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6. **Oxford Advanced Learner's Dictionary of Current English** / A. S. Hornby. 4th edition. Oxford University Press, 1993.
7. **Oxford Popular Dictionary & Thesaurus 2 in 1.** Oxford University Press, 1998.
8. **The Oxford American College Dictionary** [Электронный ресурс]. URL: http://www.highbeam.com/The+Oxford+American+College+Dictionary/publications.aspx? (дата обращения: 07.01.2010).
9. **Webster's Dictionary** (1913 edition) [Электронный ресурс]. URL: http://www.bibliomania.com/2/3/257/frameset.html (дата обращения: 25.12.2009).

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The article deals with the mathematical analysis of the DNA helix structures and abiotical reproduction and use, especially in nanotechnology. In mathematics, such structures are remarkably similar to an infinite series of solutions in integers of Diophantus and Pythagorean triples of numbers. It is possible that the superstring, in fact, can also be spiral: twins, triplets, etc.

Key words and phrases: DNA structure; double helix; triple helix; nanotechnology; Diophantine equations; Pythagorean triples of numbers; superstring.

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PYTHAGOREAN NUMBERS AND DOUBLE (TRIPLE) SPIRALS©

More than 50 years ago James Watson and Francis Creak discovered double spiral structure of DNA molecule and brought genetics to physics thus having plotted the way for biology development in the late 20th century. By now thousands of researchers are decrypting genetic codes encoded in DNA. Modern biotechnical methods being used, long DNA molecules with desired sequence of function boxes can be made and thus implementing opportunities not used by nature in the course of life as well as other abiotic implementations of DNA such as setting up structures and devices in nanotechnology. DNA lattices are capable to hold a range of large biological molecules.

Nanosize DNA-structure consists of two base chains between which complementary base pairs with weak bonds are located. The most common DNA is B-DNA twisted as a right-hand double spiral with 2 nanometers diameters. One full turn of spiral takes about 3.5 nanometers with 10 pairs of bases on them. Occasionally DNA can form left-hand double spiral (helix) called Z-DNA [2].

At the same time mathematical basis of DNA-structures of double helixes hasn't been studied yet. It would be fine if there were any analogues of two-spiral structures in mathematics. In this connection let's analyze DNA structure with two helixes.

1. Double helix DNA structures are two-lobe helixes.
2. Double helix DNA structures may represent not only linear chains but branched (two-dimensional and three-dimensional) ones as well.
3. Double helix DNA structures couple separate helixes into a double structure with the help of four types of linkages between helix molecules.
4. Double helix DNA structures repeat (resemble) characteristics of helix elements longwise.

In mathematics such structures wonderfully resemble infinite sequences of Diophantus equation solutions in integers [1; 3]:

$t^2-ax^2=\pm b$

These two sequences of solutions, infinite in two directions are presented in Table 1 by two first columns for t and x accordingly, with different values for a and for b=1. An infinite set of such double sequences of numbers can be constructed not only for the given a and b=1 values but for other values of a and b. Note a surprising regularity of double sequences of numbers, namely the determinant of two adjacent rows (consisting of four adjacent numbers) is always equal to one and the same value throughout the infinite length of double numerical chains.

It should be noted that quadruples of adjacent numbers may be connected to physical values (geometrical in particular). It can be seen in [1] for a=2 and $b=d^2$, where d is the absolute difference module for leg lengths of right triangles. Diophantus equations are determined by the following correlations:

$n^2-2m^2=\pm d^2$

$c^2-2z^2=-d^2$

$t^2-2p^2=+d^2$

so that

$(c^2+t^2)=2(z^2+p^2)$

where quadruples of numbers z, c, p, t for two sequences of numbers m and n characterize hypotenuses, the sum of the legs, perimeter, and the sum of the perimeters with the hypotenuse, with a pair of numbers z, c and p, t being obtained by interlacing sequences of numbers m and n, defined by Pythagoras equation

$x^2+y^2=z^2$

$(2mn)^2+m^2-n^2)^2=(m^2+n^2)^2$

where x and y are legs of infinite sequence of right-angled triangles, defined by the same value of the modulus of the difference of the legs (Table 2). Absolute difference of the legs is marked by subscript. In Table 2 the values of the series z, c, p and t, and the numbers m and n, can be extended in both directions, with the same recurrence relations being used.

