Torsion Field: Theoretical Research and Some Applications

YI-FANG CHANG

Department of Physics, School of Physics and Astronomy, Yunnan University,
Kunming, 650091, China.
*Corresponding author E-mail: yfc50445@qq.com, yifangch@sina.com

ABSTRACT

Based on torsion field theory, we research some new results. First, it is a generalization of general relativity to Einstein-Cartan theory. Next, torsion can derive spin, so it may combine general relativity and quantum mechanics. Third, torsion may unify gravitational field and electromagnetic field. Fourth, torsion can describe various helices, from galaxies, biological sciences to DNA, and the left and right rotations are different, such as the energy spectrum. Fifth, torsion field is possibly the theoretical foundation of quantum entanglement. Its propagation equation obtains wave, whose analogy to the gravitational wave has several features, nonlinear, superluminal, etc. Torsion in negative matter is discussed. Finally, we research some applications of torsion field, such as astronomy, particle physics, plant, bioscience and DNA, parapsychology, etc. Torsion field is worth exploration, and can be widely applied.

Keywords: Torsion field, General relativity, Unification, Spin, Application, Astronomy, Helices.

INTRODUCTION

The field in mathematics may include scalar field, vector field, tensor field in general relativity, spinor field of particles, torsion and twistor fields, etc[1].

Torsion field calls also as spin field or axion field. It is the field produced by the object spin angular momentum distorting the space-time coordinates. In 1913 E.J. Cartan declared that there must be a field produced by rotation in nature. In general relativity, Einstein assumed that the torsion field did not exist, but in 1922 Cartan first considered the distortion of the object spin in space-time, thus generating the torsion field, and supplement to a more complete relativity. Weyl pointed out also in the 1930s that mathematics could not exclude the torsion field, which is another force, for the fifth force. In the 1970s a new field of physics was formed: Einstein-Cartan theory as the basis of torsion field, whose primary source is the rotations of the elementary particle. Rotation is everywhere, and each rotation element produces its own torsion field. These fields consisting of elementary particles, atoms, molecules, people, planets, etc., fuse in the universe. P. Bridgman established that the torsion field can be generated not only by the proper rotational moment of the elementary particle, called spin, but also under certain conditions, especially when the structure of the physical vacuum is distorted. These form different torsion fields.

Russian scientists developed torsion theory and some practical execution. A. Akimov proposed that torsion may be divided into static and dynamic field. The static torsion field is generated by a rotating object with a constant angular velocity, which does not radiate energy. But, if a rotating object has more than one form of motion, then it releases energy in the form of a dynamic torsion field wave. Further, Akimov developed his communication concept by torsion field. G. Shipov combined the concept of Cartan and the research of Akimov, and developed the theory of physical vacuum in 1998.

Some scientists believe that torsion field is a front of science in the 21st century. Of course, Weinberg also disagreed[2]. Although there are differences, exploration papers are still many, in 2025 Pylypovskyi, *et al.,* studied the effects of magnetic frustration in ferrotoroidal spin chains via curvature and torsion[3]. Rodriguez-Benites, *et al.,* investigated the cosmological dynamics of a homogeneous scalar field nonminimally coupled to torsion gravity, which also interacts with cold dark matter through energy and momentum transfer[4]. In this paper, we discuss theories and applications of torsion field, and propose some new methods.

Theories of Torsion Field

In a general 4-dimensional Riemann-Cardan geometry there are 16 elements, which include 10 symmetrical fields and 6 antisymmetrical fields. The metric tensor is:

$$g_{\mu\nu} = s_{\mu\nu} + a_{\mu\nu} \tag{1}$$

In Riemann geometry the Christoffel symbols are[5]:

$$\Gamma^i_{kl} = \frac{1}{2} g^{im} \left(\frac{\partial g_{mk}}{\partial x^l} + \frac{\partial g_{ml}}{\partial x^k} - \frac{\partial g_{kl}}{\partial x^m} \right) \tag{2}$$

