The Lifetime of the Neutron

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Theoretical findings of the Reciprocal System indicate that the neutron exists in two forms: as the *massless* type, M ½-½-0, and as the *compound* type, M 1-1-(1) == C (½)-(½)-1. As matters now stand, while the massless neutron is unobserved, the compound neutron is identified as the observed neutron. Larson[1] shows how the mass of the compound neutron, calculated from the Reciprocal System, agrees with the observed value. This paper attempts to arrive at the compound neutron's lifetime on the basis of the same theoretical system and thus add a further element of validation to the identification of the compound neutron.

The motional structure of the compound neutron is rather unusual. First, while its net total displacement is only one unit, like that of the sub-atomic particles, it has two rotating systems like the atoms. Secondly, it is the only structure (of those that have been identified so far) in which the two rotating systems are completely "heteroscalar," that is, while one system is built up on the material rotational base (with negative vibration and positive rotation), the second system is built up on the cosmic rotational base (with positive vibration and negative rotation).

Since basically the gravitation of the cosmic type structure is inward in time, cosmic rotational units cannot exist in the material reference frame (with its outward time progression) for not more than one natural unit of time under ordinary circumstances. This, however, does not apply in the case of the cosmic neutrino type rotation that constitutes the second rotating system of the compound neutron, for its net effective three-dimensional rotational displacement is zero. Nonetheless, the association of M 1-1-(1) and C (½)-(½)-1 should not last for more than one natural unit of time. The reason is that the corresponding displacements of the two systems, both in the case of the basic photon vibration and in the case of a rotation in any of the dimensions, are respectively of opposite space-time directions. Since the relation of space to time constitutes motion, the two rotating systems must dissociate after the elapsing of one natural unit of time.

The situation, however, is not quite so simple: the two rotating systems belong to different space-time regions, and the motion that is effective across the regional boundary is determined by the interregional factors arising out of the limitation on the number of directions that can be transmitted. We may recall that a material rotating unit—either an atom or a subatomic particle—exists inside one natural unit of space, i.e., the "time region," whereas a cosmic rotating unit exists in the "space region," which is inside of one natural unit of time. Now the crucial point to be recognized is that the expulsion of the c-neutrino motion (from the compound neutron) takes place only if the direction of the c-neutrino motion, interacting across the inter-regional boundary, happens to be antiparallel to the direction of the motion of the proton motion, and not otherwise. Thus the lifetime of the compound neutron is the time elapsed before the eventual occurrence of this antiparallel encounter that results in the neutron's decay.

Had the cosmic type rotation in the second rotating system of the compound neutron been a one-dimensional motion, the encounter and resultant decay would take place within one natural unit of time. But the neutrino-type rotation, i.e., C (½)-(½)-1, is three-dimensional, and it is known that the full influence of spatial (or temporal) effects does not get transmitted across the boundary, except when it involves only one dimension. On the other hand, only a fraction of 1/c in the case of two-dimensional

1 Larson, Dewey B., *Nothing But Motion* (North Pacific Publishers, Portland, OR, 1979), p. 167.

effects, and a fraction of $1/c^2$ in the case of three-dimensional effects gets transmitted.[2] As such, the effect of the c-neutrino motion existing in the space region and interacting with the proton motion existing in the time region is reduced by a factor of $1/c^2$.

Here, we must recall that,

> …the non-rotating photon remains in the same absolute location permanently… The rotating photon, on the other hand, is continually moving from one absolute location to another as it travels back along the line of the progression of the natural reference system, and each time it enters a new absolute location the vectorial direction is re-determined by the chance process. Inasmuch as all directions are equally probable, the motion is distributed uniformly among all of them…[3]

In the present case, although the net effective rotational displacement of the c-neutrino motion is zero, its net total rotation is one negative unit, and after the elapse of each natural unit of time (n.u.t.), its direction is re-determined by chance. Therefore, inasmuch as the chances of the orientation of the c-neutrino motion taking the correct direction in three-dimensional time, required for an antiparallel encounter referred to earlier, are reduced by a factor of $1/c^2$, the probable time for this encounter to happen is increased from one n.u.t. to c^2 n.u.t.

