Spinor Technology: the Field Formalism to the Duality between Quantum Particles and their Waves

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Abstract—One useful formalism in field theory to quantum level is the spinor formalism, which involves the energy of the zero-point field (bosons $W^0$, and their relations with sided-handed boson Weyl fields for every different particles that shape the electromagnetic charge from this referred fundamental boson level to be represented in their duality as quantum waves in the Dirac equation ready to be used in electronic propagators in quantum transmission devises, that is to say, the use of spinor technology in action. The present work analyze these dualities and their actions with their corresponding Hamiltonians, demonstrated that the total Hamiltonian to the electromagnetic quantum wave is a difference of Hamiltonians of d-type and b-type particles with the corresponding to the zero-point field.

Index Terms—Spinor formalism, massless particle tensor, sided-handed Dirac fields, Higgs boson, ground energy, electromagnetic quantum wave, zero-point field.

I. INTRODUCTION

THE zero-point energy or zero-point field, also called quantum vacuum zero-point energy, is the lowest possible energy that a quantum mechanical physical system may have; it is the energy of its ground state. All quantum mechanical systems undergo fluctuations even in their ground state and have associated zero-point energy, a consequence of their wave-like nature. The uncertainty principle requires every physical system to have a zero-point energy greater than the minimum of its classical potential well [1].

Considering the quantum wave from the duality between field and particles obtained in the spinor formalism and given by the quantum wave [2]:

$$\Psi(x) = \sum_{s=\pm} dp \left[ b_s(p) u_s(p)e^{ipx} + d_s^\dagger(p) u_s(p)e^{-ipx} \right].$$

we can define the $b$-type particle as the particle with moment $p$, energy $\omega = \left(p^2 + m^2\right)^{1/2}$, and spin $S = \frac{1}{2}s$. Likewise is the particle with state

$$|p, s, +\rangle = b_s^\dagger(p)|0\rangle,$$

where $+$ is their label of charge. For other side we can to define the $d$-type particle as the particle with moment $p$, energy $\omega = \left(p^2 + m^2\right)^{1/2}$, and spin $S = \frac{1}{2}s$. Likewise is the particle with state

$$|p, s, -\rangle = d_s^\dagger(p)|0\rangle.$$

Then $b$- and $d$-particles are distinguished by the value of the charge $Q = \int dx^0 j^0$.

We want to find a general expression of wave $\Psi(x)$, of the spinor field to a particle $x$, in the space-time $I \times \mathbb{R}^3$, that involves the creation and annihilation operators in this same spinor formalism from the level of the $b$- and $d$-type particles. Then will be necessary determine certain amplitudes that characterize the energy to each case using the dualities between boson particle and quantum wave. In this process are important the actions due to the fermions and their helicities.

II. SPINOR TECHNOLOGY

The 4-component spinors obey the equations [Holstein]:

$$(p + m)u_s(p) = 0, \quad (3)$$
and
\[ (-p + m)\nu_s(p) = 0, \]  
(4)

In the rest frame, we can choose:
\[ u_+(0) = \sqrt{m} \begin{pmatrix} 1 \\ 0 \\ 1 \\ 0 \end{pmatrix}, \quad u_-(0) = \sqrt{m} \begin{pmatrix} 0 \\ 1 \\ 0 \\ 1 \end{pmatrix}, \]

\[ \nu_+(0) = \sqrt{m} \begin{pmatrix} 0 \\ 1 \\ 0 \\ -1 \end{pmatrix}, \quad \nu_-(0) = \sqrt{m} \begin{pmatrix} -1 \\ 0 \\ 1 \\ 0 \end{pmatrix}, \]  
(5)

where \( s = +, \text{or} \) \(-, \) for \( m \neq 0, \) \( p = -m\gamma^0, \) and the canonical Dirac matrix
\[ \gamma^0 = \begin{pmatrix} 0 & I \\ I & 0 \end{pmatrix}. \]  
(6)

Also observe that is considered the normalization in (5) given by \( \sqrt{m}. \)