In general metric-affine geometry the Christoffel symbols divide a symmetrical part and an antisymmetric part:

$$\Gamma^\lambda_{\mu\nu} = \frac{1}{2}(\Gamma^\lambda_{\mu\nu} + \Gamma^\lambda_{\nu\mu}) + \frac{1}{2}(\Gamma^\lambda_{\mu\nu} - \Gamma^\lambda_{\nu\mu}) \tag{3}$$

Here antisymmetric part is called torsion[6]:

$$T^\lambda_{\mu\nu} = \frac{1}{2}(\Gamma^\lambda_{\mu\nu} - \Gamma^\lambda_{\nu\mu}) \tag{4}$$

Spin tensor corresponds to torsion[7]

The general bending space has curvature and torsion. It without torsion (T = 0) is general relativity, and it without curvature (R = 0) is Riemann-Cartan space-time (its space-time degree of freedom is 16)[8]. It without curvature and torsion is an ordinary flat space.

The curvature tensor in Riemannian geometry is:

$$R^i_{klm} = \frac{\partial \Gamma^i_{km}}{\partial x_l} - \frac{\partial \Gamma^i_{kl}}{\partial x_m} + \Gamma^i_{nl}\Gamma^n_{km} - \Gamma^i_{nm}\Gamma^n_{kl} \tag{5}$$

Here are the Christoffel symbols

Einstein gravitational field equations by the contraction of im are:

$$R_{kl} = \frac{\partial \Gamma^i_{kl}}{\partial x_i} - \frac{\partial \Gamma^i_{kl}}{\partial x_i} + \Gamma^i_{nl}\Gamma^n_{ki} - \Gamma^i_{ni}\Gamma^n_{kl} = \kappa T_{kl}^* = \kappa(T_{kl} - \frac{1}{2}g_{kl}T) \tag{6}$$

Such the curvature tensor is symmetry

$R^i_{klm} = -R^i_{kml}$, and by the contraction of ik, Eqs.(5) become

$$R_{lm} = R^k_{klm} = [\frac{\partial \Gamma^k_{km}}{\partial x_l} - \frac{\partial \Gamma^k_{kl}}{\partial x_m}] + (\Gamma^k_{nl}\Gamma^n_{km} - \Gamma^k_{nm}\Gamma^n_{kl}) \tag{7}$$

Both tensors R^i_{klm} and R_{lm} are antisymmetry. They correspond to electromagnetic field and the electromagnetic general relativity[9].

We may assume that the general tensor is:

$$H_{\mu\nu} = S_{\mu\nu} + A_{\mu\nu} \tag{8}$$

Both are symmetry and antisymmetry, respectively.

Hojman, *et al.,* discussed gauge invariance, minimal coupling, and torsion[10]. Kao studied possible implications of a ten-dimensional Einstein-Kalb-Ramond theory, and related torsion, compactification and inflation[11]. Gauntlett, *et al.,* discussed superstrings with intrinsic torsion[12]. Blagojevi, *et al.,* searched "Exotic" black holes with torsion[13].

Torsion Combines General Relativity and Quantum Mechanics

Torsion tensor is:

$$S^\lambda_{\mu\nu} = \frac{1}{2}(\Gamma^\lambda_{\mu\nu} - \Gamma^\lambda_{\nu\mu}) \tag{9}$$

Based on Eq.(9), we derive

$$S_{kl}^i = \frac{1}{2}[g^{im}(\frac{\partial g_{mk}}{\partial x^l}+\frac{\partial g_{ml}}{\partial x^k}-\frac{\partial g_{kl}}{\partial x^m})-g^{im}(\frac{\partial g_{ml}}{\partial x^k}+\frac{\partial g_{mk}}{\partial x^l}-\frac{\partial g_{lk}}{\partial x^m})]=\frac{1}{2}g^{im}(\frac{\partial g_{kl}}{\partial x^l}-\frac{\partial g_{lk}}{\partial x^m}) \quad (10)$$

