

pair of two-component spinors, one of which defines the direction of the line and the other, its moment about the origin, gives the simplest type of twistor, with four complex components.

Penrose, et al., proposed twistor theory as an approach to the quantisation of fields and space-time [47]. Penrose searched nonlinear gravitons and curved twistor theory. Twistor space is a parameter space-time with complex structure [48]. Twistor is:

$$Z_\alpha = (\lambda_A, \bar{\mu}^{\dot{A}}), \quad \bar{Z}^\alpha = (\mu^A, \bar{\lambda}_{\dot{A}}). \tag{15}$$

Here a pair of two-component spinors is:

$$Z_{;1}^A = (\omega^\alpha, \bar{\pi}_{\dot{\beta}}), \quad Z_{;2}^A = (\lambda^\alpha, \bar{\eta}_{\dot{\beta}}). \tag{16}$$

A 4-dimensional point is represented by 3-dimensional complex space, i.e., complex number in twistor. It is applied to quantization and curved space-time.

Penrose and Rindler discussed spinor and twistor methods in space-time geometry [49]. Twistor theory offers a new approach to the synthesis of quantum theory and relativity. Twistors for flat space-time are the SU(2,2) spinors of the twofold covering group O(2,4) of the conformal group. Penrose's basic relations are [49]:

$$\omega^\alpha = iz^{\alpha\dot{\beta}} \bar{\pi}_{\dot{\beta}}, \quad \bar{\omega}^{\dot{\alpha}} = -i\pi_{\beta\dot{\alpha}} \bar{z}^{\beta\dot{\alpha}}. \tag{17}$$

They describe the momentum and angular momentum structure of zero-rest-mass particles. Space-time points arise as secondary concepts corresponding to linear sets in twistor space. Twistors are represented in two-component spinor terms. The generalisation to curved space can be accomplished in three ways; i) local twistors, a conformally invariant calculus, ii) global twistors, and iii) asymptotic twistors which provide the framework for an S-matrix

approach in asymptotically flat space-times.

Further, Hayashi discussed general relativity as gauge field theory in curved twistor space [50]. Penrose summarized the central programme of twistor theory, which includes twistor quantization, self-dual and anti-self-dual fields, helicity 3/2 fields and the vacuum equations, etc [51]. Twistor may be related to string, superstring and supersymmetry [52-54], twistor space [55,56], twistor transform in d dimensions and a unifying role for twistors [57], particles and superparticles, instanton and gauge field, etc. Bando, et al., even proposed supertwistors [58]. The variables of supertwistors are:

$$Z_L^I = (\lambda_L^\alpha, \mu_L^{\dot{\alpha}}, \psi_L^A) \tag{18}$$

$$Z_R^I = (\lambda_R^\alpha, \mu_R^{\dot{\alpha}}, \psi_R^A).$$

These are a pair equations of three variables. Generally, these are n pair equations of m variables. Fedoruk, et al., researched unification of various string models from twistor [59], and twistor string, etc [60].

We researched applications of twistor and its extensions in biology, which may describe some biological duality, and proposed specially the twistor model of DNA [61]. It is well-known that space-time depend on matter and its movement in general relativity. Interactions between biological elements of different levels determine biological structures and shapes. For example, in DNA "horizontal" hydrogen bond interaction connects A-T, and "vertical" stacking interaction connects C-G [62]. Bena, et al., [63,64] elucidated the one-loop twistor-space structure corresponding to momentum-space maximally helicity-violating diagrams, and use the "holomorphic anomaly" to define modified differential operators which can be used to probe the twistor-space structure of one-loop amplitudes [63,64]. Bena, et al., searched loops in twistor space, and twistor transform

in d dimensions and a unifying role for twistors [64]. We applied the loop quantum theory to biology, and proposed the model of protein folding and lungs, and obtain four approximate conclusions [65]. Further, it may combine twistor [61].