Is clear that this choice corresponds to eigenvectors of the spin matrix

\[ S_\gamma = \frac{i}{4}[\gamma^1, \gamma^2] = \frac{i}{2}\gamma^1\gamma^2 = \begin{pmatrix} \frac{1}{2}\sigma_3 & 0 \\ 0 & \frac{1}{2}\sigma_3 \end{pmatrix}, \]  
(7)

where is used the covariant property of particle tensor (spinor)
\[ S^{\mu\nu} = \frac{i}{4}[\gamma^\mu, \gamma^\nu][2, 4]. \] Then the spin matrix applied to the amplitudes given in (5) give us:

\[ S_\gamma u_\pm(0) = \pm\frac{1}{2}u_\pm(0), \]

and

\[ S_\gamma \nu_\pm(0) = \pm\frac{1}{2}\nu_\pm(0), \]

(8)

This choice results in (we will see with more detail it later):

\[ \begin{pmatrix} J_z, b_\pm(0) \end{pmatrix} = \pm\frac{1}{2}b_\pm(0), \]  
(10)

and

\[ \begin{pmatrix} J_z, d_\pm(0) \end{pmatrix} = \pm\frac{1}{2}d_\pm(0), \]  
(11)

Where are created the particles \( \pm\frac{1}{2}b_\pm(0), \) and \( \pm\frac{1}{2}d_\pm(0), \) with spin up (+), or down (−) along the z-axis. In this point is very important to sign the production of \( b \)-particles and \( d \)-particles that appear as consequence of the spins and these as consequence of the electrodynamics vector current \( J_z, [2] \) along the z-axis.

Let us also compute the barred spinors:

\[ \bar{\nu}_s(p) = u_\gamma^+(p)\beta, \]

(12)

and

\[ \bar{\nu}_s(p) = \nu_\gamma^+(p)\beta, \]

(13)

where \( \beta = \begin{pmatrix} 0 & I \\ I & 0 \end{pmatrix}, \) is such that \( \beta = \beta^\top = \beta^\dagger = \beta^i. \) Then we get:

\[ \bar{\nu}_+(0) = \sqrt{m}(1,0,1,0), \]

\[ \bar{\nu}_-(0) = \sqrt{m}(0,1,0,1), \]

\[ \bar{\nu}_+(0) = \sqrt{m}(0,-1,0,1), \]

\[ \bar{\nu}_-(0) = \sqrt{m}(1,0,-1,0), \]

For other side, we can find spinors as:

\[ D(\Lambda) = \exp(i\eta\hat{p} \cdot \hat{K}), \]  
(14)

where the vector \( K^i = \frac{i}{4}[\gamma^i, \gamma^0] = \frac{i}{2}\gamma^i\gamma^0, \) which comes from the application of the spin matrix

\[ S^{\mu\nu} = \frac{i}{4}[\gamma^\mu, \gamma^\nu][2, 4]. \]  
(15)
and
\[ \eta = \sinh^{-1}(|p|/m), \]
(16)

at arbitrary 3-momentum by applying the matrix that corresponds to the boost [5]
\[ U(\Lambda)^{-1}\Psi(x)U(\Lambda) = D(\Lambda)\Psi(\Lambda^{-1}x), \quad \forall \ x \in \mathbb{R}. \]

Then we find the spinors
\[ u_\mu(p) = \exp(i\eta\hat{p} \cdot K)u_\mu(0), \]
(17)
\[ \nu_\mu(p) = \exp(i\eta\hat{p} \cdot K)\nu_\mu(0), \]
(18)

and similarly
\[ \bar{u}_\mu(p) = \bar{u}_\mu(0)\exp(i\eta\hat{p} \cdot K), \]
(19)
\[ \bar{\nu}_\mu(p) = \bar{\nu}_\mu(0)\exp(i\eta\hat{p} \cdot K), \]
(20)

where \( K^j = \bar{K}^j \), and \( A \equiv \beta A^\dagger \beta \), where this last identity is satisfied for any gamma matrices [5].

It is straightforward to show:
\[ \gamma^\mu = \gamma^\mu, \]
(21)
\[ S^{\mu\nu} = S^{\mu\nu}, \]
(22)
\[ i\gamma_5 = i\gamma_5, \]
(23)
\[ \gamma^\mu\gamma_5 = \gamma^\mu\gamma_5, \]
(24)
\[ i\gamma_5S^{\mu\nu} = i\gamma_5S^{\mu\nu}, \]
(25)

Where is considered the spin tensor (spinor)
\[ S^{\mu\nu} = \frac{1}{2}\left[ \gamma^\mu, \gamma^\nu \right], \]
and the property of the vector \( \bar{K}^j = K \).