Since g_{kl} are antisynnetry, so

$$S_{kl}^i = \frac{1}{2}g^{im}\frac{\partial(g_{kl}-g_{lk})}{\partial x^m} = g^{im}\frac{\partial g_{kl}}{\partial x^m} \quad (11)$$

In microscopic scale, g_{kl} and g_{lk} are opposite, both correspond to ±1, respectively.

$$R_{klm}^i = (\frac{\partial \Gamma_{km}^i}{\partial x^l}-\frac{\partial \Gamma_{kl}^i}{\partial x^m})+(\frac{\partial^2 g_{km}}{\partial x_l \partial x^i}-\frac{\partial^2 g_{kl}}{\partial x_m \partial x^i})+(\Gamma_{nl}^i\Gamma_{km}^n-\Gamma_{nm}^i\Gamma_{kl}^n)+(\frac{\partial g_{nl}}{\partial x^i}\frac{\partial g_{km}}{\partial x^n}-\frac{\partial g_{nm}}{\partial x^i}\frac{\partial g_{kl}}{\partial x^n}) \quad (12)$$

When, $S_{kl}^i = \frac{\partial g_{kl}}{\partial x^l} \rightarrow s = \frac{\hbar}{2}n$ torsion becomes spin s (n = 0,1,2, 3,4,..). So torsion may derive spin, and can combine general relativity and quantum mechanics.

General relativity combines the spin to should obtain torsion field, which is also unified with quantum mechanics. Torsion field equations may be respectively: 1). Change and develop $G_{\mu\nu}$, which is similar to Pauli equation as Schrödinger equation + $\frac{e\hbar}{2m}(\sigma \cdot M)\psi$ with spin and magnetic fields. This is the additional potential energy in the external magnetic field H, in which $\frac{e\hbar}{2mc}$ is Bohr magneton. 2). Expand $G_{\mu\nu}$ to $C_{\mu\nu}$, which is similar to Dirac equations derive automatically Pauli equation in the electromagnetic field. The torsion field should derive handedness.

Unification of Gravitational and Electromagnetic Fields

Perhaps, torsion field even is a more general electromagnetic field. The electromagnetic field originates from torsion field. Or torsion field may changes approximately to the electromagnetic field, which is extended to the general antisymmetry field. This is also a unification of gravitational field and electromagnetic field[14].

In 1943 Schrödinger discussed the relation between torsion and electromagnetic field. In the Einstein-Cartan-Sciama-Kibble theory of gravity, the torsion of the spacetime is linearly related to the spin density of the source. Nester, *et al.,* investigated torsion singularities. This singularity is qualitatively different from that which occurs in the corresponding Einstein-Proca (zero torsion) cosmology[15]. Sharpe explained discrete torsion[16].

Some unified theories on the gravitational and electromagnetic fields are researched[14]. A unified method on the general nonsymmetric metric field with high-dimensional space-time and its matrix representations are analyzed mathematically[17]. This is also the Einstein non-symmetric field[18].

General space is ds² = $g_{\mu\nu}dx_\mu dx_\nu$. For gravitational field $g_{\mu\nu}$, $g_{\nu\mu}$ for electromagnetic field $g_{\mu\nu}$ = − $g_{\nu\mu}$. $\Gamma_{\mu\nu}^\lambda = \Gamma_{\nu\mu}^\lambda$ are no-torsion with 40 elements; $\Gamma_{\mu\nu}^\lambda = \Gamma_{\nu\mu}^\lambda$ are torsion with 24 elements[5].

Contorsion tensor as a combination of torsion tensors is[6]:

$$K_{\mu\nu\lambda} = S_{\mu\nu\lambda} - S_{\nu\lambda\mu} + S_{\lambda\mu\nu} \quad (13)$$

in which $S_{\mu\nu\lambda} + S_{\mu\nu}^k g_{k\lambda}$.