So far, biology applies only twister. Twistor as an extension of scalar, vector, spinor and tensor includes the self-dual Yang-Mills field. We may research generally twistor in biology. Based on complex number and the conformal transformation, twistor is [49]:

$$\begin{pmatrix} t+z & x+iy \\ x-iy & t-z \end{pmatrix} = t\sigma_0 + x\sigma_x + y\sigma_y + iz\sigma_z \quad (19)$$

Here using quaternion or Pauli matrices are:

$$\sigma_0 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = I, \quad \sigma_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix},$$

$$\sigma_y = \begin{pmatrix} 0 & i \\ -i & 0 \end{pmatrix}, \quad \sigma_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}. \quad (20)$$

Twistor (15) is two pair conjugate complex numbers, and includes (t, x, y, z) and Pauli matrices. Its space is C^4 . This may be related to relativity. Pauli matrices describe particles with spin $1/2$.

Some structures in biology are helix. RNA is a single link structure on A-U and G-C. Here A is adenine and G is guanine, while U is uracil and C is cytosine. It is known that a helical line is:

$$x = a \cos t, y = b \sin t, z = dt \quad (21)$$

Here d is a thread pitch. A form of the complex function is:

$$z = a \cos t + ib \sin t, w = dt \quad (22)$$

The double helix is:

$$z = a \cos(\varphi + \frac{C_1}{C_2}) \quad \text{and} \quad w = d\varphi.$$

(23)

In complex function $f^{x+iy} = f^x f^{iy}$. When $f=e$, so $e^x e^{iy}$ is a circle with radius $\rho = e^x$ and $\phi = y$ [66].

Twistor may describe biological extensive string with meander and twister. RNA as a string, and DNA as the double string of the double helix structure on A-T and G-C (here T is thymine) should be able to apply twistor. Therefore, we may research the twistor model described DNA, RNA, etc [61].

We may transform quaternion or Pauli matrices to other different forms:

$$1) \quad 1 \rightarrow I = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \text{ is unit matrix, and}$$

$$i \rightarrow C = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \text{ and } C^2 = -I. \text{ Assume that}$$

a new complex positive number j , here $j^2 = 1$.

$$\text{Then, let } j \rightarrow B = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \quad B^2 = I, \text{ correspond}$$

to an inversion operator.

$$k = ij \rightarrow A = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix} = CB, \text{ here } A^2 = I \text{ and}$$

$ji = -k \rightarrow -A$. This set $(1, i, j, k)$ is another quaternion, and relates the Clifford fourfold quaternion. It corresponds to that a field is extended to a ring. Such new twistor is:

$$\begin{pmatrix} t+z & x+y \\ x-y & t-z \end{pmatrix} = tI + xB - yC - zA \quad (24)$$

2) We introduce two pair conjugate complex numbers

$$\begin{pmatrix} t+iz & x+iy \\ x-iy & t-iz \end{pmatrix} = tI + xB - iyC - izA$$

. (25)

This corresponds to two circles.

3) We may add four parameters

$$\begin{pmatrix} at+dz & bx+cy \\ bx-cy & at-dz \end{pmatrix} = atI + bxB - cyC - dzA$$

. (26)

Such their radii may be different, and may be determined. For DNA they correspond to a diameter 20A and the pitch 34A, etc.

These corresponding relations between new quaternion and DNA ($t \sim A$, $z \sim T$ and $x \sim G$, $y \sim C$) are symmetry completely. It is usual B-DNA. Other is A-DNA and Z-DNA, etc. New forms of twistor correspond to develop matrix and tensor, etc.

Twistor is developed from general relativity, and may describe the curved space-time. It is also consistent with a basic idea: the matter determines the structure of space in biology [66]. Moreover, A-T(U), C-G in DNA (RNA) all are 2 square matrix.

Moreover, in biology there is duality. For example, duality and synergy in peptide antibiotic mechanisms by which peptide antibiotics disrupt bacterial DNA synthesis, protein biosynthesis, cell wall biosynthesis, and membrane integrity shown rich diversity, and involved in synergistic relations with antibiotics and proteins [67]. Two ideas in theoretical biology, 'decomposition into functions' and 'gluing functions', show a duality. They imply two biologically significant conditions: the existence of cycles in finite graphs and anticipatory diagrams [68]. Al-Sady, et al., searched mechanistic duality of transcription factor function in phytochrome signaling, and found that PIF3 acts positively as a transcription factor, exclusively requiring its DNA-binding capacity [69]. Twistor and spinor with double components may describe some biological

duality, for example, excitatory synapse and inhibitory synapse, and above duality. The twistor model of DNA [61] is probably advantageous to development of DNA computing model [70].

