The evolution process of Left - Right neutrinos' modeling population

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Abstract: In this letter we investigate the Left-Right Symmetric Model, in the framework of evolution theory. We calculate the sufficient number of K-meson decays, where heavy Right hand Majorana neutrinos are suppressed. The evolution pattern of Left-Right neutrinos modeling population is also studied. The proposed evolution pattern yields to the possible heavy Right hand Majorana neutrinos observation in single isolated K-meson decay in energy scale of 14 TeV.

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In modern particle physics, a challenging task is to discover the neutrinos of positive helicity (known as right currents). Until recently, the Standard Model (SM) [1-3] of particle physics assumed only neutrinos of negative helicity (known as left currents). Other physicists extend the electroweak theory, building a model with Left-Right symmetry [4-15] that is, incorporating neutrinos of positive helicity (known as right currents). In this letter we investigate a Left-Right Symmetric model [4-15], in the framework of evolution theory. We calculate the sufficient number of K-meson decays where heavy Right hand Majorana neutrinos are suppressed. The proposed evolution pattern of Left-Right neutrinos modeling population is also studied. Such pattern yields to the possible heavy Right hand Majorana neutrinos observation in single isolated K-meson decay in high energy scale of 14 TeV.

Here the 'Left-Right Symmetric model' is based to the gauge group

$SU(3)_c \times SU(2)_L \times SU(2)_R \times U(1)_{B-L}$. (1)

Either is an extension of standard model gauge group or a subgroup of SO (10) and E_6 groups [16], [17], [4].
The gauge group SU $(2)_L \times$SU $(2)_R$ proposes an additional right hand W_R gauge boson which carries the weak V +A currents [6]. The W_R and W_L are mixing to produce the nature state, the mixing angle ζ of left-and right-handed bosons ($\zeta < 3\times10^{-3}$) [18]. As the mixing angle ζ of left-and right-handed bosons is very small, the light (SM) W is the pure W_L and the heavy vector-boson is W_R with mass about ($M_W^R < 715$ GeV) [18]. The model is proposing heavy Right hand Majorana neutrinos, based to the K-meson decay in high energy scale of 14 TeV.

If the lower limit on the mass of heavy vector-boson ($M_{W_R} < 715$ GeV) [18] and the upper limit on the mixing angle ζ of left-and right-handed bosons ($\zeta < 3\times10^{-3}$) [18] are taken into account, one finds the asymmetry parameter lambda (λ) to be very close to minus unity ($-1 < \lambda < -0.98$).

In the above left-right framework [4-15], we introduce a modeling left-right neutrino population which obeys the Hardy-Weinberg law [19] given by

$p^2LL + pq\,(LR+ RL) + q^2RR=1$. (2)

Where p the frequency for left (SM) neutrino state and q the frequency for Right heavy Majorana neutrino state given by $q=1-p$, and pq the frequency of the mixing between Left and Right neutrino states. The Hardy-Weinberg law [19] for the hypothetical Left-Right modeling neutrino population represents the *status quo* of a given Left-Right initial selections. However, a possible transition from L to R neutrino states is corresponding with changes in the frequency p and q. The evolution process of Left-Right neutrinos modeling population is the result of the above opposed directions action on the system [19]. Let the transition $L \rightarrow$ R with a rate u in K-meson decay, in every decay the changes of Left (SM) frequency p in the modeling population given by

$dp=-up$ (3)

if nothing can stop the transition $L \rightarrow$ R the population could be equally distributing for right (SM) neutrinos if the frequency p_0 is for the K-meson decays. After n such decays is given by

$p_n=p_0(1-u)^n$ (4)

The transition rate $L \rightarrow$ R is very small about (10^{-4}-10^{-7}), therefore to observe a transition we need a lot of decays. For example: if the contribution of mixed between left and Right states is $W_1=1$, then the contribution of heavy Right hand Majorana neutrinos is $W_2= W_1-s$, s is the Left-Right selective coefficient.

If the Darwinian fit for *LL* and *LR +RL* is 1, and for *RR* is *1-s* the corresponding frequency *p*,*q* and frequency *pq* before and after the new Left-Right selective are given by the Table.1

Table.1. The Left-Right modeling population evolution pattern

Neutrino states	*LL(SM)*	*LR+RL (mixing)*	*RR(heavy)*	*N(population)*
Darwinian fit	*1*	*1*	*1-s*	*W'*
Initial frequency	p^2	*2pq*	q^2	*1*
Final frequency	p^2	*2pq*	$(1-s)\,q^2$	$1-sq^2$

The P_1 left (SM) neutrino frequency, in the next K-meson decay is given by

$P_1=(p^2+pq)/(1-sq^2)=p/(1-sq^2)$. (5)

The increasing Dp of the Left (SM) neutrinos state in one K-meson decay is given by

$Dp=spq^2/(1-sq^2)$ (6)

The sufficient number of K-meson decay for the above heavy Right hand Majorana neutrinos pattern is given by

$N=q_0-q_n/\ q_0\ q_n+log(1-q_n/1-q_0$ (7)

In the case of $s=0,1$ the above equation becomes

$N=q_0-q_n/\ q_0\ q_n$. (8)

The progress of the Left-Right selective coefficient is fast in the beginning when the pure heavy Right hand Majorana neutrinos state is common in the modeling population, and becomes slow when the pure heavy Right hand Majorana neutrinos state is suppressed .

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