The complete affine connection is decomposed as[6]:

$$\Gamma_{\mu\nu\lambda} = \Gamma_{\mu\nu\lambda} + K_{\mu\nu\lambda} \quad (14)$$

A corresponding equation of motion is:

$$\ddot{x}^\mu + \overline{\Gamma}_{k\lambda}^\mu \dot{x}^k \dot{x}^\lambda - 2S_{k\lambda}^\mu \dot{x}^k \dot{x}^\lambda = 0 \quad (15)$$

This is an equation considered the antisymmetry. Further, it should include the corresponding antisymmetric electromagnetic field and Maxwell equations, and their generalizations, such as the Bianchi identity.

The Maxwell-Lorentz equation in the curved space-time is[6]:

$$\ddot{x}^\mu + \overline{\Gamma}_{k\lambda}^\mu \dot{x}^k \dot{x}^\lambda = \frac{e}{mc} F_k^\mu \dot{x}^k \quad (16)$$

Einstein-Cartan equations are [6]:

$$G^{\mu\nu} - \frac{1}{2}D_k(S^{\mu\nu,k} - S^{\nu k,\mu} + S^{k\mu,\nu}) = kT^{\mu\nu} \quad (17)$$

$S^{\mu\nu}$ link to the spin density, which is derived by torsion field [6], and corresponds to s = 1/2 fermion. This is related to Lense-Thirring drag effect in the rotational reference frame. Ordinary flat space is not curvature or torsion.

It is known that there has similar electrodynamics in general relativity[18,5]. For long-range gravitational field and electromagnetic field we

researched various unifications, and the quantization of these unified theories[14]. This is related to the development of general relativity to two tensor-tensor field theory, which may combine the electromagnetic general relativity[9]. It may simplified to a tensor-vector (like an electromagnetic field) theory, and a tensor-scalar theory, in which torsion field becomes a potential field. The most complete theory should be the tensor-tensor theory. Electromagnetic field F is also antisymmetry. Kim studied Brans-Dicke theory in general space-time with torsion, and the equations of motion are satisfied with the conservation laws[19]. The electromagnetic general relativity [9] should have similar or extensive torsion field.

$G_{\mu\nu}$ conserved, its generalization should also be conserved, which is similar to angular momentum including spin conservation. It corresponds to Bianchi identities[6]. The total angular momentum M should include torsion A. Energy-momentum symmetry conservation, and angular momentum antisymmetry M = r×p.

Spin $S = \frac{1}{2}\hbar\sigma$, and $\sigma_\chi\sigma_y = -\sigma_\chi\sigma_y$ are antisymmetry. The angular momentum in the gravitational field corresponds to torsion field. Its secondary effect may be the spin.

Torsion Effects and Quantum Entanglement

Imaki, *et al.,* studied lattice field theory with torsion, and derived the analytical formula for the chiral torsion effect in the continuum limit[20]. Space-time has torsion with antisymmetry, which must have some effects. It may be related to spatial distortion, spin, chirality, similar magnetic field, superluminal velocity.

In special relativity we provided that there are necessarily two symmetrical topological structures separated by the light-cone, in which phase velocity of GLT is superluminal[20,21].

A. The time-like interval $s^2 = r^2_{mn} - c^2t^2_{mn} < 0$, and LT, in which group velocity v<c.

B. The space-like interval $s^2 = r^2_{mn} - c^2t^2_{mn} > 0$, and GLT, in which phase velocity $\nu > c$ is superluminal.

LT and GLT are connected by the de Broglie relation $v\nu = c^2$, in which v is group velocity and particle velocity, and ν is phase velocity, which must be superluminal. Phase as a state in ν is a very magic definition. The superluminal GLT may solve many problems on $\Delta t \rightarrow 0$ and the simultaneity.

We proposed a simple superluminal entangled communication scheme, whose base is quantum entanglement and theoretical base is GLT in space-like interval of special relativity[22]. Conversely, these corresponding effects also indicate space-time with torsion, and the electron spin is also superluminal.

