Chapter

Kinematic-Energy Measurements of the Torsion Tensor in Space-Time

Francisco Bulnes, Isaías Martínez, Omar Zamudio and Edgar Navarro

Abstract

We consider the relation between the twistor kinematic-energy model of the space-time and the kinematic-energy tensor as the energy-matter tensor studied in relativity theory to obtain the torsion tensor of the space-time. Measurements of the torsion tensor through their energy spectra are obtained for the movement of a particle under certain trajectories (curves whose tangent spaces twist around when they are parallel transported) when crossing an electromagnetic field. We want to give an indicium of the existence of torsion field through the electronic signals produced between the presence of electromagnetic field and the proximity of movement of matter.

Keywords: energy-matter tensor, kinematic-energy tensor, movement energy vacuum, torsion tensor, twistor kinematic-energy model

1. Introduction

The fundamental problem considered in this chapter is linked with the determination of energy-(space-)time variations that occur in the interaction of movement and matter-energy on a special geometry of movement or movement kinematics. However, we need a background component that permits the measure and detects under the invariance of its fields the change of matter particle spin (as could be in the torsion case [1], considering a quasi-local matter model represented through the gravitational waves of cylindrical type to measure and detect the field torsion). This last, considering only a component of geometrical torsion no vanish, along of a curve of a particle as study object that moves affected by an energy radiation that permits the use of some physical effect like the Hall effect.

The gauging of the torsion system using movement in an external field, which acts on a particle through the deformation space, could be the simplest way to use the dual concepts of twistor frame and spinors. The objective is to demonstrate the existence of the kinematic twistor tensor in a system that detects the torsion and obtains its image by spinors due to the duality, as demonstrated in Ref. [2].

We know the need of an intermediate gauge field to establish experimentally the relation between the kinematic twistor tensor and the energy-matter tensor (this last due to the movement in the space-time) in duality, as determined in Ref. [3].

Likewise, we consider M the space-time as the complex Minkowski model, and we define the kinematic twistor tensor as the obtained of the model in a space region Σ. Then considering the energy-matter tensor and its image in a two-dimensional surface will be two-surface twistor $\mathbb{T}(S)$. The geometrical evidence of torsion is precisely through this contorted surface.

In other words, the kinematic twistor tensor $A_{\alpha\beta}$ in the radiation energy bath (electromagnetic radiation) from the energy-matter tensor $T_{\alpha\beta}$ will be defined by the interaction of two fields Z_1^α and Z_2^α that act in Σ,

$$A_{\alpha\beta}Z_1^\alpha Z_2^\beta = \int_\Sigma T_{\alpha\beta}k^\alpha d\sigma^\beta, \tag{1}$$

which produces an electrical total charge due to the Gauss divergence theorem on currents $T_{\alpha\beta}k^\alpha$,

$$Q[k] = \frac{1}{4\pi G}\int_\Sigma R_{\alpha\beta\gamma\delta}f^{\alpha\beta}d\sigma^{\gamma\delta}, \tag{2}$$

This can be identified as the source depending on the killing vector k^α of the Minkowski space background model

$$M = S^2 \otimes \mathbb{C}^2 \otimes M, \tag{3}$$

where M is the space-time of two components

$$M = S^+ \oplus S^-. \tag{4}$$

Then, its system has a complex set of four-dimensional solution families $\left(\cong \mathbb{C}^2\right)$, and the family defines the two-surface twistor space $\mathbb{T}(S)$.

Likewise, we can define the space of kinematic twistor tensor as the space of tensors [2]:

$$(\mathbb{T}(S)\odot\mathbb{T}(S))* = \left\{A_{\alpha\beta} \in T_2^4(M) \middle| A_{\alpha\beta}Z^\alpha Z^\beta = Q[k]\right\}, \tag{5}$$

Though a gauge field (electromagnetic field as photons) acts on the back-ground radiation of the Minkowski space M, and the energy of the matter will be related to this gauge field through the equation

$$j^\alpha = T_{\alpha\beta}k^\alpha, \tag{6}$$

where k^α can represent the density of background radiation, which establishes the curved part of the space (with spherical symmetry) together with $T_{\alpha\beta}$ (see **Figure 1**)

$$Q[k] = \frac{1}{4\pi G}\int_{S^2} T_{\alpha\beta}k^\alpha d\sigma^\beta \geq \int_{S^2} j^\alpha d\sigma^\beta \geq 2\pi\chi, \tag{7}$$

The corresponding electromagnetic device generates an electromagnetic radiation bath in a space region, where a movement of mass is detected inside this region, producing variations in the electromagnetic field. If we use a curvature energy sensor [3–5], we will obtain a spectrum in a twistor-spinor frame.