5. Some Applications of Various Fields

New researches shown that the entangled state should be is a new fifth interaction [71,72]. Its action distance seem to be middle-rang, and its strength is also middle one. This likes the thought field [73]. Further, we proposed the entangled field, whose phase particle (phason) has some characters and corresponding equations. It is tachyon, and assume that it is similar to photon and $J=1$ and $m=0$ or mass is very small as similar neutrino, and may show the action at a distance. We researched that this field as wave has some characters, and discussed the superluminal quantum communication by a pair of entangled states is generated on both positions, or by preparing and transmitting a pair of entangled instruments, so the superluminal quantum communication. Assume that the entangled field has a similar magnetic theory, which may be a quantum cosmic field, or be the extensive quantum theory, or God or the Buddha-fields and so on. These are all macroscopic fields, which correspond to de Broglie-Bohm nonlinear "hidden variable" theory, but it is microscopic [74].

There are Earth's magnetic field [75] and stress field of the Earth's crust [76]. These fields are related to the plate tectonics and global mantle currents. They also determine earthquakes. Based on the nonlinear equations of fluid dynamics, we derived a simplified nonlinear solution of momentum, which correspond to the accumulation of the energy. Their values are excess a faulting threshold, earthquake will take place. From this a chaos equation is obtained, in which chaos corresponds to the earthquake, which shows

complexity on seismology, and impossibility of exact prediction of earthquakes. But, combining the Carlson-Langer model and the Gutenberg-Richter relation, we derived approximately the magnitude-period formula of the earthquakes [12,73,77-80]:

$$T = 10^{-b(M - M_0)} T_0. \quad (27)$$

By this formula some predictions can be calculated quantitatively and are already tested. We forecasted a series of earthquakes in California [73,78,79] since 2004. From this in California next earthquakes should take place in 2009, 2014 and 2019, etc. Earthquakes (M=6.9) occurred on 3 August of 2009, and M=6 on 24 August of 2014. A large earthquake of 2019 is more possible [73,78,79]. In fact, two earthquakes occurred July 4 (M=6.4) and July 5 (M=7.1) in California, which agrees completely with my prediction [80].

Mathematics is a powerful and important tool in modern ecology and environment science [81,82]. We researched field theory is applied to social sciences [3]. Ecological field is namely useful concept. Its complete mode is the unification field of human-nature in Chinese traditional culture. Using the similar formulas of the preference relation and the utility function, we proposed the confidence relations and the corresponding influence functions that represent various interacting strengths of different families, cliques and systems of organization. It produces a multiply connected topological economics. This model may describe a corruption field in usual economic system. Further, we discussed the binary periods of the political economy by the complex function and the elliptic functions [83].

We proposed the social extensive general relativity. Everyone possesses fate and luck, and both correspond to mass self and life orbit

and movement. General relativity shows that matter and movement determine the space-time of everyone, and may derive the corresponding field equations and the evolutionary orbits. In Fig. 2 the big mass of the center and its movement correspond to the great countries and great men that determine space-time and era, from which everyone's mass and efforts determine the orbits of life. Both determine the evolution of whole society and mankind. This as a universal physical representation of causality is a great contribution to modern social science. It is the causality field as a common basis of various natural sciences, Buddhism and some social sciences [84].



Fig. 2. Matter and movement determine the space-time, and space-time determines the evolutionary orbits.

Based on the social structure we introduced the social individual-wave duality, and researched the social topology and the social strain field [82]. A variant of the damage field $D(r,t)$ should agree with the damage field equation:

$$\frac{\partial D}{\partial t} + \frac{\partial(Dv)}{\partial r} = f. \quad (28)$$

Here f is dynamical function of damage.

In a word, in natural science and social science there are widely change and evolutionary fields. The development of mathematics often leads to the progress of physics and science. Field theory has been widely applied in many regions of natural and social sciences, and any development of field theory will necessarily inspire and apply to more aspects.

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