For barred spinors we get that using \( A \equiv \beta A^\dagger \beta \), we have
\[ \bar{u}_\mu(p) = \bar{u}_\mu(0)\beta, \]
(26)
\[ \bar{\nu}_\mu(p) = \bar{\nu}_\mu(0)\beta, \]
(27)

Then in (3) and (4) we have
\[ \bar{u}_\mu(p)(p + m) = 0, \]
(28)
\[ \bar{\nu}_\mu(p)(-p + m) = 0, \]
(29)

It is straightforward to derive explicit formulas for spinors, but will not need them; all we will need are products of spinors of the form (considering (17)-(20)):
\[ \bar{u}_\mu(p)u_\mu(0) = u_\mu(p)u_\mu(0), \]
(30)

Which do not depend on \( p \)! Then realizing all the products we find (using the Kronecker delta):
\[ \bar{u}_\mu(p)u_\mu(0) = +2m\delta_{s}, \]
(31)
\[ \bar{\nu}_\mu(p)\nu_\mu(0) = -2m\delta_{s}, \]
(32)
\[ \bar{u}_\mu(p)\nu_\mu(0) = 0, \]
(33)
\[ \bar{\nu}_\mu(p)u_\mu(0) = 0, \]
(34)

We consider the useful identities (Gordon identities):
\[ 2mu_\mu(p')\gamma^\mu u_\mu(p) = \\
= \bar{u}_\mu(p')[(p' + p)^\mu - 2iS^{\mu\nu}(p' - p)_\nu]u_\mu(p), \]
(35)
\[ -2m\nu_\mu(p')\gamma^\nu \nu_\mu(p) = \\
= \bar{\nu}_\mu(p')[(p' + p)^\mu - 2iS^{\mu\nu}(p' - p)_\nu] \nu_\mu(p), \]
(36)

Indeed, we consider the two relations between \( \gamma^\mu, p \), and \( S^{\mu\nu} \),
\[ \gamma^\mu p = \frac{1}{2} (\gamma^\mu , p) + \frac{1}{2} [\gamma^\mu, p] = -p^\mu - 2iS^{\mu\nu}p_\nu, \]
(37)
\[ p'\gamma^\mu = \frac{1}{2} (\gamma^\mu, p') - \frac{1}{2} [\gamma^\mu, p'] = -p'^\mu + 2iS^{\mu\nu}p'_{\nu}, \]
(38)

Adding the two equations, and sandwich them between spinors:
\[ \{\gamma^\mu, \gamma^\nu\} = -2g^{\mu\nu}, \quad S^{\mu\nu} \equiv \frac{i}{4}[\gamma^\mu, \gamma^\nu], \]
and using the pairs of equations (3), (4) and (28), (29) we find the Gordon identities. An important special case is when \( p' = p \), having
\[ \bar{u}_\mu(p)\gamma^\mu u_\mu(p) = 2p^\mu \delta_{s}, \]
(39)
\[ \bar{\nu}_\mu(p)\gamma^\mu \nu_\mu(p) = 2p^\mu \delta_{s}, \]
(40)

One can also show
\[ u_\gamma(p)\gamma^0 u_\gamma(-p) = 0, \quad (41) \]
\[ v_\gamma(p)\gamma^0 u_\gamma(-p) = 0, \quad (42) \]

where

\[
\gamma_5 \equiv i\gamma^0\gamma^1\gamma^2\gamma^3 = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}. \tag{52}
\]

Thus we will find the sum of spins of the form

\[
\sum_{i=\pm} u_i(p)u_i(p), \text{ for } \sum_{i=\pm} \]

which can be directly calculated but we will find the correct for by the
following argument: the sum over spin removes all the memory
of the spin-quantization axis, and the result can depend only on
the momentum four-vector and gamma matrices with all
indices contracted [2, 4].

In the rest frame we can write \( \gamma^0 \), as \(-p/m\), and \( \gamma^3 \), as \( z \), and so we have:

\[
S_z = \frac{1}{2m} \gamma_5 z p. \tag{53}
\]

which is clear from (49) and (50). Then let’s look at the
situation with 3-momentum in the z-direction. The component
of the spin in the direction of 3-momentum is called the helicity
(a fermion with helicity +1/2 is called right-handed a fermion
with helicity -1/2 is called left-handed).