$m_{k+1}=2m_k+ m_{k-1}$

$n_{k+1}=2n_k+n_{k-1}$

$z_{k+1}=6z_k - z_{k-1}$

$c_{k+1}=6c_k -c_{k-1}$

$p_{k+1}=6p_k - p_{k-1}$

$t_{k+1}=6t_k -t_{k-1}$

As a result these numbers in each row are located on the line of infinite length in both directions.

Table 1

				a=3		Δ	b	a=8		Δ	b	a=15		Δ	b
				0	1	-1	-1	0	1	-1	-1	0	1	-1	-1
				1	2	-1	-1	1	3	-1	-1	1	4	-1	-1
				4	7	-1	-1	6	17	-1	-1	8	31	-1	-1
				15	26	-1	-1	35	99	-1	-1	63	244	-1	-1
				56	97	-1	-1	204	577	-1	-1	496	1921	-1	-1
				780	1351	…	-1	6930	19601	…	-1	30744	119071	…	-1
a=2		Δ	b	a=5		Δ	b	a=10		Δ	b	a=17		Δ	b
0	1	-1	-1	0	1	-1	-1	0	1	-1	-1	0	1	-1	-1
1	1	1	1	1	2	1	1	1	3	1	1	1	4	1	1
2	3	-1	-1	4	9	-1	-1	6	19	-1	-1	8	33	-1	-1
5	7	1	1	17	38	1	1	37	117	1	1	65	268	1	1
12	17	-1	-1	72	161	-1	-1	228	721	-1	-1	528	2177	-1	-1
70	99	…	-1	1292	2889	…	-1	8658	27379	…	-1	34840	143649	…	-1

Table 2

m_1	n_1	m_7	n_7	m_{17}	n_{17}	m_{23}	n_{23}	m_{31}	n_{31}	m_{41}	n_{41}	m_{47}	n_{47}	m_{49}	n_{49}
70	99	234	331	736	1041	900	1273	1518	2147	1218	1723	2184	3089	2580	3649
29	41	97	137	305	431	373	527	629	889	505	713	905	1279	1069	1511
12	17	40	57	126	179	154	219	260	369	208	297	374	531	442	627
5	7	17	23	53	73	65	89	109	151	89	119	157	217	185	257
2	3	6	11	20	33	24	41	42	67	30	59	60	97	72	113
1	1	5	1	13	7	17	7	25	17	29	1	37	23	41	31
0	1	-4	9	-6	19	-10	27	-8	33	-28	57	-14	51	-10	51
1	-1	13	-17	25	-31	37	-47	41	-49	85	-113	65	-79	61	-71
-2	3	-30	43	-56	81	-84	121	-90	131	-198	283	-144	209	-132	193
5	-7	73	-103	137	-193	205	-289	221	-311	481	-679	353	-497	325	-457
z_1	c_1	z_7	c_7	z_{17}	c_{17}	z_{23}	c_{23}	z_{31}	c_{31}	z_{41}	c_{41}	z_{47}	c_{47}	z_{49}	c_{49}
29	41	97	137	305	431	373	527	629	889	505	713	905	1279	1069	1511
5	7	17	23	53	73	65	89	109	151	89	119	157	217	185	257
1	1	5	1	13	7	17	7	25	17	29	1	37	23	41	31
1	-1	13	-17	25	-31	37	-47	41	-49	85	-113	65	-79	61	-71
5	-7	73	-103	137	-193	205	-289	221	-311	481	-679	353	-497	325	-457

p_1	t_1	p_7	t_7	p_{17}	t_{17}	p_{23}	t_{23}	p_{31}	t_{31}	p_{41}	t_{41}	p_{47}	t_{47}	p_{49}	t_{49}
70	99	234	331	736	1041	900	1273	1518	2147	1218	1723	2184	3089	2580	3649
12	17	40	57	126	179	154	219	260	369	208	297	374	531	442	627
2	3	6	11	20	33	24	41	42	67	30	59	60	97	72	113
0	1	-4	9	-6	19	-10	27	-8	33	-28	57	-14	51	-10	51
-2	3	-30	43	-56	81	-84	121	-90	131	-198	283	-144	209	-132	193

Sequence of numbers *m* and *n, z* and *p* and *t*, are obtained up to a sign accuracy at the same value d_i^2 and Δ_i for the determinant (Table 3).

