Fullerene structures of massive elementary particles.
Is the Higgs boson needed for us?

In „The Subquark Model MSq"[1] at analysis of the structure of more massive elementary particles and comparing their structure with quark structure of the Standard Model clearly results, that these particles including more massive quarks and bosons ***W*** and ***Z*** have biquark structures as the Platonic and Archimedean solids, and most massive – as biquark fullerenes and multiple layers of fullerenes so-called fullerene nanobulbs (rather "femtobulbs") or fullerene onions.

Because recently detected *Y(4140)* particle in Fermilab[2] perfectly is fitting in fullerene theory of the structure of massive particles according to the MSq[3] model as the biquark fullerene $\mathbf{f_{60}}$, so I decided to deal with more massive particles detected experimentally in the profounder way.

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27.05.2009

[1] Ampel Leszek, *The Subquark Model of the structure of elementary particles,* (2009), http://all-subquarks.eu/ (publication - 150 pages in PDF format – available after registering).
[2] Fermilab http://www.fnal.gov/, *Particle oddball surprises CDF physicists*, (18.03.2009), http://www.fnal.gov/pub/presspass/press_releases/Y-particle-20090318.html
[3] Ampel Leszek, *Whether new particle Y(4140) is confirming the correctness of MSq?*, (2009), http://all-subquarks.eu/

1. Accepted labels and values of constants needed for calculations of masses, radii and determining the structure of massive elementary particles

Coefficients (constants) for strong interaction in MSq are equal:

A_{PS} = 3.0719489011767207 and C_{PS} = - 0.19847054425773258

These are two constants used in the formula for calculating masses of individual kinds of appearing bonds amongst bonded pairs of subquarks and with particles created by them.

However for calculating of great masses created through bonded with oneself biquarks it will be sufficient for us only to know enumerated values of masses of asymmetrical and symmetrical biquark bonds B_a and B_s.

Values of the energy of bonds (masses) between two bonded biquarks:

B_a = 52.86039509859153 [MeV] - energy of asymmetrical bond of two biquarks (opposite spins),

B_s = 33.77191909076681 [MeV] - energy of symmetrical bond of two biquarks (parallel spins).

A constant distance between bonded biquarks (direct bonds, not gluons):

a = r_{bb} = 1.9613443634365583 [fm] - length of all edges of biquark structures

a ≈ 1.961 [fm].

Full biquark suit (set) – biquarks being in all 4 possible states:

$b_x, \overline{b}_x, b_y, \overline{b}_y$ (biquarks b_x and b_y with charges +⅓e and -⅓e and with spins + ½ђ and - ½ђ).

Four such biquarks have all zero quantum numbers being characteristic of them.

Resultant spin of fullerene structures S = 0 ђ (unless in the table is marked differently).

In this study we won't be analyzing the subtle structure of elementary particles on account of their resultant spin or charge. It stayed shown in parts: *B. Detailed model - Subquark structure of matter* and *D. Subquark Model „MSq" and Standard Model „SM" - resemblances and differences*. In this study we are interested in only load-bearing structures (massive) of different particles so that calculated mass agrees with experimental mass of these particles, and their decays into less massive particles made sense.[4] However let us remember

[4] If given structure (particle) however should have the spin for example S=+1 ђ, it will be enough one of biquarks about the spin S=- 1/2 ђ to turn away upside down. Mass of the entire particle can change slightly then (instead of a few bonds B_a will be B_s and vice versa).

that inside these massive structures bonded lepton structures can be with oneself (virtual electrons, electron neutrinos, particles *g*), which are also giving the contribution to the total spin, charge (lepton and baryon) and mass of the analyzed particle.

Multiple biquark bonds

Distances amongst biquarks connected with oneself are always identical (omitting elastic gluon bonds). At a large number of biquarks bonded together with oneself we can expect forming spatial solids about edges a = r_{bb}. They are Platonic and Archimedean solids, and at the bulk of bonds (of biquarks) – fullerenes and layered structures compound of many fullerenes – fullerene onions (femtobulbs, femto-onions).

Biquarks can be connected in the more varied way than carbon structures. Bonds can come into existence between:

- two biquarks (pairs of biquarks in light particles),
- three – compatible structures to carbon fullerenes (made of hexagons and pentagons faces),
- 3, 4 and 5 – structures in accordance with Platonic and Archimedean solids having side walls in the form: of equilateral triangles, of squares, of pentagons, of hexagons, of octagons (all about the edges = a) having begun from the regular tetrahedron, of cube, and so on,
- to 8 bonds in nuclides (in the proton all of 7 quarks are connected together between oneself with 6 bonds giving the structure of triangular dipyramid).