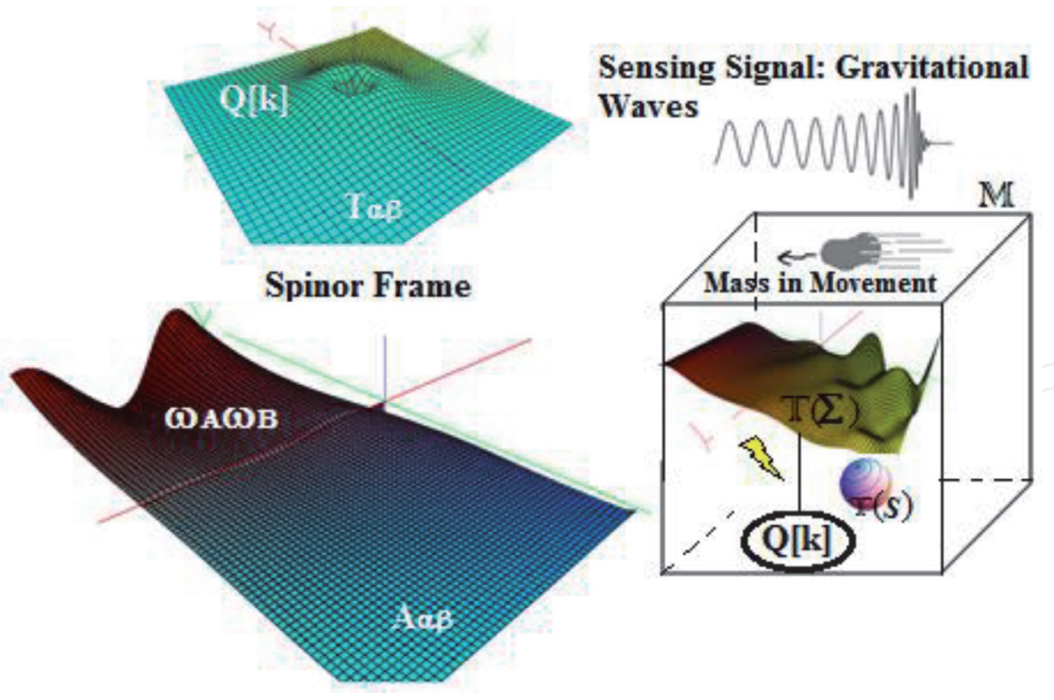

Figure 1.
Supermassive mass movement field + electromagnetic energy field = torsion evidence on the surface of sensing (sphere). How can we construct a tensor whose evidence of torsion can trace the electronic signals that could come from matter and electromagnetic fields of gravitational waves? We need a tensor of invariants of movement identified by invariants in geometry. This is the kinematic twistor tensor $A_{\alpha\beta}$. The space S is the sphere that senses the torsion and transmits its variation at the time to the surface Σ defined by the electromagnetic-matter movement. Two-dimensional model of spinor representation of the kinematic twistor tensor $A_{\alpha\beta}$ is constructed from the sphere.

Likewise, by the twistor-spinor theory, and by using the duality between the tensors $T_{\alpha\beta}$, and $A_{\alpha\beta}$, we can determine the mechanism of measurement and characterize the geometrical context of the detection of torsion. We define the twistor space as the points set[1]

$$\mathbb{T} = \left\{ Z^{\alpha} | Z^{\alpha} = \left(\omega^{A}, \pi_{A} \right) \right\}, \tag{8}$$

for all coordinates systems A and A. We define the twistor infinity tensor $I_{\alpha\beta'}$[2] as the obtained directly of the all space-time whose structure obeys a Minkowski space M. Then the surface Σ, which is a 3-dimensional surface is obtained for the twistor fields Z^{α} and Z^{α}, that is to say:

$$\Sigma = \Sigma\left(Z^{\alpha}, Z^{\beta} \right), \tag{9}$$

which has a metric defined when $\alpha = \beta$ and $Z^{\beta} = \overline{Z^{\beta}}$ (its complex conjugate). Then, in the infinity of the space-time, we have the sequence of mappings:

$$\mathbb{T} \xrightarrow{I^{\alpha\beta}} \mathbb{T}(S) \xrightarrow{I^{\alpha\beta}_{\Sigma}} \mathbb{T}(\Sigma) \tag{10}$$

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1 $\omega^{A} : \mathbb{T}* \to \mathbb{T}$, with rule of correspondence on points of the space–time $\pi_{A'} \mapsto ix^{AA'}\pi_{A'}$. Also its dual $\pi_{A'}$: $\mathbb{T} \to \mathbb{T}*$, with correspondence rule of points of the space–time $\omega^{A} \mapsto \text{-}ix^{AA'}\omega^{A}$. Likewise, the corresponding twistor spaces in this case are:

$$\mathbb{T} = \left\{ Z^{\alpha} = \left(\omega^{A}, \pi_{A'} \right) | \omega^{A} = ix^{AA'}\pi_{A'} \right\}, \quad \mathbb{T}* = \left\{ W_{\alpha} = \left(\pi_{A}, \omega^{A'} \right) | \omega^{A'} = -ix^{AA'}\pi_{A} \right\},$$

2 $I_{\alpha\beta} : \mathbb{T}* \to \mathbb{T}$, with the correspondence rule $W_{\alpha} \mapsto Z^{\alpha} I^{\alpha\beta} W_{\beta}$.