Table 3

n_1	m_1	$\pm d^2_1$	Δ_1	c_1	z_1	$-d^2_1$	Δ_1	t_1	p_1	d^2_1	Δ_1
7	5	-1^2	-1^2	41	29	-1^2	$2\cdot1^2$	99	70	1^2	$-2\cdot1^2$
3	2	1^2	1^2	7	5	-1^2	$2\cdot1^2$	17	12	1^2	$-2\cdot1^2$
1	1	-1^2	-1^2	1	1	-1^2	$2\cdot1^2$	3	2	1^2	$-2\cdot1^2$
1	0	1^2	1^2	-1	1	-1^2	$2\cdot1^2$	1	0	1^2	$-2\cdot1^2$
-1	1	-1^2	…	-7	5	-1^2	…	3	-2	1^2	…
n_7	m_7	$\pm d^2_7$	Δ_7	c_7	z_7	$-d^2_7$	Δ_7	t_7	p_7	d^2_7	Δ_7
23	17	-7^2	-7^2	137	97	-7^2	$2\cdot7^2$	331	234	7^2	$-2\cdot7^2$
11	6	7^2	7^2	23	17	-7^2	$2\cdot7^2$	57	40	7^2	$-2\cdot7^2$
1	5	-7^2	-7^2	1	5	-7^2	$2\cdot7^2$	11	6	7^2	$-2\cdot7^2$
9	-4	7^2	7^2	-17	13	-7^2	$2\cdot7^2$	9	-4	7^2	$-2\cdot7^2$
-17	13	-7^2	…	-103	73	-7^2	…	43	-30	7^2	…
n_{17}	m_{17}	$\pm d^2_{17}$	Δ_{17}	c_{17}	z_{17}	$-d^2_{17}$	Δ_{17}	t_{17}	p_{17}	d^2_{17}	Δ_{17}
73	53	-17^2	-17^2	431	305	-17^2	$2\cdot17^2$	1041	736	17^2	$-2\cdot17^2$
33	20	17^2	17^2	73	53	-17^2	$2\cdot17^2$	179	126	17^2	$-2\cdot17^2$
7	13	-17^2	-17^2	7	13	-17^2	$2\cdot17^2$	33	20	17^2	$-2\cdot17^2$
19	-6	17^2	17^2	-31	25	-17^2	$2\cdot17^2$	19	-6	17^2	$-2\cdot17^2$
-31	25	-17^2	…	-193	137	-17^2	…	81	-56	17^2	…
n_{23}	m_{23}	$\pm d^2_{23}$	Δ_{23}	c_{23}	z_{23}	$-d^2_{23}$	Δ_{23}	t_{23}	p_{23}	d^2_{23}	Δ_{23}
89	65	-23^2	-23^2	527	373	-23^2	$2\cdot23^2$	1273	900	23^2	$-2\cdot23^2$
41	24	23^2	23^2	89	65	-23^2	$2\cdot23^2$	219	154	23^2	$-2\cdot23^2$
7	17	-23^2	-23^2	7	17	-23^2	$2\cdot23^2$	41	24	23^2	$-2\cdot23^2$
27	-10	23^2	23^2	-47	37	-23^2	$2\cdot23^2$	27	-10	23^2	$-2\cdot23^2$
-47	37	-23^2	…	-289	205	-23^2	…	121	-84	23^2	…

Thus, Table 3 gives the classification of the entire infinite series of number sequences that match the given value of the modulus difference between the legs. The same applies to the series of sequences of numbers *m, n, z, c* and *p, t*.

The magnitude of the difference between the catheti *x* and *y* is repeated for different value series of Pythagorean triples, for example, the number 7 for the difference between the catheti is repeated for two series, with one of the triples necessarily occurring, in which the sum of the legs is equal to the same number. This regularity allows the ranks of Pythagorean triples to be joined pair wise with the same difference value between the catheti forming planes of numerical sequences.