The torsion field is produced by the space-time structure distorted by the spins of anything (Fig. 1). It is even called the fifth fundamental force of the universe.
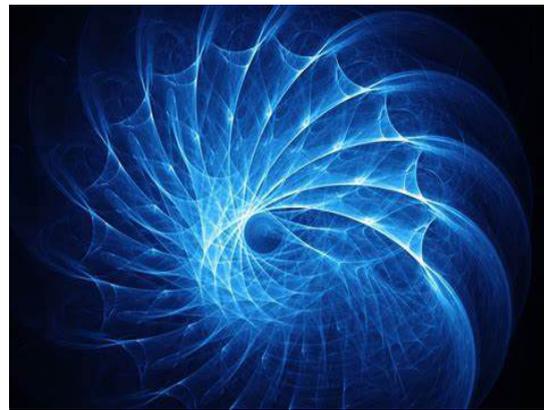
Fig. 1. Torsion field

In 1993 G. Shipov proposed a set of vacuum equations to discuss the various properties of the physical vacuum. According to his equations torsion field derived some unusual characteristics, for example, torsion field is not covered by any natural matter, and its propagation in natural matter does not lose energy, its role will only change the spin state of the matter. Torsion field has holographic properties, which make the universe as a whole. The action of torsion field can change the spin state of the matter.

D.V. Dubrovsky believes that the propagation speed of torsion field is superluminal 10^9 c.

Torsion field produces axial acceleration. After the torsion field source is removed, the spatial spin structure still remains at the site, i.e., torsion field has residual effect.

Torsion field equations are essentially nonlinear, therefore, torsion fields can have a complex internal structure, and form the carrier of

considerable information. The three main properties of the primary torsion field distinguish them from the known physical field: 1). The ability of a torsion field to transmit information without transferring energy; 2). Ability to transmit information faster than the speed of light; 3). Torsion field even can travel through time and space, not only to the future, but also to the past.

If there is torsion in space-time, the motion equation of the spin will predict the existence of self-parallel precession[6]. Torsion tensor of differential geometry is a manner of characterizing a twist or screw of a moving frame around a curve, whose torsion appears in the Frenet-Serret formulas. More generally, on a differentiable manifold equipped with an affine connection, torsion and curvature form the two fundamental invariants of the connection.

Fluid dynamics and magnetohydrodynamics can show vividly some effects of torsion field.

Torsion Wave, and Torsion in Negative Matters
Kaempffer discussed self-consistent torsion potentials, whose gauge-invariant feature is the propagation of a longitudinal massless torsion mode[23]. A theory of gravity is developed which allows for propagating torsion. This predicts the existence of torsion in a vacuum and torsion waves emitted by sources with varying spin. Neville researched spin-2 propagating torsion[23].

Currently, scientists in more than 120 countries around the world are studying the second level of reality, cosmic information field. The primary torsion field generates a physical vacuum, which is the carrier of all the other fields that matter produces. Torsion field interacts with the external field, similar to spin and electromagnetic field. The outfield seems to be divided into two types: strengthened or weakened torsion-antisymmetry fields. Torsion field is a means of information management of world. They instantly cover the entire universe, and creating the cosmic information field or the cosmic consciousness field. Theory of torsion field has been well developed, and its properties and scientific predictions have been confirmed directly or indirectly. The nature of torsion field is unique. They can be generated not only by spins, but also by geometric and topological graphs. They can be generated by themselves, and are always generated by an electromagnetic field. Torsion radiation has a high penetration force and,

like gravity, passes through the natural medium without decay, and meaning unshielded by natural materials. Torsion field potential of sources with radiation is independent of distance. Torsion field in a rotational direction is attracted, and is repelled in different directions.

In essence torsion field means twisting or spiraling. Any spin object or particle may produce torsion field waves, and has its own unique torsion field. This new energy is not an electromagnetic energy, nor is associated with gravity. This new form of energy is a spiral, non-Hertz electromagnetic wave. Since the wave form is a spiral, it is called torsion field wave. These waves are called non-Hertz waves because they do not fit the classical theory of Hertz and Maxwell describing wave behavior.