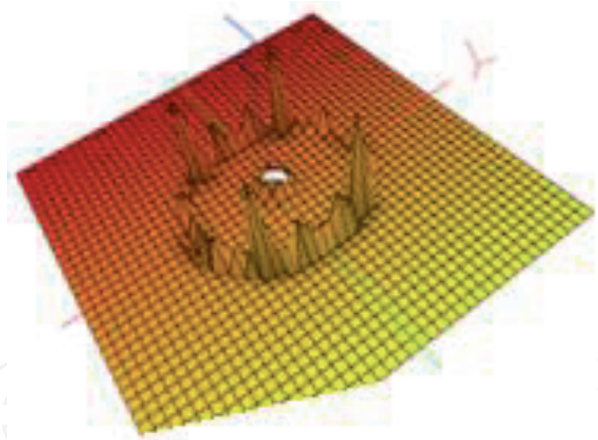


Figure 2.
Kinematic twistor tensor due to the energy-matter tensor perturbation of the supermassive body, which is determined on sphere S.

whose correspondence rule is given as follows:

$$Z^{\alpha} \mapsto I^{\alpha\beta} S_{\beta\beta'} \overline{Z^{\beta'}} \mapsto I^{\alpha\beta} \Sigma_{\beta\beta''} \overline{Z^{\beta'}}. \tag{11}$$

We consider the symmetric part of the fields Z^{α} and Z^{β}, given by the spinors ω^{AB}, which satisfy the valence-2 twistor equation:

$$\nabla^{A}_{A'} \omega^{BC} = -i \in^{A\left(B k^{C}_{A'}\right)}, \tag{12}$$

which has a solution in a 10-dimensional space. We need limit the space region of our study to spinor waves in a four-dimensional space, that is, on a component of Eq. (3). The solution in the space of Eq. (12) is spanned by spinor fields ω^{AB} of the form[3]

$$\omega^{AB} = \omega_1{}^{\left(A\omega_2{}^{B}\right) = \omega^{A}\omega^{B}}, \tag{13}$$

where each ω^{A}_{i} is a valence-1 twistor, satisfying the equation:

$$\nabla^{A}_{A'} \omega^{B} = -i \in^{AB} \pi_{A'}, \tag{14}$$

We need in all time, for our measurements the conservation condition, which will be given by the equation:

$$\nabla^{\alpha} T^{\alpha\beta} = 0, \tag{15}$$

that is to say, we suppose that the energy-matter is always present in the space and is constant, at least in the space region where is bounded the three-dimensional surface Σ. Likewise, when a supermassive body exists that perturbs the space-time, the energy matter of its tensor can be carried out (see **Figure 2**):

[3] Here the spinors product $\omega_1{}^{\left(A\omega_2{}^{B}\right)}$, comes from fields product $Z_1{}^{\left(AZ_2{}^{B}\right)}$, which is a symmetric tensor product, that is to say,

$$Z_1{}^{\left(AZ_2{}^{B}\right) = Z_1 \otimes_{Symm} Z_2 \in \mathbb{T} \otimes_{Symm} \mathbb{T} = \mathbb{T} \odot \mathbb{T}.}$$

$$\mathrm{A}_{\alpha\beta} = \frac{1}{16\pi \mathrm{G}} \oint_{\mathrm{S}} \mathrm{R}_{\mathrm{AB}} \omega_{\alpha}^{\mathrm{A}} \omega_{\beta}^{\mathrm{B}}, \tag{16}$$

Finally, we can establish the following commutative diagram of twistor space mappings on the gauge and detection mechanism of torsion:

$$\begin{array}{ccc} \mathbb{T}(\Sigma) \overset{\mathrm{I}^{\alpha\beta}\Sigma_{\beta\beta'}}{\longleftarrow} & \Sigma \overset{\mathrm{A}_{\alpha\beta}}{\longrightarrow} & (\mathbb{T}(\mathrm{S}) \odot \mathbb{T}(\mathrm{S}))* \\ \mathrm{I}_{\Sigma}^{\alpha\beta} \uparrow & \uparrow \mathrm{T}^{\alpha\beta} & \uparrow \mathrm{A}_{\alpha\beta} Z^{\alpha} Z^{\beta}, \\ \mathbb{T}(\mathrm{S}) \overset{\mathrm{I}^{\alpha\beta}}{\longleftarrow} & \mathrm{S} \overset{\omega^{\mathrm{AB}}}{\longrightarrow} & \mathbb{T}(\mathrm{S}) \odot \mathbb{T}(\mathrm{S}) \end{array} \tag{17}$$

where $\odot$ is a symmetric tensor product.

2. Torsion indicium in gravitational spin waves

In this context, the use of the Einstein-Cartan-Sciama-Kibble theory is important. Likewise, this theory is convenient considering our space-time model as has been defined M, and the field experiments considering external fields created through the use of the spin Hall effect and movement of matter in Σ. We consider the curvature and twistor-spinor framework studied in Refs. [2, 4], where they recover the most important cause of the second curvature.

Likewise, for the curvature tensor $\mathrm{K}_{\alpha\beta\gamma\delta}$, we start with the Riemann tensor $\mathrm{R}_{\alpha\beta\gamma\delta}$ that appears in the integral (2). Likewise, considering the space-time M, a complex Riemannian manifold, we have the conjecture where the indicium of torsion exists [1, 2].