In their turn the pairs of planes of number sequences received can be classified in a certain way. So the differences in legs 1, 7, 17, 23, 31, 41, 47, 49, the planes with a module of the difference of the legs 1, 7, 41 represent a specific set of planes with the same sequence related to the sum of the lengths of the legs (...-7, -1, 1, 7, 41,...). The next plane in this numerical sequence will be a plane with the difference equal to 239 and so on up to infinity in both directions.

Thus, one can speak of an infinite number of three-dimensional spaces of numerical sequences of infinite length in all six directions that is about a certain kind of three-dimensional "crystals" of numerical sequences [Ibidem].

The classification problem of Pythagorean numbers seems to be connected to classification of physical values. It was mentioned in one of my books that numbers *x* and *y* are directly related to the classification of wave numbers and atom radiation. Besides, let's note that quadruples of numbers also appear in the three-dimensional spinor calculus at the classification of elementary particles with semi-identity spin. These number quadruples specify two pairs of particles so that there is a direct similarity with pairs of numbers *z, c, p* and *t* determined by Diophantus equation. This incidentally presents a virtual connection of Pythagorean numbers with double spirals of DNA-structures and string helicity.

Notice that Pythagorean equation can be recorded not only in the two-dimensional space but also in the n-dimensional space that corresponds to Euclidean space. The second-degree equation with three variables in unit numbers [Ibidem] can be written as

$t^2-(x_1^2+x_2^2)=\pm s^2$

This equation responds to the metric of three-dimensional time-like and space-like pseudoeuclidean space of index 1. Note the unique peculiarity of solving the second–degree polynomial equations with three variables that lies in the fact that like in the case of two variables number quadruples of equation solution form a periodic dependence defined by recurrent relations

$t_{k+1}=6t_k- t_{k-1}$

$x_{k+1}=6x_k- x_{k-1}$

where t_{k+1}, t_k, t_{k-1} and x_{k+1}, x_k, x_{k-1} are three consequent values t or x appearing with the same value of s. Some solution sequences are presented in Table 4.

Table 4

s, x_1, x_2, t	s, x_1, x_2, t	s, x_1, x_2, t
2, 314, 821, 879	3, 326, 1818, 1847	2, 285, 1386, 1415
2, 54, 141, 151	3, 56, 312, 317	2, 49, 238, 243
2, 10, 25, 27	3, 10, 54, 55	2, 9, 42, 43
2, 6, 9, 11	3, 4, 12, 13	2, 5, 14, 15
2, 26, 29, 39	3, 14, 18, 23	2, 21, 42, 47
2, 150, 165, 223	3, 80, 96, 125	2, 121, 238, 267
2, 874, 961, 1299	3, 466, 558, 727	2, 705, 1386, 1555

A characteristic property of such numeric sequences is a determinant constant between adjacent number quadruples in each pair of three numeric series x_1, x_2, t and constant s (Table 5), so the equation

$t^2-(x_1^2+x_2^2)=\pm s^2$

is fulfilled with s=const.

Table 5

s	x_1	x_2	t	Δ_{nk}	Δ_{tk}	Δ_{tn}
1	606	1002	1171	24	10	22
1	104	172	201	24	10	22
1	18	30	35	24	10	22
1	4	8	9	24	10	22
1	6	18	19	24	10	22
1	32	100	105	24	10	22
1	186	582	611	…	…	…

Note the possible formation of some triples of infinite length number sequences. So,

$t_i^2-2p_i^2=d_i^2$ and $c_i^2-2z_i^2=-d_i^2$

as well as

$(2c_i)^2-8z_i^2=-(2d_i)^2$ and $(2t_i)^2-8p_i^2=(2d_i)^2$

i.e. $(2d_i)^2+(2c_i)^2+z_i^2=(3z_i)^2$ and $-(2d_i)^2+(2t_i)^2+p_i^2=(3p_i)^2$

These two approaches to forming number triple sequences define the infinite number of infinite length number sequences of pseudo-Euclidean character (Table 6), with these sequences being determined by quadruple values of z, c, p and t. This corresponds to three-way spirals (3 spirals). They are characterized by six number values at every stage defined (in this case) by initial two-way spirals. Thus three-way spiral sequences of numbers can be considered as two-way spiral sequences functions.

