**Invariant Lagrangian for Neutrinos Field in Terms of Divisors**

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**Abstract:** In previous works, Weyl’s equation for neutrinos has been written in tensor form, in the form of non-linear Maxwell’s like equations, through isotropic complex vector $\vec{F} = \vec{E} + i\vec{H}$. Complex vector $\vec{F} = \vec{E} + i\vec{H}$ satisfies non-linear condition $\vec{F}^2 = 0$, equivalent to two conditions for real quantities $\vec{E}^2 - \vec{H}^2 = 0$ and $\vec{E} \cdot \vec{H} = 0$, obtained by equating to zero separately real and imaginary parts in the equality $\vec{F}^2 = 0$. In development of the above ideas, in this work, we wrote the Lagrange function for neutrinos field in terms of divisors.

**Keywords:** Invariant Lagrangian, neutrinos field, divisors.

### I. Introduction

In previous works, Weyl’s equation for neutrinos has been written in tensor form, in the form of non-linear Maxwell’s like equations through isotropic complex vector $\vec{F} = \vec{E} + i\vec{H}$. It has been proved, that complex vector $\vec{F} = \vec{E} + i\vec{H}$ satisfies non-linear condition $\vec{F}^2 = 0$, equivalent to two conditions for real quantities $\vec{E}^2 - \vec{H}^2 = 0$ and $\vec{E} \cdot \vec{H} = 0$, obtained by equating to zero separately real and imaginary parts in equality $\vec{F}^2 = 0$. It has been proved, that the vectors $\vec{E}$ and $\vec{H}$ have the same properties as those of vectors $\vec{E}$ and $\vec{H}$, components of electromagnetic field. For example, under Lorentz relativistic transformations, they are transformed as components of a second rank tensor $F_{\mu\nu}$. In addition, it has been proved that, the solution of these non-linear equations for free particle as well fulfils Maxwell’s equations for vacuum (with zero at the right side). In development of the above ideas, in this work, we shall write Lagrange function for neutrinos field in terms of divisors.

### II. Research Method

In this work, we shall investigate the possibility of elaboration of Lagrange formalism for neutrinos field in tensor formalism, through divisors. Via Cartan map, spinor Weyl’s equation for neutrinos has been written in tensor form, in the form of non-linear Maxwell’s like equations, through isotropic vector $\vec{F} = \vec{E} + i\vec{H}$. Further, these non-linear equations have been written in covariant form, through divisors $K_{\mu}$ and $m_{\mu}$. In this work, using the method of tensor analysis, we shall write the Lagrange function for neutrinos field in tensor form, through divisors $K_{\mu}$ and $m_{\mu}$.

**Lagrange Function for Neutrinos Field through Divisors**

In previous works, Weyl’s equation for neutrinos has been written in vector form, through isotropic complex vector $\vec{F} = \vec{E} + i\vec{H}$ as follows

$$p_0 \xi^\mu = (\vec{p} \vec{d} \xi)^\mu. \quad (1)$$

$$D_0 F = \frac{i}{\alpha} \vec{d} \vec{F} - (\vec{d} F) \vec{v}, \quad (2)$$

Where $D_0 = \frac{1}{\alpha} \vec{d}$

$$\vec{d} = \frac{i}{\alpha} \vec{d}$$

$$\vec{v} = \frac{\vec{E} + i\vec{H}}{\vec{B}}. \quad (3)$$

Here we use the natural system of units in which $c = \hbar = 1$. Separating real and imaginary parts in equation (2), we obtain...
In this work, we solved the problem of elaboration of Lagrange formalism for neutrinos field in tensor formalism through divisors. Via Cartan map, spinor Weyl’s equation for neutrinos has been written in tensor form, in the form of non-linear Maxwell’s like equations, through strengths \( \vec{E} \) and \( \vec{H} \). Further, these non-linear equations have been written in covariant form, through divisors \( K_\mu \) and \( m_\mu \). In this work, we elaborated the Lagrange formalism for neutrinos field in tensor formalism. We found the Lagrange function for neutrinos field, written through divisors \( K_\mu \) and \( m_\mu \). It is clear that, applying Noether’s theorem, we can derive from the obtained Lagrange function, expressions for fundamental dynamical variables (energy, momentum, charge and spin) conserved in time. These expressions for fundamental dynamical variables have been obtained in previous works.

III. Discussion and Conclusion

In this work, we solved the problem of elaboration of Lagrange formalism for neutrinos field in tensor formalism through divisors. Via Cartan map, spinor Weyl’s equation for neutrinos has been written in tensor form, in the form of non-linear Maxwell’s like equations, through strengths \( \vec{E} \) and \( \vec{H} \). Further, these non-linear equations have been written in covariant form, through divisors \( K_\mu \) and \( m_\mu \). In this work, we elaborated the Lagrange formalism for neutrinos field in tensor formalism. We found the Lagrange function for neutrinos field, written through divisors \( K_\mu \) and \( m_\mu \). It is clear that, applying Noether’s theorem, we can derive from the obtained Lagrange function, expressions for fundamental dynamical variables (energy, momentum, charge and spin) conserved in time. These expressions for fundamental dynamical variables have been obtained in previous works.

References