Conjecture 2.1 (Bulnes F, Rabinovich I). The curvature in the spinor-twistor framework can be perceived with the appearance of the torsion and the anti-self-dual fields.

Proof. [2].

In the previous research of this conjecture [2], it was established that the spinor model of torsion can be written as follows:

$$\mathrm{S}_{\alpha\beta}^{\gamma} = \chi_{\mathrm{AA'}}^{\mathrm{CC'}} \in_{\mathrm{A'B'}} + \tilde{\chi}_{\mathrm{A'B'}}^{\mathrm{CC'}} \in_{\mathrm{AB}}, \tag{18}$$

where it is clear that

$$\mathrm{T}_{\alpha\beta}^{\gamma} = 2\mathrm{S}_{\alpha\beta}^{\gamma}, \tag{19}$$

Then, it is obvious that the torsion tensor can be written as follows:

$$\mathrm{T}_{\alpha\beta}^{\gamma} = 2\left(\chi_{\mathrm{AA'}}^{\mathrm{CC'}} \in_{\mathrm{A'B'}} + \tilde{\chi}_{\mathrm{A'B'}}^{\mathrm{CC'}} \in_{AB}\right), \tag{20}$$

Considering the spinor equation of torsion (15) in the twistor-spinor framework, we have the transformation in the infinity twistor of the space-time:

$$\mathrm{I}_{\alpha\beta} = \pi_{\alpha}^{\mathrm{A'}} \pi_{\beta\mathrm{A'}}, \tag{21}$$

and for other transformation of spinor coordinate frame (and derivative), we have:

$$\pi^{\mathrm{A'}}\left(\nabla_{\mathrm{AA'}} \pi_{\mathrm{B'}}\right) = \xi_{\mathrm{A}} \pi_{\mathrm{B'}} - 2\pi^{\mathrm{A'}} \pi^{\mathrm{C'}} \chi_{\mathrm{A'B'AC'}}, \tag{22}$$

3. Curvature energy to torsion

The following results obtained in Ref. [2] are the fundamental principles that are required to gauge and detect the torsion through the tensor $A_{\alpha\beta}$, considering the law transformation to pass from a field Z^{α} to other Z^{β} through two coordinate systems α and β to transform the surface Σ:

$$\Sigma_{\alpha\beta} = A_{\alpha\beta} I^{\beta\gamma} \Sigma_{\gamma\alpha'} \tag{23}$$

Then, we enunciate the following theorem.

Theorem 3.1 (Bulnes F, Stropovsvky Y, Rabinovich I). We consider the embedding as follows:

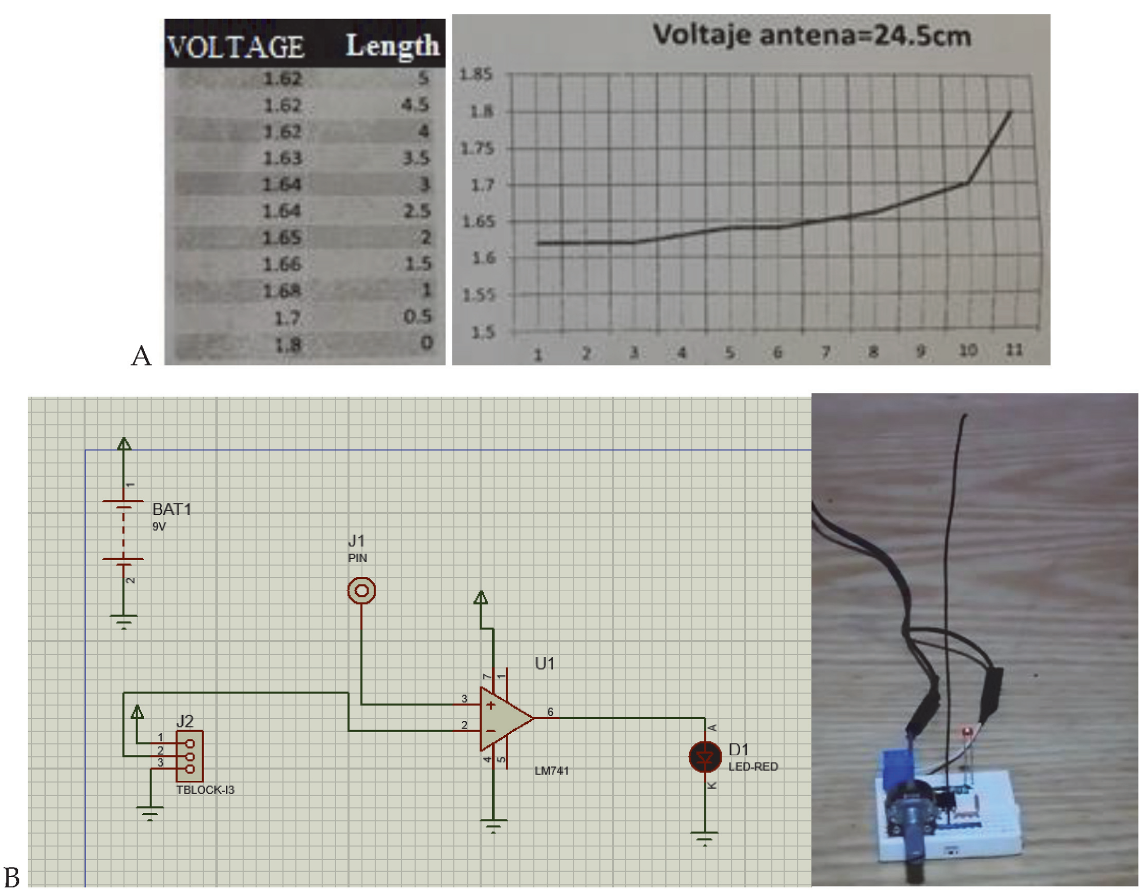
$$\sigma : \Sigma \to (\mathbb{T}(S) \otimes \mathbb{T}(S))*, \tag{24}$$