The validity of this is shown in Table 7. There three types of three-way spirals (x_1, x_2, t_1) are presented, which are linear combinations with a shift for sequences of numbers z_i, c_i, p_i and t_i for d_i=1, 7, 17, 23,....

Let's note the possibility to form some quadruples of sequences for infinite length numbers. The quadruples of sequences of numbers determine for different s_i the infinite number of infinite length sequences of pseudo-Euclidean character (Table 8), these sequences being determined by values of quadruple numbers z, c, p and t. This corresponds to four-way spirals (4 spirals). They are defined by 8 values of numbers at every stage, which in this case are determined by parameters of two initial two-way spirals. Thus it is possible to think that four-way spiral sequences of numbers are functions of two-way spiral sequences.

Table 6

$d_i^2+p_i^2+p_i^2=t_i^2$	d_1	p_1	p_1	t_1	$4d_i^2+z_i^2+4c_i^2=9z_i^2$	$2d_1$	z_1	$2c_1$	$3z_1$
1, 70, 70, 99	1	70	70	99	2, 29, 82, 87	2	29	82	87
1, 12, 12, 17	1	12	12	17	2, 5, 14, 15	2	5	14	15
1, 2, 2, 3	1	2	2	3	2, 1, 2, 3	2	1	2	3
1, 0, 0, 1	1	0	0	1	2, 1, -2, 3	2	1	-2	3
1, -2, -2, 3	1	-2	-2	3	2, 5, -7, 15	2	5	-7	15
$d_i^2+p_i^2+p_i^2=t_i^2$	d_7	p_7	p_7	t_7	$4d_i^2+z_i^2+4c_i^2=9z_i^2$	$2d_7$	z_7	$2c_7$	$3z_7$
7, 234, 234, 331	7	234	234	331	14, 97, 274, 291	14	97	274	291
7, 40, 40, 57	7	40	40	57	14, 17, 46, 51	14	17	46	51
7, 6, 6, 11	7	6	6	11	14, 5, 2, 15	14	5	2	15
7, -4, -4, 9	7	-4	-4	9	14, 13, -34, 39	14	13	-34	39
7, -30, -30, 43	7	-30	-30	43	14, 73, -206, 219	14	73	-206	219
$d_i^2+p_i^2+p_i^2=t_i^2$	d_{17}	p_{17}	p_{17}	t_{17}	$4d_i^2+z_i^2+4c_i^2=9z_i^2$	$2d_{17}$	z_{17}	$2c_{17}$	$3z_{17}$
17, 736, 736, 1041	17	736	736	1041	34, 305, 862, 915	34	305	862	915
17, 126, 126, 179	17	126	126	179	34, 53, 146, 159	34	53	146	159
17, 20, 20, 33	17	20	20	33	34, 13, 14, 39	34	13	14	39
17, -6, -6, 19	17	-6	-6	19	34, 25, -62, 75	34	25	-62	75
17, -56, -56, 81	17	-56	-56	81	34, 137, -386, 411	34	137	-386	411
$d_i^2+p_i^2+p_i^2=t_i^2$	d_{23}	p_{23}	p_{23}	t_{23}	$4d_i^2+z_i^2+4c_i^2=9z_i^2$	$2d_{23}$	z_{23}	$2c_{23}$	$3z_{23}$
23, 900, 900, 1273	23	900	900	1273	46, 373, 1054, 1119	46	373	1054	1119
23, 154, 154, 219	23	154	154	219	46, 65, 178, 195	46	65	178	195
23, 24, 24, 41	23	24	24	41	46, 17, 14, 51	46	17	14	51
23, -10, -10, 27	23	-10	-10	27	46, 37, -94, 111	46	37	-94	111
23, -84, -84, 121	23	-84	-84	121	46, 205, -578, 615	46	205	-578	615