However, it must be noted that the number of possible orientations that the proton rotation can take in three-dimensional time is not just one but is given by the interregional ratio, *R*.[4] As any of these orientations in the time region can deal with the incoming c-neutrino motion, the chances of the antiparallel encounter are increased by the factor *R*. In other words, this means that the previous lifetime arrived at, c^2 n.u.t. is decreased to c^2/R n.u.t (or $c^2 \times t_{nat}/R$ seconds, where t_{nat} is one n.u.t. as expressed in the c.g.s. units).

(It can readily be seen that since c^2/R represents the total number of possibilities of equal probability for the antiparallel encounter, R/c^2 is the probability that the neutron decays in one unit of time. Thus it can be identified with λ the classical decay constant).

The value of R pertinent here is not the 128 (1 + 2/9) value computed in *Nothing But Motion*.[4] Firstly, the proton, M 1-1-(1) is a single rotating system unlike the atoms, which are double rotating systems. As such, only one of the nine possible vibrational positions is occupied, bringing the total number of orientations to 128 (1 + 1/9). Secondly, of the two mutually opposite directions in any dimension of the basic photon vibration, only one results in an antiparallel alignment (the other resulting in a parallel alignment). Consequently, the effective vibrational contribution reduces by half. Thus the value of *R* applicable to the present situation is 128 (1 + 1/18) = 135.1111.

Adopting the values of c and t_{nat} from *Nothing But Motion*,[5] we have the mean lifetime of the compound neutron as

$$\begin{aligned}\tau &= \left[\frac{\left(2.99793\times 10^{-10}\right)^2}{135.1111}\right]\left(1.520655\times 10^{-16}\right) \\ &= 1.01154\times 10^{3}\,sec. \quad or \quad 16.859\,min.\end{aligned} \tag{1}$$

2 Larson, Dewey B., *New Light on Space and Time* (North Pacific Publishers, Portland, OR, 1979), p. 185.
3 Larson, *Nothing But Motion*, *op. cit.*, p. 58.
4 *ibid.*, p. 154.
5 *ibid.*, p. 160.

Or the same result can be expressed in terms of half-life T as

$$\begin{aligned} T &= \tau \ln(2) \\ &= 1.01154 \times 10^{3} \ln(2) \\ &= 701.145\, sec. \quad or \quad 11.686\, min. \end{aligned} \tag{2}$$

This compares very favorably with the experimental value of 11.7 ± 3 min.[6] with a discrepancy of -0.144 percent.

Addendum

Besides the compound neutron and the mass-one hydrogen isotope belonging to the “intermediate” rotating systems, there appears to be another theoretical possibility. The two rotating systems of this particle are made up of the material neutrino-type rotation and the cosmic electron rotation respectively. Thus it can be designated: M ½-½-(1) == C 0-0-1. As can be seen, while the net displacement of one system is zero, there is a net positive displacement in the other system. As the net total displacement of the combination is equivalent to that of the neutron, M ½-½-0, this seems to be another version of the compound neutron. But due to the small mass and the extremely short lifetime of this combination, it might easily escape detection.

The potential mass of both the neutrino and the c-electron is actualized when the rotations of these particles enter into combination, constituting this compound neutron. In addition, there is an initial electric unit as the two rotational bases are heteroscalar. The resulting mass is 0.00231482.

Since the c-electron has effective rotation in only one dimension, the mean lifetime of this compound particle, calculated on the basis of the considerations developed in the paper is:

$$\tau = \frac{t_{nat}}{R} = \frac{1.5206655 \times 10^{-16}}{135.1111} = 1.1255 \times 10^{-18}\, sec. \tag{3}$$

6 *American Institute of Physics*, Handbook., pp. 8-118