The space $\sigma(\Sigma)$ is smoothly embedded in the twistor space $(\mathbb{T}(S) \otimes \mathbb{T}(S))*$. Then, their curvature energy is given in the interval $M_N \geq A_{\alpha\beta} Z^{\alpha} I^{\beta\gamma} \overline{Z}_{\gamma} \geq 0$.

Proof. [2].

We have a source to linearized gravitational field that is explained through kinematics and electrodynamics used in its construction (see **Figure 3**). The linearized Riemann tensor corresponding to the spinor frame has been constructed, considering the components

$$f_{\alpha\beta} = \omega_{AB} \in_{A'B'}, \tag{25}$$



VOLTAGE	Length
1.62	5
1.62	4.5
1.62	4
1.63	3.5
1.64	3
1.64	2.5
1.65	2
1.66	1.5
1.68	1
1.7	0.5
1.8	0

Figure 3.
(A) Antenna with voltage feeding of length 24.5 cm. (B) Electronic device of electronic monopole to electromagnetic radiation bath.

which relates to the spinor field ω_{AB}, with the killing vector k^{α}, in the valence-2 twistor equation. We use the divergence theorem when S is a 2-surface in the 3-surface Σ, which is given as follows:

$$\Sigma = \omega^{A}\overline{\pi}_{A'} + \omega^{A}\overline{\pi}_{A'}, \tag{26}$$

around the source having several censorship conditions designed through dominating energy conditions of curvature that can be used in the electronic experiments.

We have a metrology [5–7] of curvature measured and detected by our curvature sensors, which permitted us to have the curvature in new units obtained under the strong electronic gauging study [3, 7].

Likewise, the energy of the kinematic twistor tensor that will be substantive energy to curvature energy measure in the case of the spinor-twistor framework is given in the energy domain $M_N \geq A_{\alpha\beta}Z^{\alpha}I^{\beta\gamma}\overline{Z}_{\gamma} \geq 0$.

Then, the solution of the quasi-local mass is directly related to the quantity of energy-matter tensor. Likewise, this solution is a function of radius and time as wave pulse, which can be spectrally reproduced in a function $\frac{\sin\omega L}{\omega L}$, under voltage of the electronic device of electromagnetic radiation bath interacting with the proximity of supermassive object or simple mass movement (see **Figure 2**, and **Figure 3 (A)** and **(B)**).

4. Electronic experiment demonstration of torsion existence through wave links such as spinors and wave pulses

An electromagnetic field as detector can also be a part of establishing the perturbation in the space-time that must help us to perceive the torsion existence. Likewise, this field as a solution of the Maxwell equations in the spinor-twistor framework (**Figure 4**)[4] complies the integrals:

$$\varphi_{A'B'\ldots L'}(\mathbb{R}^{a}) = \frac{1}{2\pi i}\oint_{Z^{\alpha}\leftrightarrow\mathbb{R}^{a}} \pi_{A'}\cdots\pi_{L'}f(Z)\pi_{F'}d\pi_{F'} \tag{27}$$

and

$$\varphi_{AB\ldots L'}(\mathbb{R}^{a}) = \frac{1}{2\pi i}\oint_{Z^{\alpha}\leftrightarrow\mathbb{R}^{a}} \frac{\partial}{\partial\omega^{A}}\cdots\frac{\partial}{\partial\omega^{L}}f(Z)\pi_{F'}d\pi_{F'} \tag{28}$$

which for the particular case of the determination of $A_{\alpha\beta}$, are the integrals:

$$\begin{aligned} A_{\alpha\beta} &= \frac{1}{16\pi G}\oint_{S} R_{AB}\omega_{\alpha}^{A}\omega_{\beta}^{B} \\ &= \frac{1}{16\pi G}\oint_{S} R_{\alpha\beta\gamma\delta}f^{\alpha\beta}d\sigma^{\gamma\delta}, \\ &= \frac{1}{2\pi i}\frac{i}{8\pi G}\oint_{S}\omega_{\alpha}^{A}d^{2}\omega_{\beta A} \\ &= \frac{1}{16\pi G}\oint_{S}\omega_{\alpha}^{A}d^{2}\omega_{\beta A}, \end{aligned}$$

[4] Here our electromagnetic wave equation can be characterized by the massless field equations:

$$\nabla^{AA'}\varphi_{AB\ldots L} = 0, \quad \nabla^{AA'}\varphi_{A'B'\ldots L'} = 0,$$

which are equivalent to $\Box\varphi = 0$, for zero spin case.

