac{(2-k)}{N_n}\right] a_z \end{aligned} \tag{8}$$

5 Equilibrium

By steady state we mean, in the material sector, uniformity with respect to time. Under steady state conditions, therefore, the relative abundance does not vary. That is, N_z, the number of atoms of the element Z is constant. (That is, N_z, the number of atoms of the element Z, is constant.) In other words, I = $O_z + E_z$ (see Fig. 2). Thus, from Equations (4), (5) and (8),

$$\begin{aligned} &\left[N_t \frac{N_n}{N_d}(2-k)\right]\left[(1-k)(Z-2)a_{z-2} + k(Z-1)a_{z-1}\right] \\ &\quad = \left[N_t \frac{N_n}{N_d}(2-k)\right]\left[Z a_z + \left(N_e \frac{(2-k)}{N_n}\right) a_z\right] \end{aligned} \tag{9}$$

or

$$a_z = \frac{(1-k)(Z-2)a_{z-2} + k(Z-1)a_{z-1}}{Z+\sigma}$$

where

$$\sigma = N_e \frac{(2-k)}{N_n} \tag{10}$$

6 Hydrogen

Since with Z = 1, hydrogen is the first element, the case of inflow from elements of lower atomic number does not arise. On the other hand, the displacement units ejected from the c-sector form the incoming flow. Since, of the N_e displacement units entering the material sector, N_n PDU are used up for the purpose of transmutation, the number of PDU that eventually transform to hydrogen atoms is N_e - N_n. Therefore, from Equations (4) and (8), balancing the inflow and the outflow,

$$N_e - N_n = \left[N_t \frac{N_n}{N_d}(2-k)\right]\left[1 a_1 + \left(N_e \frac{(2-k)}{N_n}\right) a_1\right]$$

or,

$$\frac{N_e - N_n}{N_n}(2-k)\frac{N_d}{N_t} = (1+\sigma)a_1$$

Substituting from Equations (1) and (10),

$$a_1 = \frac{\sigma-(2-k)}{\sigma+1}\sum Z a_z \quad (11)$$

Since a_z is a function of a_1, a_1 cancels out from both sides of the Equation (11). The equation, therefore, serves as the compatibility criterion between values of σ and *k*.

Further, since $N_t = \Sigma N_z$,

$$\sum a_z = 1 \quad (12)$$

Equation (12) is the normalizing condition which fixes the value of a_1, and hence of all a_z, for given values of σ and *k*.

7 Comparison with Empirical Data

The values of the two parameters σ and *k* in the above equations are to be arrived at by logical processes from the postulates of the Reciprocal System. This still remains to be done. Meanwhile, a good agreement with the empirical values of the relative cosmic abundance[3] can be demonstrated by appropriate choice of σ and *k*. The theoretical curve is plotted in Figure 2, with σ = 9.5 and *k* = 0.9.

3 *American Institute of Physics Handbook*, 1963.

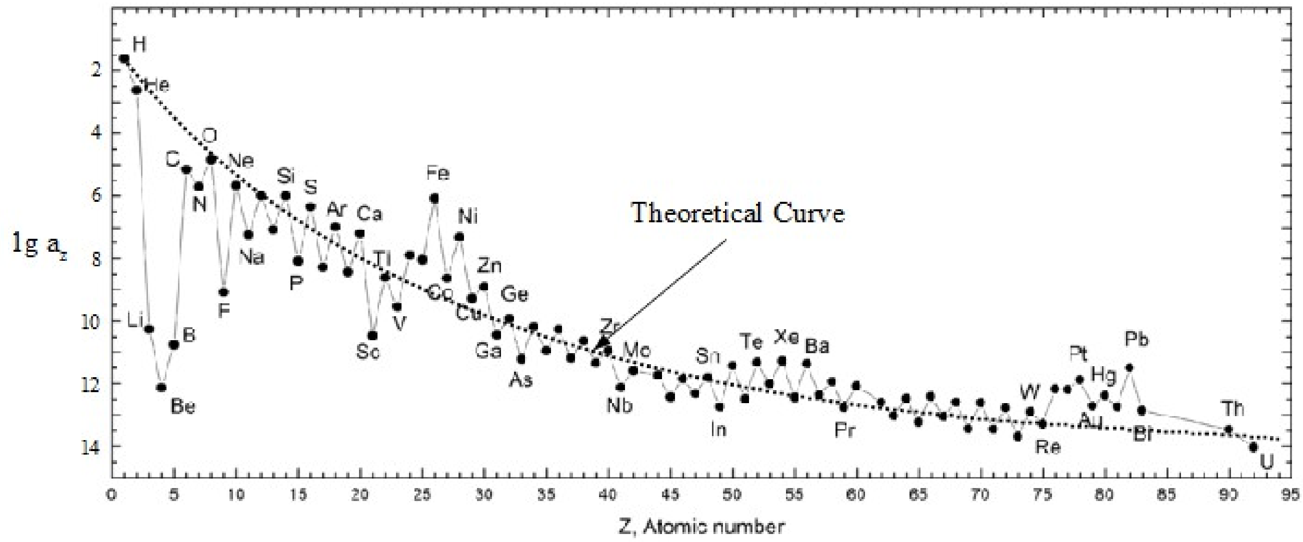

Figure 2: Relative Abundance

It must be noted that, in the figure, the abundance values are plotted on a logarithmic scale and hence the discrepancy between the theoretical and the observational values wherever it occurs should not be underestimated. However, it is clear that, as far as it goes, the trend of the theoretical curve conforms well to the actual.

Further refinement is in order in considering the possibility of transmutation by triple or multiple capture of PDU, which have a nonzero probability at the higher Z values. In fact, the comparatively higher abundance of the Even-Z elements over those of the Odd ones can be explained on the basis of the corresponding distribution in the values of k for the single, double, or higher multiple capture events. Remembering that the atomic number is the net total electric displacement units, and Even-Z can be seen to correspond to an Odd speed 1/(1+Z). As Larson explains,[4] Odd speeds (like 1/3 or 1/5) are the direct result of scalar directional reversals, whereas Even speeds (like 1/4 or 1/6) are obtained only by way of compounding two Odd speeds. As such, the probability of an Odd speed (Even-Z) is comparatively higher than that of an Even speed (Odd-Z).

Among the assumptions made, the first is that the relative abundance is uniform in the universe. The second one is that the magnetic ionization level is zero. This may be true only in the case of interstellar and intergalactic matter, most of which lies undetected. Consequently, the contribution of this matter to the cosmic abundance is not reflected adequately in the observational values. The zero ionization level assumption, therefore, is likely to give rise to a large error in the predicted values, especially at the higher atomic numbers. Evaluation based on the consideration of the atomic weight rather than the atomic number will be more appropriate to the situation as it takes care of the rotational displacement present as the gravitational charge as well.

Another important factor that has not been taken into account in this preliminary analysis is the disintegration of matter that occurs on attaining the destructive thermal limit (as in the stellar energy generation process). Also to be considered is the effect of supernova explosions on the abundance of the Fe group of elements, and the possibility that the relative abundance in the matter ejected out of the material sector in Type II explosions is considerably different from that applicable at large.

---

4 Larson, *Nothing But Motion*, *op. cit.*, p. 98.