Torsion field waves are analogy to the gravitational waves, which have several features, nonlinear, superluminal, etc[24]. They originate from all matter, and all atoms are actually generators of torsion field wave. A torsion field wave is generated whenever the spin of the particle changes. Torsion field can be considered as a spin wave propagating in space. Some believe the torsion field wave. But, so far torsion field is unable to reconcile with the established concept of quantum waves in physical theory. Quantum-entangled particles all have spins. The mesons with zero spin are too short lifetime, and have not entangled. Torsion field should have the frequency, and $E = h\nu = mc^2$. Torsion field is possibly the theoretical foundation of quantum entanglement.

Based on Dirac negative energy, Einstein mass-energy relation and principle of equivalence, since 2007 we proposed the negative matter as the simplest model of unified dark matter and dark energy. Because there is repulsion between positive matter and negative matter, both form two different regions of topological separation, so it is invisible dark matter, and repulsion as dark energy[25-27]. In 2025 I have systematically summarized its theories and possible observations, and published a book[28].

Torsion is completely symmetry in the negative matter, but should be opposite between positive and negative matters. The general relativity with torsion will help to explain the richer cosmic phenomena and their evolution.

Applications of Torsion Field

Torsion field is widely applied in Einstein-Cartan theory and so on. They may include:

Astronomy

Li, *et al.,* employed the dynamical attractor and heteroclinic orbit to torsion cosmological dynamics[29]. The gravitational torsion field should have different experimental results. This must be in strong gravity, or in some special cases in astronomy, such as black holes, neutron stars, etc. Spiral galaxies, rod spiral galaxies have huge rotation, and should have astronomic effects on torsion field. They are either left-or right-handed, and have Lense-Thirring drag effect or rotation effect. They and the accretion disk[30] should have some torsion field effects.

Particle physics

Kleinert discussed relations between torsion and particles with spin 1/2 and integral spin[6]. The particle torsion field becomes and corresponds to spin. The base element of the energy is the helix, which corresponds to the superstring. It can change the spin, i.e., linked to anyons. Particle energy can have at least spin-left or spin-right, and corresponds to Yin and Yang in Chinese traditional culture.

In d-dimensional case, $R_{\mu\nu\lambda k}$ has $[\frac{d(d-1)}{2}]^2$ component, and S^i_{kl} has $\frac{d^2(d-1)}{2}$ component[6]. For d = 2, both are 1 and 2 component, respectively. They correspond to the point particles (leptons and nucleons) may have two spins. Such spin s = ±(1/2) may correspond to left or right torsion. For d = 3, both are all 9 component. They may be s = 0, 1/2, 1,3/2, 2.., and may correspond to different torsions, or different coupled particles. They may also be gluons add photon (8+1). Based on the emergence string with oscillation K and rotation I, whose Schrödinger equation is:

$$\frac{d^2\psi}{dr^2} + [-\frac{K(K+1)}{r^2} + 2m(E-U)]\psi = 0. \quad (18)$$

In torsion field the oscillation quantum number S corresponds to momentum P and gravitational field, and rotation quantum number I corresponds to angular momentum and torsion field. Mass formula of quantum equations with torsion should be different.

Utiyama, Sciama, Kibble[7], Hammond, *et al.,* researched the relations between torsion and the gravitational-field spin density. The torsion is applied to the multivalued fields in condensed matter, electromagnetism and gravitation, and direct link to the dislocation density[6], etc.

Moreover, in materials science, and especially elasticity theory, ideas of torsion also play an important role. In fluid dynamics, torsion is naturally associated to vortex lines. Some people researched possible application for cold fusion.