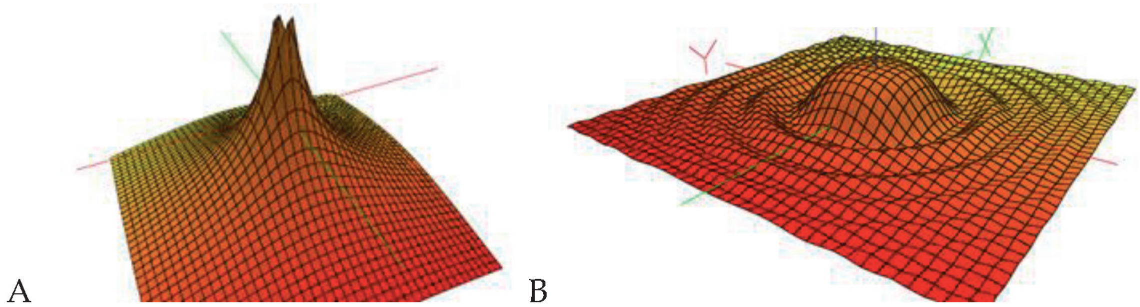


Figure 4.
(A) Two-dimensional surface of charge Q[k] *in monopole field. (B) Two-dimensional surface of energy-matter tensor* $T^{\alpha\beta}$ *in supermassive body.*

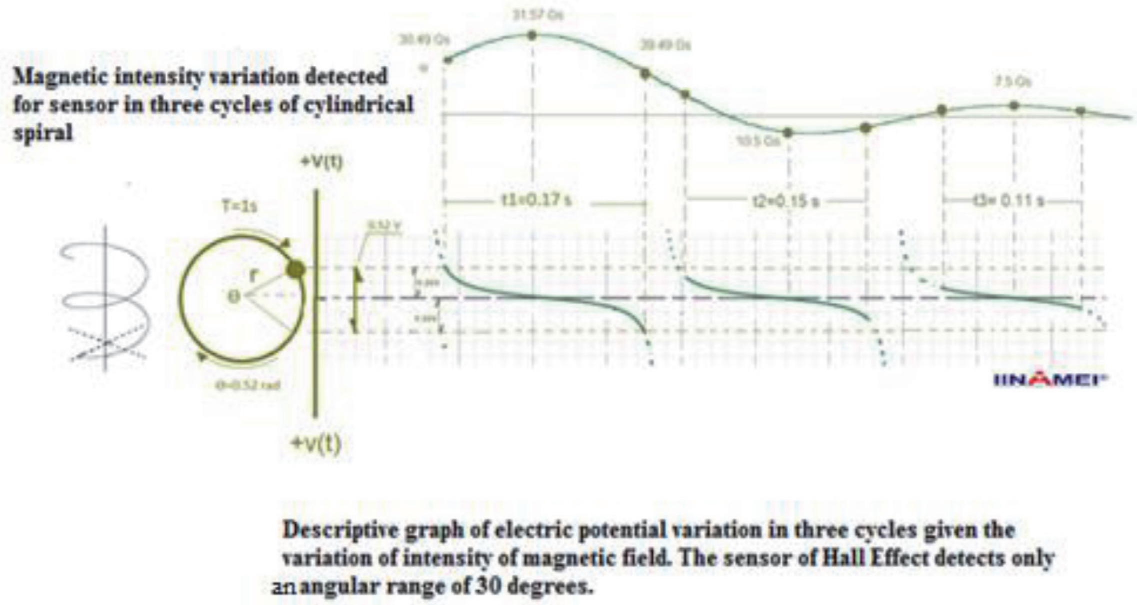
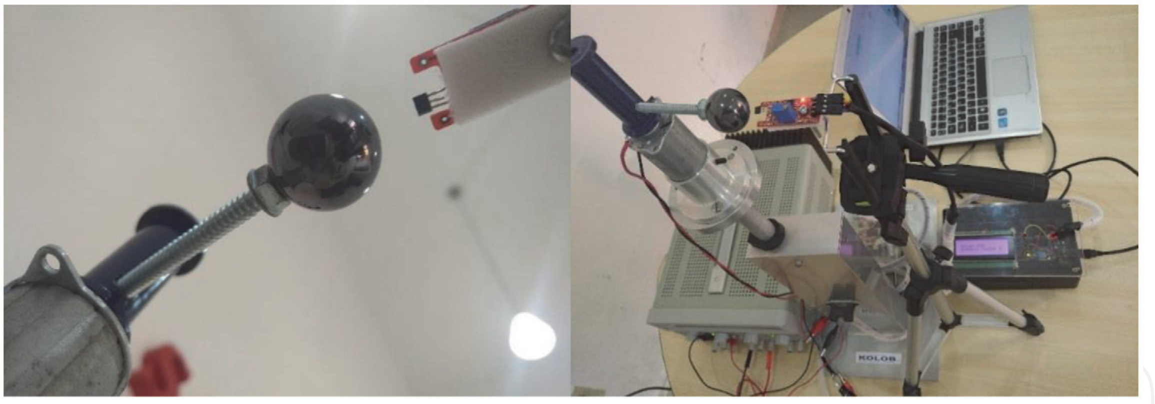


Figure 5.
Dynamic-magnetic system defining the formula $A_{\alpha\beta}Z^{\alpha}I^{\beta\gamma}\overline{Z}_{\gamma}$..

where it has been applied in the field around the circle used as cycle of the displacement along the three-cylindrical spiral cycles (see **Figure 5**). As discussed in Section 2, the torsion evidence can be obtained with a good approximation (given the limitations of the electronic system) when a complete signal $\frac{\sin\omega L}{\omega L}$ is obtained in each three cycles, where two complete spinors are produced.