From a point of view of the inner structure of the group of
actions \( \mathfrak{so}(V), [6, 7] \) this helicity can be defined from of spinor
space \( S(V) \), as \( S^\pm(V) \), having in the space \( V = \mathbb{C}^2 \), the
momentum and their curve involving the rapidity and satisfying
the equations \( p \cdot z = 0 \), and \( z^2 = 1 \):

\[
\frac{1}{2}(1 + 2sS_z)u_\gamma(0) = \delta_{\alpha\beta} u_\gamma(0), \quad (49)
\]
\[
\frac{1}{2}(1 - 2sS_z)u_\gamma(0) = \delta_{\alpha\beta} v_\gamma(0), \quad (50)
\]

The spin matrix \( S_z = \frac{i}{2} \gamma^1\gamma^2 \), can be written as:

\[
S_z = -\frac{1}{2} \gamma_3 \gamma^3 \gamma^0, \tag{51}
\]

Then in the limit of large rapidity
\[ z^\mu = \frac{1}{m} p^\mu + O(e^{-\eta}), \]  

(58)


\[ u_s(p)\overline{u}_s(p) \rightarrow \frac{1}{2}(1 + s\gamma_5)(-p), \]

\[ \nu_s(p)\overline{\nu}_s(p) \rightarrow \frac{1}{2}(1 - s\gamma_5)(-p), \]

(59) \hspace{1cm} (60)

Observe that dropped \( m \), small relative to \( p \).

In the extreme relativistic limit the right-handed fermion (helicity +1/2) described by spinors \( u^+ \), for \( b \)-type particle and \( \nu^- \), for \( d \)-type particle is projected onto the lower two components only (part of the Dirac field that corresponds to the right-handed Weyl field). Similarly left-handed fermions are projected onto upper two components (right-handed Weyl field).

Several formulas to massless particles can be obtained from consider the extreme relativistic limit of a massive particle, in particular the formulas (39)-(42), (47), (48), (59) and (60) are valid when \( m = 0 \).

III. OBTAINING THEIR HAMILTONIAN

We consider the general solution to the Dirac equation that is given by

\[ \Psi(x) = \sum_{j=\pm} \overline{b}_j(p)u_j(p)e^{ipx} + \frac{d^\dagger_j(p)\nu_j(p)e^{-ipx}}{2}, \]

(61)

We want to find formulas for creation and annihilation operator. Then considering the fundamental charge described by their spinor field, we have that \( Q = \int dx^3 j^0 \), comes given as:

\[ \int d^3x e^{-ipx}\Psi(x) = \sum_{j=\pm} \left[ \frac{1}{2\omega} b_j(p)u_j(p)e^{ipx} + \frac{1}{2\omega} d^\dagger_j(p)\nu_j(p)e^{-ipx} \right]. \]

(62)

Remember that \( u_j(p)e^{ipx} \), and \( \nu_j(p)e^{-ipx} \), are 4-component spinors and \( b_j(p), d^\dagger_j(p) \) are the creation and annihilation operators. Multiply by \( \overline{u}_j(p)\gamma^0 \), on the left side from (62) we have

\[ b_j(p) = \int d^3x e^{ipx} \overline{u}_j(p)\gamma^0\Psi(x), \]

(63)

Remember that \( \overline{u}_s(p)\gamma^0\nu_s(-p) = 0 \), and \( \overline{u}_s(p)\gamma^0\nu_s(p) = 2p^\mu\delta_{s,s'} \). To Hermitian conjugate of (63) we have

\[ b_s^\dagger(p) = \int d^3x e^{ipx} \overline{\nu}_s(p)\gamma^0\Psi(x), \]

(64)

where the \( b \)’s are time independent.

Analogously to \( d \)’s, considering the same general wave solution given by (61), and multiply by \( \overline{\nu}_s(p)\gamma^0 \), (considering the properties discussed in the before section \( \overline{\nu}_s(p)\gamma^0\nu_s(-p) = 0 \), and \( \overline{\nu}_s(p)\gamma^0\nu_s(p) = 2p^\mu\delta_{s,s'} \) we have:

\[ d_s^\dagger(p) = \int d^3x e^{ipx} \overline{\nu}_s(p)\gamma^0\Psi(x), \]

(65)

And their Hermitian conjugate

\[ d_s(p) = \int d^3x e^{-ipx} \overline{\Psi}(x)\gamma^0\nu_s(p), \]