Plant, bioscience and DNA

In plant, bioscience and human body various helices and corresponding torsion fields are widespread. They include torsion field of brain, and the biological membranes[31], etc. The human hand is capable of generating spin-torsion-axion fields. The human brain is the source of human magnetic field, which is also a torus form with a vortex funnel. The torus is a multidimensional vortex. The DNA also has the ring form that is symbolic.

Schrödinger equation adds a Pauli term, so result of DNA will be different. At least they have different energy levels in the magnetic fields. Further, it corresponds to the multivalued mapping principle[6].

Parapsychology

The holographic nature of torsion field waves is regardless of time and distance, and the similarity to human consciousness. It may mean that consciousness exists in the world of torsion field. If the Shibov's equation is correct, the field may become the front of science in the 21st century, which will reveal the mystery of parapsychology. It includes telepathy, clairvoyance, precognition for the future, thought field[32] which is probably related with torsion field.

This realization for the unique nature of torsion field immediately indicates and associates with various physical and mental integration (Psycho Spiritual Integration, PSI). Torsion field can describe some phenomena in parapsychology. In Eq.(9) if $\mu = 0$, or $\nu, \lambda = 0$ with time, torsion will relate possibly to consciousness, etc.

Kozyrev discovered that human thoughts and feelings produce torsion field waves. Such

findings open the door to a "physical" understanding of consciousness as well as more complete models of reality. The relations between torsion field with thought and time are discussed. Kozyrev believes that our minds can change the density of time, and with the ability to concentrate on time at will, we can make telepathy happen. Such all integrated PSI phenomena would be stripped of the supernatural, and accepted by the world of natural phenomena.

In 2013 Si-Chen Lee and W.C. Liang used the theory to prove that although torsion field produced by the particle spin is very weak, the coupling with a large range of rotation, it will produce a huge torsion field, which can be detected[33].

Moreover, UFO is also usually spiraling-flying.

CONCLUSION

Except Weinberg[2], Kleinert thought also that all the theories including torsion may be only a theoretical speculation[6]. But, so far scientists generally believe that torsion field is worth continuous exploration. We research some new results on torsion field theory. It is a generalization of general relativity to Einstein-Cartan theory. Torsion can derive spin, so it may combine general relativity and quantum mechanics, and may unify gravitational field and electromagnetic field. Torsion field can describe various helices, and is possibly the theoretical foundation of quantum entanglement. Some applications of torsion field, such as astronomy, particle physics, plant, bioscience and DNA, parapsychology, etc., are discussed. In a world, torsion field should be searched, and can be widely applied.

Conflict of interest
There is not the conflict of interest.

REFERENCES

1. Yi-Fang Chang.; Some developments and applications on field theory in geometry., *Algebras, Groups, and Geometries*., **2023**, *39*(1), 113-126.
2. S. Weinberg, The value of Einstein's mistakes., *Physics Today*., **2006**, *4*(10), 31-35.
3. O.V. Pylypovskyi.; E.D. Benedetto.; C. Ortix and D. Makarov, Manipulation by magnetic frustration in ferrotoroidal spin chains via curvature and torsion., *Phys. Rev. Research*., **2025**, *7*, 013088.
4. C. Rodriguez-Benites.; M. Gonzalez-Espinoza.; G. Otalora and M. Alva-Morales, Cosmological dynamics in interacting scalar-torsion f(T) gravity: Investigating energy and momentum couplings., *Phys. Rev.*, **2025**, *D111*, 043506.
5. L.D. Landau and E.M. Lifshitz, The Classical Theory of Fields. Pergamon Press., **1975**.
6. H. Kleinert.; Multivalued Fields in Condensed Matter, Electromagnetism and Gravitation. Singapore: World Scientific Publishing Company., **2008**.
7. T.W.B. Kibble, Lorentz invariance and the gravitational field., *J. Math. Phys.*, **1961**, *2*(2), 212-221.
8. K. Hayashi.; T. Shirafuji.; New general relativity., *Phys.Rev.*, **1979**, *D19*, 3524-3553.
9. Yi-Fang Chang.; GRT extended for electromagnetic fields: equivalence principle and geometrization., *Galilean Electrodynamics*., **2005**, *16*(5), 91-96.
10. S. Hojman.; M. Rosenbaum.; M. P. Ryan and L. C. Shepley, Gauge invariance, minimal coupling, and torsion., *Phys. Rev.*, **1978**, *D17*, 3141.
11. W.F. Kao.; Torsion, compactification, and inflation., *Phys. Rev.*, **1993**, *D47*, 3639.
12. J.P. Gauntlett, D. Martelli and D. Waldram, Superstrings with intrinsic torsion., *Phys. Rev.*, **2004**, *D69*, 086002.
13. M. Blagojevi.; B. Cvetkovi and M. Vasili, "Exotic" black holes with torsion., *Phys. Rev.*, **2013**, *D88*, 101501(R).