The sensor device of magnetic field of Hall effect has detected the boundary whose region is an arco length of 0.045 m (see **Figure 6(A)**). Without this range, there is no detection of field, although it is evident the cyclic subsequent displacements of the magnetic dilaton. This is shown with three curves in the graph of **Figure 5**, with displacement times $t_1, t_2,$ and t_3 The electric potential that is generated due to the magnetic field variation is inversely proportional to the magnetic field intensity with base in the relation of 19.4 mV/Gs (**Figure 7**).

In the first half of walk, the magnetic dilaton generates a decreasing potential of 0.52 V, until a minimum of 0.26 V. In the second half of walk, the magnetic dilaton generates an increasing potential of 0.26 V, until a maximum of 0.52 V, when it moves away. For the subsequent cycles, the remoteness of sensor in the trajectory obeys the spiral trajectory of the dynamic system. Both the effect of magnetic dilaton and the dynamics of system define our kinematic twistor tensor $A_{\alpha\beta},$ which can be gauged in a more fine way with a quantum electronic device version of our electronic system used in this experimentation. The tensor of energy mass depends



A **B**

Figure 6.
(A) Magnetic sphere as magnetic dilaton of radius 0.025 m. This dilaton will be used to detect the distortion in the boundary surface Σ, where the interaction happens between the magnetic field of proper dilaton and the gravitational field generated for the mass of the proper dilaton and the mass of the earth. Maximum proximity of sensor is 0.010 m. (B) Rotational dynamic system of radius 0.085, with a reversible vertical displacement of 0.040 m. The sensor used is the Hall effect sensor. The device has an interface system for microcontroller and symmetric variable voltage source.

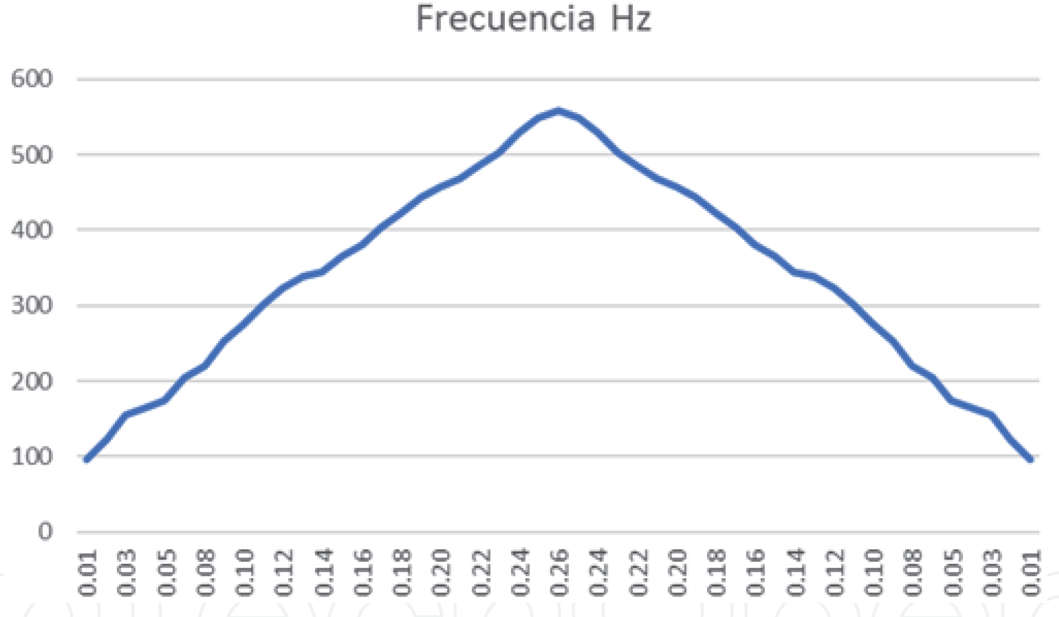


Figure 7.
Frequency in the trajectory of the first cycle.

on the gravitational field between the dilaton mass and the Earth mass. The coordinate systems A, B, … , L and A′, B′, … , L′ are considered in our inertial reference frames used in the experiment.