(66)

Using the relations (63)-(66), we can easily work out the anti-commutation relations for \( b \), and \( d \) operators\(^1\) \(^2\) having that:

\[ \{b_j(p), b_s(p')\} = 0, \]

\[ \{d_j(p), d_s(p')\} = 0, \]

\[ \{b_j^\dagger(p), b_s^\dagger(p')\} = 0, \]

and

\[ \{\overline{b}_j(p), \overline{b}_s(p')\} = 0, \]

\[ \{\overline{d}_j(p), \overline{d}_s(p')\} = 0, \]

\[ \{\overline{b}_j^\dagger(p), \overline{b}_s^\dagger(p')\} = 0, \]

where also we have the significance relations:

\[ \{\Psi_{e}(x,t), \Psi_{\mu}(y,t)\} = 0, \]

\[ \{\Psi_{e}(x,t), \overline{\Psi}_{\mu}(y,t)\} = (\gamma^\mu)^{\alpha\beta}\delta^2(x - y). \]
\[
\begin{align*}
\left\{ \hat{b}_s(p), \hat{b}^\dagger_s(p) \right\} &= \int d^3x \, d^3y e^{-ip \cdot y + ip \cdot y} \left\{ \Psi(x), \overline{\Psi(y)} \right\} \gamma^0 u_s(p') = \\
&= \int d^3x \, d^3y e^{-ip \cdot y + ip \cdot y} \overline{u}_s(p) \gamma^0 \gamma^0 u_s(p') \\
&= (2\pi)^3 \delta^3(p-p') \overline{u}_s(p) \gamma^0 u_s(p), \\
&= (2\pi)^3 \delta^3(p-p') 2\omega \delta_{ss}, \\
\end{align*}
\]

Thus we have that Hamiltonian is:
\[
H = \sum_{s,s'} \int d^3 \mathbf{p} d^3 \mathbf{p}' \chi(b^\dagger_s(p) \overline{u}_s(p') e^{-ip \cdot x} + d_s(p') \overline{u}_s(p') e^{ip \cdot x}) \\
	imes \omega_b \delta_s^s \gamma^0 u_s(p) e^{ip \cdot x} - d_s^\dagger(p') \gamma^0 u_s(p') e^{-ip \cdot x},
\]
which realizing the due products derive in
\[
H = \sum_{s,s'} \int d^3 \mathbf{p} d^3 \mathbf{p}' \chi \omega_b \delta_s^s \gamma^0 u_s(p) e^{-i(p' \cdot x)} - d_s^\dagger(p') \gamma^0 u_s(p') e^{i(p' \cdot x)}.
\]

Analogously to \(d\)'s, we have:
\[
\begin{align*}
\left\{ d_s^\dagger(p), d_s(p') \right\} &= \int d^3x d^3y e^{ip \cdot x + ip \cdot y} \overline{u}_s(p) \gamma^0 \left\{ \Psi(x), \overline{\Psi(y)} \right\} \gamma^0 \overline{u}_s(p') = \\
&= \int d^3x d^3y e^{ip \cdot x + ip \cdot y} \overline{u}_s(p) \gamma^0 \gamma^0 \overline{u}_s(p') \\
&= (2\pi)^3 \delta^3(p-p') \overline{u}_s(p) \gamma^0 u_s(p) \\
&= (2\pi)^3 \delta^3(p-p') 2\omega \delta_{ss}, \\
\end{align*}
\]

and finally:
\[
\begin{align*}
\left\{ b_s(p), d_s(p') \right\} &= \int d^3x d^3y e^{-ip \cdot x + ip \cdot y} \overline{u}_s(p) \gamma^0 \left\{ \Psi(x), \overline{\Psi(y)} \right\} \gamma^0 \overline{u}_s(p') = \\
&= \int d^3x d^3y e^{-ip \cdot x + ip \cdot y} \overline{u}_s(p) \gamma^0 \gamma^0 \overline{u}_s(p') \\
&= (2\pi)^3 \delta^3(p+p') \overline{u}_s(p) \gamma^0 u_s(-p) \\
&= 0,
\end{align*}
\]

We want to compute the Hamiltonian in terms of \(b\)'s, and \(d\)'s, operators, using the 4-component notation we would find:
\[
H = \int d^3x \Psi(-iy' \partial_i + m) \Psi,
\]
(70)