Table 7

z_1	c_1	p_1	t_1	s_1	x_{11}	x_{21}	t_1	s_1	x_{11}	x_{21}	t_1	s_1	x_{11}	x_{21}	t_1
29	41	70	99	1	22	46	51	1	104	172	201	2·1	49	238	243
5	7	12	17	1	4	8	9	1	18	30	35	2·1	9	42	43
1	1	2	3	1	2	2	3	1	4	8	9	2·1	5	14	15
1	-1	0	1	1	8	4	9	1	6	18	19	2·1	21	42	47
5	-7	-2	3	1	46	22	51	1	32	100	105	2·1	121	238	267
z_7	c_7	p_7	t_7	s_7	x_{77}	x_{71}	t_7	s_7	x_{77}	x_{71}	t_7	s_7	x_{77}	x_{71}	t_7
97	137	234	331	7	74	154	171	7	348	576	673	2·7	165	798	815
17	23	40	57	7	16	28	33	7	62	106	123	2·7	37	154	159
5	1	6	11	7	22	14	27	7	24	60	65	2·7	57	126	139
13	-17	-4	9	7	116	56	129	7	82	254	267	2·7	305	602	675
73	-103	-30	43	7	674	322	747	7	468	1464	1537	2·7	1773	3486	3911
z_{17}	c_{17}	p_{17}	t_{17}	s_{17}	x_{117}	x_{217}	t_{17}	s_{17}	x_{117}	x_{217}	t_{17}	s_{17}	x_{117}	x_{217}	t_{17}
305	431	736	1041	17	232	484	537	17	…	1810	2115	2·17	517	2506	2559
53	73	126	179	17	46	86	99	17	192	324	377	2·17	105	462	475
13	7	20	33	17	44	32	57	17	58	134	147	2·17	113	266	291
25	-31	-6	19	17	218	106	243	17	156	480	505	2·17	573	1134	1271
137	-193	-56	81	17	1264	604	1401	17	878	2746	2883	2·17	3325	6538	7335
z_{23}	c_{23}	p_{23}	t_{23}	s_{23}	x_{123}	x_{223}	t_{23}	s_{23}	x_{123}	x_{223}	t_{23}	s_{23}	x_{123}	x_{223}	t_{23}
373	527	900	1273	23	284	592	657	23	…	2214	2587	2·23	633	3066	3131
65	89	154	219	23	58	106	123	23	236	400	465	2·23	133	574	591
17	7	24	41	23	64	44	81	23	78	186	203	2·23	165	378	415
37	-47	-10	27	23	326	158	363	23	232	716	753	2·23	857	1694	1899
205	-289	-84	121	23	1892	904	2097	23	…	4110	4315	2·23	4977	9786	10979

Its validity is shown in Table 8. There are three types of four-way spirals (s, x_1, x_2, t) of sequences of numbers z_i, c_i, p_i *and* t_i *for* d_i=1, 7, 17, 23,.... presented there, being the linear combinations with a shift.

The peculiar feature of these number sequences is the constant value of determinants between adjacent number quadruples in each pair of four number series s, x_1, x_2, t and constancy of value of s (Table 8) so the following equation is realized

$t^2-(x_1^2+x_2^2+x_3^2)=\pm s^2$

where s=const.

By analogy with time-homothetic space the space-like space with another sign at s^2 is formed.