14. Yi-Fang Chang.; Symmetry, unification and developments on long-range gravitational field and electromagnetic field., *Oriental Journal of Physical Sciences*., **2024**, *9*(1), 31-40.

15. J. M. Nester and J. Isenberg, Torsion singularities., *Phys. Rev.*, **1977**, *D15*, 2078.

16. E. Sharpe, Discrete torsion., *Phys. Rev.*, **2003**, *D68*, 126003.

17. Yi-Fang Chang.; Unified theories of gravitational and electromagnetic fields in Riemannian geometry and higher dimension., *International Review of Physics*., **2014**, *8*(5), 132-140.

18. A. Einstein, The Meaning of Relativity (Fifth edition). Princeton., **1955**.

19. Sung-Won Kim, Brans-Dicke theory in general space-time with torsion., *Phys. Rev.*, **1986**, *D34*, 1011.

20. S. Imaki and A. Yamamoto, Lattice field theory with torsion., *Phys. Rev.*, **2019**, *D100*, 054509.

21. Yi-Fang Chang, New Research of Particle Physics and Relativity. Yunnan Science and Technology Press. 1989., *Phys.Abst.*, **1990**, *93*, 1371.

22. Yi-Fang Chang., Extension and complete structure of the special relativity included superluminal and neutrino-photon with mass., *International Journal of Modern Theoretical Physics*., **2013**, *2*(2), 53-73.

23. Yi-Fang Chang, Simple superluminal entangled communication scheme and its base of special relativity., *Asian Journal of Research and Reviews in Physics*., **2021**, *5*(3), 34-40.

24. D.E. Neville, Spin-2 propagating torsion., *Phys. Rev.*, **1981**, *D23*, 1244.

25. Yi-Fang Chang.; Negative matter., repulsion force, dark matter and inflation cosmos., *Higgs mechanism*., **2007**. arXiv:0705.2908.

26. Yi-Fang Chang, Negative matter, dark matter and theoretical test., *International Review of Physics*., **2011**, *5*(6), 340-345.

27. Yi-Fang Chang.; Basis on negative matter as unified dark matter and dark energy., *SCIREA Journal of Astronomy*., **2023**, *5*(1), 1-11.

28. Yi-Fang Chang, Negative Matter as Unified Dark Matter and Dark Energy: Theories and Possible Observations. Sara Book Publication., **2025**.

29. X.-Z. Li, C.-B Sun and P. Xi, Torsion cosmological dynamics., *Phys. Rev.*, **2009**, *D79*, 027301.

30. J.C. Wheeler (ed.) Accretion Disks in Compact Stellar Systems. Singapore: World Scientific., **1993**.

31. H. Kleinert, Dynamical generation of string tension and stiffness in strings and membranes., *Phys.Lett.,* **1988**, *B211*, 151.

32. Yi-Fang Chang, Living beings and the thought field., *Journal of Religion and Psychical Research*., **2003**, *26*(2), 98-102.

33. W.C. Liang and S.C. Lee, Vorticity, gyroscopic precession, and spin-curvature force., *Phys. Rev.*, **2013**, *D87*, 044024.