We start with
\[
(-iy' \partial_i + m) \Psi = \sum_{s,s'} \int d^3p (-iy' \partial_i + m)(b_s(p) u_s(p) e^{ip \cdot x}) \\
+ d_s^\dagger(p) u_s(p) e^{-ip \cdot x} \\
= \sum_{s,s'} \int d^3p (b_s(p)(+y' p_i + m) u_s(p) e^{ip \cdot x}) \\
+ d_s^\dagger(p)(-y' p_i + m) u_s(p) e^{-ip \cdot x} \\
= \sum_{s,s'} \int d^3p (b_s(p)(\gamma^0 \omega) u_s(p) e^{ip \cdot x}) \\
+ d_s^\dagger(p)(-\gamma^0 \omega) u_s(p) e^{-ip \cdot x},
\]

\[
\begin{align*}
\left\{ d_s^\dagger(p), b_s(p) \right\} &= (2\pi)^3 \delta^3(p-p') 2\omega \delta_{ss}, \\
\end{align*}
\]

Thus we finally find:
\[
H = \sum_{s,s'} \int d^3 \mathbf{p} \omega_b (b^\dagger_s(p)b_s(p) + d^\dagger_s(p)d_s(p)) - 4\delta_0 V,
\]
(75)
where the term $-4\delta_0 V$, represents the four times the zero-point energy of a scalar field and opposite sign, assuming that the zero-point energy is cancelled by a constant term.

Now we analyze some cases. Considering of quantum field of vacuum $|0\rangle$, and the $b$-type and $d$-type particles produced around of the momentum the $W^+$, $W^-$, and $W^0$(for example the ground space given by the neutrino interactions: tau, etc) we have that very similar calculation as for the Hamiltonian, we get the charge [8]

$$Q = \int d^3x \bar{\Psi} \gamma^0 \Psi$$

$$= \sum_{x=\pm} \left[ \int d^3p [b_\downarrow(p) b_\uparrow(p) + d_\downarrow(p)d_\uparrow(p)] \right]$$

$$= \sum_{x=\pm} \left[ \int d^3p [b_\downarrow(p) b_\uparrow(p) - \bar{d}_\downarrow(p) \bar{d}_\uparrow(p)] + \text{constant},(76) \right]$$

Later the electron will be a $b$-type particle and the positron a $d$-type particle.

To the Majorana field, we need incorporate the Majorana condition inside (61)

$$\Psi = \bar{c} \Psi^T, \quad (77)$$

having

$$\bar{c} \Psi^T (x) = \sum_{x=\pm} \left[ \int d^3p [b_\downarrow(p) \bar{u}_\uparrow(p)e^{-ipx} + d_\downarrow(p) \bar{u}_\uparrow(p)e^{ipx} \right]$$

$$= \sum_{x=\pm} \left[ \int d^3p [b_\downarrow(p) \nu_\uparrow(p)e^{-ipx} + d_\downarrow(p) \nu_\uparrow(p)e^{ipx} \right]. \quad (78)$$

Considering that

$$\bar{c} \bar{u}_\uparrow(p)^T = \nu_\downarrow(p),$$

$$\bar{c} \bar{d}_\uparrow(p)^T = u_\downarrow(p),$$

and $d_\downarrow(p) = b_\downarrow(p)$, we have that (79) takes the form

$$\Psi(x) = \sum_{x=\pm} \int d^3p [b_\downarrow(p) u_\downarrow(p)e^{ipx} + b_\uparrow(p) \nu_\downarrow(p)e^{-ipx}], \quad (79)$$

where the anti-commutation relations

$$\{\Psi_a(x,t), \Psi_b(y,t)\} = (\bar{c} \gamma)^a_{bg} \delta^3(x - y), \quad (80)$$

translate into:

$$\{b_\downarrow(p), b_\uparrow(p')\} = 0, \quad (82)$$

$$\{\bar{b}_\downarrow(p), b_\uparrow(p')\} = (2\pi)^3 \delta^3(p - p') 2\omega \delta_{ss'}, \quad (83)$$