The conditioning signal is defined for the continuous variations of the electric potential, which are converted in frequency through the integrated circuit LM331 (see the **Figure 7**). The maximum response (output of frequency) of this device is 10 KHz; therefore, it is developed an electronic circuit to condition the signal and has required lectures. The digital signal obtaining each electric potential variation (0.52–0.26 V, and 0.26–0.52 V) as result of position change of the magnetic dilaton in the space is established. The intention of consider digital signal with pulse width to each respective 26 positions in the space is to do for each pulse a convolution with sinusoidal signal, this to obtain and try with periodic signals to the points study that

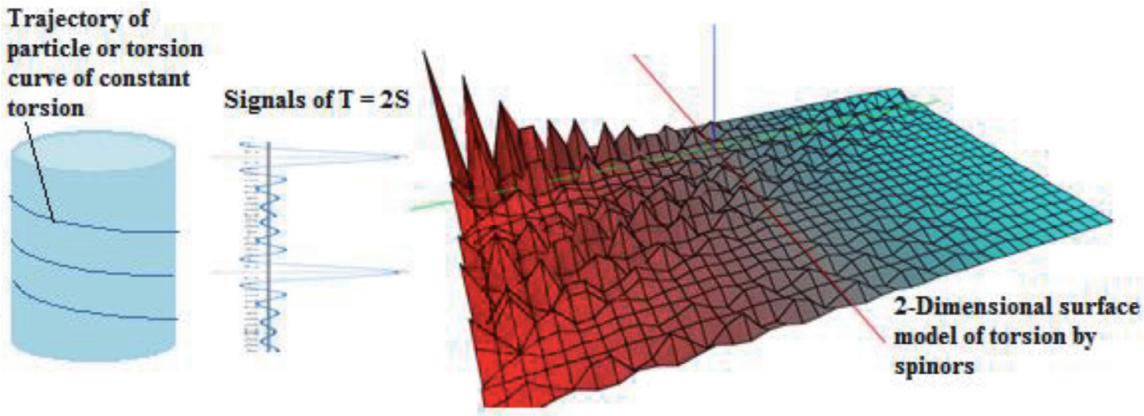


Figure 8.
Two-dimensional model of torsion by spinors.

determine the curve in a 3-dimensional space in field theory in terms of the signal analysis.

In the first experiment (as described in Section 3), the sphere S has not curved inside the three-dimensional surface Σ. The electromagnetic field of monopole is fixed and does not produce distortion in the space. Any matter particle complies the spherical symmetry falling in the natural gravitational Earth field.

In the two experiments (in this Section 4), the choose of a magnetic dilaton represented by the ball of certain mass, which is displaced along the cylindrical spiral trajectory, produces a distortion at least in electronic device lectures and in the space, which could be affected for the Earth magnetic field and also for the gravitational field between the dilaton mass and the Earth mass. Summarizing the above, we can consider the following two-dimensional surface model of spinors deduced directly of second experiment verifying some conclusions on the torsion existence and consistence though twistors (see **Figure 8**).

5. Conclusions

We can establish different dualities in field theory, geometry, and movement to relate the energy-matter tensor and the kinematic twistor tensor for the torsion study. The torsion is a field observable, which in geometry is a second curvature. From a point of view of the field theory, torsion is an high evidence of the birth gravity and its consequences until our days with the gravitational waves detected from astronomical observatories.

Through of electronics is designed an analogue of the measurement of torsion as evidence of gravitational waves existence. With an experiment we gave some fundamentals studied in the gravitation theories, but with a modern mathematical study on invariants as are the twistors and spinors used to microscopic and microscopic field theory.

However, the limitations of our purely electronic devices only let see and interpret using the arguments of geometry, certain traces of electronic signals of the torsion evidence considering an electromagnetic field determined in certain voltage range and a movement of cylindrical trajectory, which as we know, is the constant torsion. However, this verifies Conjecture 2.1 and Theorem 3.1 established in other studies in theoretical physics and mathematical physics. Likewise, the methods and results of the research are on parallel themes and related to the gravity (no gravity precisely), considering this method as analogous to detect gravity waves but in this case to detect waves of torsion in an indirect way.

Appendix. (A) The experimental data table to the cycles of magnetic dilaton displaced along the cylindrical spiral movement

Degrees	Gs
15	30.49
14	30.62
13	30.75
12	30.87
11	30.98
10	31.08
9	31.17
8	31.25
7	31.33
6	31.39
5	31.44
4	31.49
3	31.52
2	31.54
1	31.56
0	31.57
259	31.56
258	31.54
257	31.52
256	31.49
255	31.44
254	31.39
253	31.33
252	31.25
251	31.17
250	31.08
249	30.98
248	30.87
247	30.75
246	30.62
245	30.49

Appendix. (B) Voltage that corresponds to proximity between magnetic dilaton (magnetic sphere) and sensor

Voltage	Frequency
0.01	26
0.02	122

Voltage	Frequency
0.03	155
0.04	165
0.05	174
0.07	205
0.08	220
0.09	252
0.10	275
0.11	303
0.12	324
0.13	338
0.14	344
0.15	365
0.16	380
0.17	404
0.18	422
0.19	443
0.20	457
0.21	489
0.22	495
0.23	502
0.24	530
0.25	542
0.26	559
0.25	548
0.24	530
0.23	503
0.22	495
0.21	483
0.20	457
0.19	443
0.18	422
0.17	404
0.16	380
0.15	265
0.14	344
0.13	338
0.12	324
0.11	303
0.10	275
0.09	252

Voltage	Frequency
0.08	220
0.07	205
0.05	174
0.04	165
0.03	155
0.02	122
`0.01	96

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