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Abstract

It is inferable that the birth of the universe is caused by the pair-creation of photon and anti-photon based on the time-energy uncertainty relation. Since photon $F_{\mu\nu}$ and anti-photon $F_{\nu\mu}$ are corresponding to positive and negative energy respectively, we can conclude that the Universe was born as the pair of photon and anti-photon. Then the photon and the anti-photon must be come into the world simultaneously. Since $F_{\nu\mu} = -F_{\mu\nu}$, they will be transmitted as an ordinary photon. If the primeval time interval is Planck-time, the primeval 4-dimensional energy can be estimated as $E \approx 10^{147}$ GeV. The transformation from the primeval photon (laser) to neutron is considered to occur by SSB, and it can be derived that the transformation occurred at the time 10^{-11} seconds after the birth of the Universe.

The Birth of the Universe and the Following Expansion

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1 INTRODUCTION

On the explanation that an elementary particle is made from a single or a compound looped photon [Yotsumoto(2013)], we can consider that the fundamental equation of energy can be summarized to only the Maxwell equations. Accordingly, it is inferable that the Universe was born as a pair creation of photon and anti-photon on the basis of uncertainty principle from the three-dimensional Euclidean space.

2 THEORY

Since the solutions to the time-energy uncertainty relation are $Et \geq h/2$ and $(-E)(-t) \geq h/2$, the pair-creation of photon and anti-photon can be shown as follows. Electromagnetic field tensor is written as antisymmetry contravariant tensor, $F_{\mu\nu} = -F_{\nu\mu}$. That is, since $F_{\mu\nu}$ and $F_{\nu\mu}$ are corresponding to photon and anti-photon respectively, they are corresponding to positive and negative energy respectively. Therefore, the relation of energy and time in each case of photon or anti-photon can be written as photon=$(E)(T)$ or anti-photon=$(-E)(-t)$ respectively. Accordingly, this pair can be shown as Fig.1. From this event, we can conclude that the Universe was born as the pair of photon and anti-photon. Then the photon and the anti-photon should be come into the world simultaneously. Since $F_{\nu\mu} = -F_{\mu\nu}$, Fig.1 can be shown as Fig.2, so they will be transmitted as an ordinary photon.

If the primeval time interval is Planck-time 10^{-43} sec, the primeval 4-dimensional energy can be estimated as $E = h\nu^4 = 1.048 \times 10^{-25} \times (10^{43})^4 \approx$

10^{147} GeV. Then the energy density decreases with time as $\rho \propto t^{-4}$. The transformation from the primeval photon (laser) to neutron can be considered to occur by SSB at the time of $\rho \leq 10^{19}$ GeV (the point at which quantum corrections to general relativity should render it invalid [Kolb & Turner(1990)]); the corresponding time can be estimated as $t =^4 \sqrt{10^{147}/10^{19}}/10^{43} = 10^{-11}$ sec. That is, the transformation must occur one-ten billionth seconds after the birth of the Universe, and the corresponding radius of the Universe will be about 3 mm.

The density of the total energy of the primeval photon decreases with the radius of the Universe as $\rho \propto R^{-4}$. While the distribution density of neutron decreases with radius as $\rho \propto R^{-3}$. This means that the quarter of total photon's energy must be emitted as the thermal radiation because the temperature of the space decreases as $T \propto R^{-1}$. This thermal radiation is just the cosmic microwave background radiation (CMBR).

3 CONCLUSIONS

1. The Universe was born as pair-creation of photon and anti-photon on the basis of time-energy uncertainty relation.

2. The transformation from photon to neutron is inferable to be one-ten billionth seconds after the birth of the Universe. (The corresponding radius is 3 mm.)

3. The total energy of the universe is amounts up to 10^{147} GeV.

References

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[Kolb & Turner(1990)] Kolb,E.W., and Turner,M.S. (1990). The Early Universe(Westview Press)

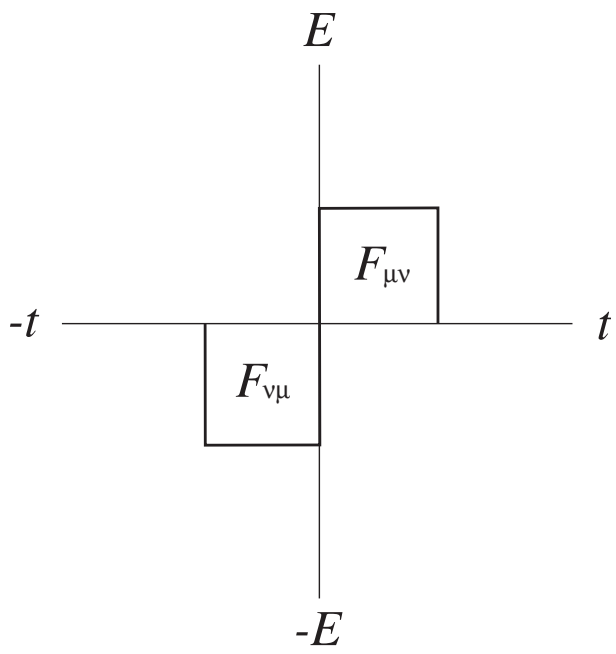

Figure 1: Photon, $F_{\mu\nu}$, and anti-photon, $-F_{\nu\mu}$, were born simultaneously.

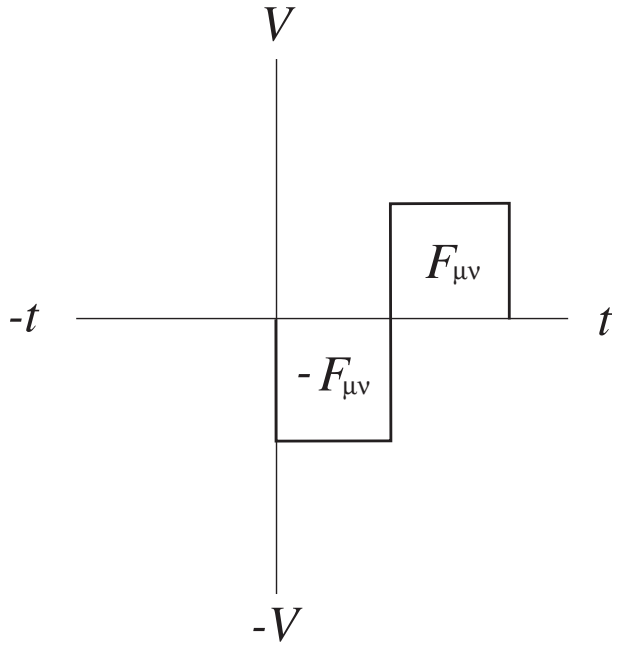

Figure 2: Since $F_{\nu\mu} = -F_{\mu\nu}$, Fig.1 can be shown as Fig.2, so they will be transmitted as ordinary photon.

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