A calculation that is the same as for the Dirac field! Finally the Hamiltonian to the Majorana field is:

$$H = \frac{1}{2} \int d^3x \bar{\Psi} \gamma(-i\gamma^\partial + m)\Psi$$

$$= \frac{1}{2} \int d^3x \bar{\Psi} (-i\gamma^\partial + m)\Psi, \quad (84)$$

And repeating the same manipulations as for the Dirac field we find:

$$H = \frac{1}{2} \sum_{x=\pm} \left[ \int d^3p [d^\downarrow(p) d^\uparrow(p) - 2\delta_0 V]. \quad (85) \right]$$

where the term $-2\delta_0 V$, represents the two times the zero-point energy of a scalar field and opposite sign, assuming that the zero-point energy is cancelled by a constant term. Here $\delta_0$, and $V$, are respectively:

$$\delta_0 = -(2\pi)^3 \int d^3k \omega, \quad (86)$$

$$V = (2\pi)^3 \delta^3(0) \int d^3x, \quad (87)$$

IV. SPINOR DEVICES AND APPLICATION PROSPECTIVE

Considering the exposition realized in the section II, and the spintronic developments obtained in the last years to measure torsion as a derived field from the special considerations on the

We can demonstrate that the identities $\bar{c} \bar{u}_\uparrow(p)^T = \nu_\downarrow(p)$, come from of $\bar{c} \bar{u}_\uparrow(p)^T = u_\downarrow(p)$, use the matrix

$$\mathcal{C} = \begin{pmatrix} 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & +1 \\ +1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \end{pmatrix}$$

and the calculation of $u_\downarrow(p)$. Moreover, $\nu_\downarrow(p)$, $u_\downarrow(p)$, and $\nu_\uparrow(p)$ with their conjugates, considering furthermore

that $\beta \gamma = -\bar{c} \beta$, $\bar{c} \gamma^a \gamma^b \bar{c} = -(\gamma^b)^T$, the vector

$$K' = \frac{i}{4} [\gamma^1, \gamma^0] = \frac{i}{2} \gamma^1 \gamma^0$$

and their property $\bar{c} \gamma^a K' \bar{c} = -(K')^T$. 

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Maxwell equations [9] (furthermore of the hypothesis of the torsion as effect of the field) we can define to the torsion as any variable to describe rotation in a multi-radiative scale, considering a frame multi-spinor energy states that shape this torsion [10, 11]. Then the wave equations in the spinor formalism shape the torsion in the space due to the action of the electromagnetic field and can generate the “spinor waves” waves generated from the multi-radiative device that under the principles of other effects, as quantum Hall effect Stark effect or the Zeeman effect under a adequate magnetic or electric potential; can to realize actions of organized and synergic transformations on the space or the transmission of information between particles connecting them by this “spinor waves” which are spinor states of the field to many times created for the momentum of every particles interacting with the other particles (see figure 1).

![Spinor fields in duality as quantum waves in the Dirac equation.](image)

Beyond this established research, advocates of the scientific spin field or torsion field theories claim that “spin-spin interaction” [8, 12] itself a well-studied quantum phenomenon, can be transmitted through space similar to electromagnetic waves, does not carry mass or energy but only information, and does so at speeds of up to $10^7$ times the speed of light. At the same time they claim that spin-spin interaction is carried by neutrinos [2, 11], which have very little mass and high energy, that it does not interact with matter but, at the same time, can be generated and detected easily.

Considering new postulates and principles as given in [13, 14], the torsion field theory has been embraced by some as the scientific explanation of homeopathy [13] (here is used the cohomological space $H^1(\mathbb{P}\mathcal{B}_2,\mathbb{O}(-k))$, to explain and demonstrate the correspondences between helicities of the quantum spin fields and the actions that correct and restore the vital field), telepathy, telekinesis, [15], levitation (for example the production of electro-antigravity described in [16, 17] where other again we have used a cohomological space seemed to before, considering twistor geometry to describe the action of a rotation ring and their magnetic field in the movement of the magnetic levitation ship), clairvoyance [18] and extra-sensorial perception [15], and other paranormal phenomena. The harnessing of torsion fields has been claimed to make everything possible from miracle cure devices (including devices that cure of all sickness such and as the Bulnes hypothesis [13] given to explain the appearing organic illness and the re-composition of the fields by codes given by path integrals (Bulnes-Feynman integrals [13, 18] to risk the health, considering that past and future of the scattering phenomena) or to create working perpetual behavior and motion machines, star-gates (worm holes in the space) and synchrotron propulsion (advanced space ships) analogs to advanced spaceship, and disintegrative mass weapons, using the same principles.