Table 8

z_1	c_1	p_1	t_1	s_1	x_{11}	x_{21}	x_{31}	t_1	s_1	x_{11}	x_{21}	x_{31}	t_1
29	41	70	99	1	46	58	80	109	1	111	140	193	263
5	7	12	17	1	8	10	14	19	1	19	24	33	45
1	1	2	3	1	2	2	4	5	1	3	4	5	7
1	-1	0	1	1	4	2	10	11	1	-1	0	-3	-3
5	-7	-2	3	1	22	10	56	61	1	-9	-4	-23	-25
z_7	c_7	p_7	t_7	s_7	x_{17}	x_{27}	x_{37}	t_7	s_7	x_{17}	x_{27}	x_{37}	t_7
97	137	234	331	7	154	194	268	365	7	371	468	645	879
17	23	40	57	7	28	34	50	67	7	63	80	109	149
5	1	6	11	7	14	10	32	37	7	7	12	9	15
13	-17	-4	9	7	56	26	142	155	7	-21	-8	-55	-59
73	-103	-30	43	7	322	146	820	893	7	-133	-60	-339	-369
z_{17}	c_{17}	p_{17}	t_{17}	s_{17}	x_{117}	x_{217}	x_{317}	t_{17}	s_{17}	x_{117}	x_{217}	x_{317}	t_{17}
305	431	736	1041	17	484	610	842	1147	17	1167	1472	2029	2765
53	73	126	179	17	86	106	152	205	17	199	252	345	471
13	7	20	33	17	32	26	70	83	17	27	40	41	61
25	-31	-6	19	17	106	50	268	293	17	-37	-12	-99	-105
137	-193	-56	81	17	604	274	1538	1675	17	-249	-112	-635	-691
z_{23}	c_{23}	p_{23}	t_{23}	s_{23}	x_{123}	x_{223}	x_{323}	t_{23}	s_{23}	x_{123}	x_{223}	x_{323}	t_{23}
373	527	900	1273	23	592	746	1030	1403	23	1427	1800	2481	3381
65	89	154	219	23	106	130	188	253	23	243	308	421	575
17	7	24	41	23	44	34	98	115	23	31	48	45	69
37	-47	-10	27	23	158	74	400	437	23	-57	-20	-151	-161
205	-289	-84	121	23	904	410	2302	2507	23	-373	-168	-951	-1035

Note the possibility to form some quintuples (sextuples, sevens, octuples) of infinite length number sequences. The quintuples (sextuples, sevens, octuples) of number sequences determine a pseudo-Euclidean infinite length number sequences for s_i (Table 8), these sequences being determined by values of quadruples of numbers *z*, *c, p and t*. This corresponds to five (six, seven, eight)-way spirals (5-, 6-, 7-, 8-spirals). They are defined by double values of numbers at every stage determined (in this case) by initial two-way spiral parameters. Thus, it is possible to expect the five (six, seven, eight)-way spirals to be functions of two-way spiral sequences.

The validity of this is shown in Table 9. It presents two types of five (six, seven, eight)-way spirals($s, x_1, x_2,\dots, x_n, t$) (which are linear combinations with a shift) for number sequences z_i, c_i, p_i and t_i for d_i=1, 7, 17, 23,....

The peculiar feature of these number sequences is the constant value of determinants between adjacent number quintuples (sextuples, sevens, octuples) in each pair of five (six, seven, eight) number series $s, x_1, x_2,\dots, x_n, t$ and constancy of value of s (Table 8), so the following equation is realized:

$$t^2-(x_1^2+x_2^2+\dots+x_n^2)=\pm s^2$$

with $s=s_1$=1,where the blocks correspond to time-like an space-like intervals.

Table 9

x_1	x_2	x_3	x_4	t				x_1	x_2	x_3	x_4	t			
46	58	58	138	167				111	140	140	333	403			
8	10	10	24	29				19	24	24	57	69			
2	2	2	6	7				3	4	4	9	11			
4	2	2	12	13				-1	0	0	-3	-3			
22	10	10	66	71				-9	-4	-4	-27	-29			
x_1	x_2	x_3	x_4	x_5	t			x_1	x_2	x_3	x_4	x_5	t		
46	58	58	58	196	225			111	140	140	140	473	543		
8	10	10	10	34	39			19	24	24	24	81	93		
2	2	2	2	8	9			3	4	4	4	13	15		
4	2	2	2	14	15			-1	0	0	0	-3	-3		
22	10	10	10	76	81			-9	-4	-4	-4	-31	-33		
x_1	x_2	x_3	x_4	x_5	x_6	t		x_1	x_2	x_3	x_4	x_5	x_6	t	
46	58	58	58	58	254	283		111	140	140	140	140	613	683	
8	10	10	10	10	44	49		19	24	24	24	24	105	117	
2	2	2	2	2	10	11		3	4	4	4	4	17	19	
4	2	2	2	2	16	17		-1	0	0	0	0	-3	-3	
22	10	10	10	10	86	91		-9	-4	-4	-4	-4	-35	-37	
x_1	x_2	x_3	x_4	x_5	x_6	x_7	t	x_1	x_2	x_3	x_4	x_5	x_6	x_7	t
46	58	58	58	58	58	312	341	111	140	140	140	140	140	753	823
8	10	10	10	10	10	54	59	19	24	24	24	24	24	129	141
2	2	2	2	2	2	12	13	3	4	4	4	4	4	21	23
4	2	2	2	2	2	18	19	-1	0	0	0	0	0	-3	-3
22	10	10	10	10	10	96	101	-9	-4	-4	-4	-4	-4	-39	-41

Similarly the population of infinite length number sequences for other values of s can be brought, so for $s=s_7$ these sequences look as follows.