Torsion field theories are sometimes presented as version of the general relativity, as given by Penrose in his twistor theory. Examples of this include the Einstein-Cartan theory and gauge theories of gravitation for the Poincaré and the affine groups, which seek to add torsion of space-time to the curvature-based description of gravity; and thereby predict a multitude of new physical effects. Also there is the motivational description as intent to unified the gravity field and electromagnetic field through of the Evans equations. However, the predicted effects of such alternative theories are either infinitesimal or directly contradict the experimental evidence. It may be shown that space-time curvature and torsion are alternative ways of describing the gravitational field and are completely interchangeable, while attempts to account for them simultaneously produce inconsistencies [19].

According to A.I. Veinik's theory, "chronons" generate the so called "chronal" field. A.I. Veinik found experimentally that strong "chronal" fields can be generated by spinning masses. A.I. Veinik measured some properties of "chronal" fields and found that two types of "chronons" exist ("plus" and "minus" chronons). It is important to emphasize that A.I. Veinik concluded that the sign of the "chronon" depended on orientation of it's spin. Some of these facts could explain the hyperbolicity of the space and their law of the minimal action and geometrical trajectories “brachistochrone curve” satisfying this law of minimal action, and consigned in the inertial law inside of the Einstein equations with expansion reflected into the Christoffel symbols considered in the gravity equations. The spinning space can be consigned in a smooth space (as apparent uniformity of the space-time in the ground) when the energy fluxes of the spins derive in neutrinos and these full all space of energy. The problem with the manage of the chrono-geometry with this particles is the definition of the synchronicity that is required to some process to quantum level to generate some process and their integration inside of synergic action or “organized transform” to obtain reality of the space-time [18].

**Theorem IV.1. (F. Bulnes).** The extension of quantum sources is equivalent to the following process:

1. Creation of particles
2. The uniformity of the space-time through of the values of energy-momentum engaged “obtaining of a Hamiltonian in terms of b’s, and d’s”.
iii) In the case of two particles created by different sources then their joint amplitude are contained in the vacuum amplitude $\langle 0_{\mu} | \hat{p}_{\mu} \rangle = \langle 0_{\mu} | \hat{p}_{\mu} \rangle$, “the joint amplitude of the b's, and d's-type particles” [20].

iv) The total current from the spin fluxes to all particles is an seemed integral to the soft photons (uniformity of the space-time in the quantum level)

$$j^\mu(\xi) = eq\int_{0}^{\infty} ds (p^\mu / m) \delta(\xi - x' - (p^\mu / m)s)$$

$$+ eq\int_{-\infty}^{0} ds' m^\mu \delta(\xi - x' - ns), \quad (88)$$

Proof. Using the quantum transforms to the fields $\hat{j}^\mu$, and $J^\mu$, described by the Bulnes theorem [18], and using the representations of the spinor space given in [6] on the context of soft photons of the uniformity hypothesis of the space-time, we obtain a orbital integral [21] to every spin fluxes. Their total consideration on a trajectory of the space-time gives the integral (88). The other sentences are consequences of the exposition in the section II, and III of this work.

The equivalence for all these sentences will demonstrate the philosophy to create, design and develop devices in spintronics (see figure 2).

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V. CONCLUSION

The extension of quantum sources through of a photon sea can be the key to give a conditioning of the space or media necessary to realize all the quantum organized transforms that are required to all the mentioned in the section IV. The existence of Hamiltonians that involves the creation of particles that promote and give a plus of energy [12] from the duality of their field can to solve the problems of linking between atoms and particles and can prepare the space, media, or matter to be infiltrated with the action of a field that have spin actions to every particle, and for other side annihilate the energy rest or scattering that could be without interchange (accumulated) [22]. The spinor formalism is the first formalism that search manages and manipulates of the quantum field and their energy states through of a quantum wave from the spin-spin interaction, that is to say, as spin wave or spinor [23]. For other side, the spinor is a mathematical object associated with the energy contents of invariants in the space-time, considering invariance spin of their representations of their operators of the Lie corresponding group of rotations $SO(V)$. In the moment of that this source to be extended will have the possibility of know the source of the secrets of the energy continuum that define our Universe. The theorem IV. 1, jointly with the wave solution in the spinor formalism can be the first step in certain sense to the obtaining of all devices and technologies that we require, but we need change our schemes on the world.

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