Table 10

x_1	x_2	x_3	x_4	t				x_1	x_2	x_3	x_4	t			
154	194	194	462	559				371	468	468	1113	1347			
28	34	34	84	101				63	80	80	189	229			
14	10	10	42	47				7	12	12	21	27			
56	26	26	168	181				-21	-8	-8	-63	-67			
322	146	146	966	1039				-133	-60	-60	-399	-429			
x_1	x_2	x_3	x_4	x_5	t			x_1	x_2	x_3	x_4	x_5	t		
154	194	194	194	656	753			371	468	468	468	1581	1815		
28	34	34	34	118	135			63	80	80	80	269	309		
14	10	10	10	52	57			7	12	12	12	33	39		
56	26	26	26	194	207			-21	-8	-8	-8	-71	-75		
322	146	146	146	1112	1185			-133	-60	-60	-60	-459	-489		
x_1	x_2	x_3	x_4	x_5	x_6	t		x_1	x_2	x_3	x_4	x_5	x_6	t	
154	194	194	194	194	850	947		371	468	468	468	468	2049	2283	
28	34	34	34	34	152	169		63	80	80	80	80	349	389	
14	10	10	10	10	62	67		7	12	12	12	12	45	51	
56	26	26	26	26	220	233		-21	-8	-8	-8	-8	-79	-83	
322	146	146	146	146	1258	1331		-133	-60	-60	-60	-60	-519	-549	
x_1	x_2	x_3	x_4	x_5	x_6	x_7	t	x_1	x_2	x_3	x_4	x_5	x_6	x_7	t
154	194	194	194	194	194	1044	1141	371	468	468	468	468	468	2517	2751
28	34	34	34	34	34	186	203	63	80	80	80	80	80	429	469
14	10	10	10	10	10	72	77	7	12	12	12	12	12	57	63
56	26	26	26	26	26	246	259	-21	-8	-8	-8	-8	-8	-87	-91
322	146	146	146	146	146	1404	1477	-133	-60	-60	-60	-60	-60	-579	-609

Thus the solution of basic equation of particular theory of relativity can be found:

$$t^2-(x_1^2+x_2^2+x_3^2)=\pm s^2$$

as well as similar equation of octo-dimensional time-space

$$t^2-(x_1^2+x_2^2+\ldots+x_7^2)=\pm s^2$$

in the integers with different interval square values for time-like and space-like variants. These solutions are the base for obtaining other correlations determined by integer values t, x_i, s, such as velocity, so one can speak of quantified physical values.

Generally speaking, the construction of n-dimensional space is possible for square of interval, though these solutions won't correspond to definite vector algebra, i.e. this variant may be not admissible.

References

1. **Коротков А. В.** Элементы классификации пифагоровых чисел. Новочеркасск: Набла, 2009. 73 с.
2. **Нейдриен С.** Нанотехнологии и двойная спираль // В мире науки. 2004. № 9.
3. **Сяхович В. И.** Пифагоровы точки. Минск: Изд. центр БГУ, 2007. 288 с.

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Физико-математические науки

Основанием для определения поликвадратичных форм является найденная раннее семимерная векторная алгебра, отличающаяся от трёхмерной векторной алгебры, в которой используется лишь понятие биквадратичных форм. При этом определены симметрические скалярные функции не только для двух векторов, но и скалярное произведение четырёх и шести векторов, а также угол и расстояние между четырьмя и шестью векторами.

Ключевые слова и фразы: линейное вещественное векторное пространство; скалярное произведение четырех и шести векторов; биквадратичные формы; поликвадратичные формы.

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Предпосылкой и основанием для определения поликвадратичных форм является наличие в семимерной векторной алгебре симметрических скалярных функций не только двух векторов – скалярного произведения