Labels of biquark fullerenes

For differentiate structures of biquark fullerenes from carbon fullerenes, for example C60 we will simply be calling them for example $\mathbf{f}_{60}$ (f60).

Because a number of biquarks isn't deciding the size of mass, but number of bonds (number of the edges of the solid), we write it as the superscript index before the **f** letter (similarly to the number of nucleons in isotopes of chemical elements). Whereas the subscript behind the **f** letter will mean the number of biquarks in the fullerene (number of vertexes of the solid). We must still implement one distinguishing on account of the equality of both indicators for different solids, for example:

$^{36}\mathbf{f}_{24}$ would mark the solid truncated octahedron[5] and all at the same time truncated cube[6].

[5] http://mathworld.wolfram.com/TruncatedOctahedron.html
[6] http://mathworld.wolfram.com/TruncatedCube.html

Both solids have identical masses (the same number of edges – of bonds), but the different radius R and their faces are different polygons, what can be important for example at breakdowns to smaller structures and to their lifetime. In order to distinguish such cases it will be sufficient to mark the symbol of the Δ triangle at solids having the part of sides in the form of an equilateral triangles as the superscript after the **f** letter. It is determining, that $^{36}\mathbf{f}^{\Delta}_{24}$ is a truncated cube, which has 8 triangles in its building site, and symbol $^{36}\mathbf{f}_{24}$ will remain for the truncated octahedron, of whom faces are squares and hexagons.

Fullerene onions

According to the notation of carbon fullerene onions for example C540@C240@C60, for the simplicity we will be writing biquark fullerene onions for example as $\mathbf{f}_{240}$@ $\mathbf{f}_{180}$@ $\mathbf{f}_{60}$. Left superscripts (number of bonds) we will only be writing if there is an ambiguity of determining the solid (for smaller solids), for example: $^{90}\mathbf{f}_{60}$@ $^{30}\mathbf{f}_{20}$@ $^{30}\mathbf{f}^{\Delta}_{12}$. Additionally there will be written radii of individual fullerene layers in the bracket in [fm], for example (4.90@2.74@1.86).

Faces of solids

In the overall table every solid has the given number of faces on account of their kind, in the sequence having begun from: S3 (of triangle), S4, S5, S6, ..., S10 (of decagon) as numbers separated with comma, for example:

$^{36}\mathbf{f}_{24}$ (0,6,0,8) (6 squares + 6 hexagons),

$^{36}\mathbf{f}^{\Delta}_{24}$ (8,0,0,0,0,6) (8 triangles + 6 octagons).

Three solids who aren't Archimedean or fullerene solids are appearing in tables, they are non regular solids, however they have all edges = a.

Division of numbers of bonds B_a: B_s = 8 : 7 (most probable) in fullerene structures (pentagon and hexagon faces).

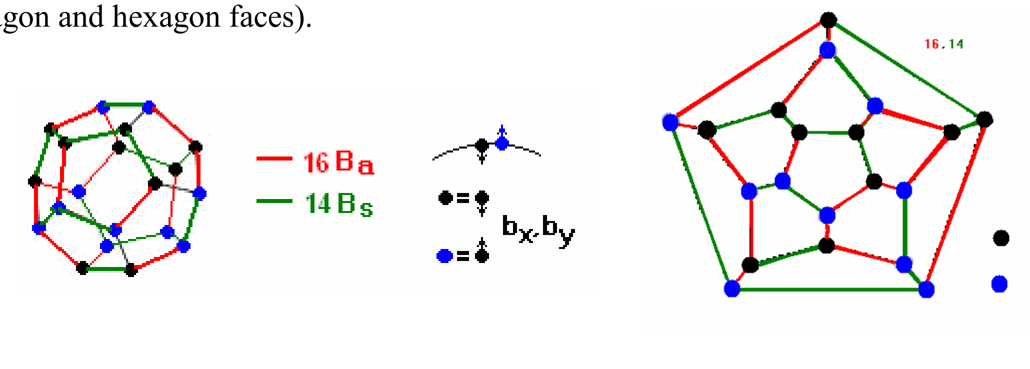


Fig.1 Example of spreading biquarks and bonds between them into biquark fullerene $^{30}\mathbf{f}_{20}$ drawn up in the form of the Schlegel diagram

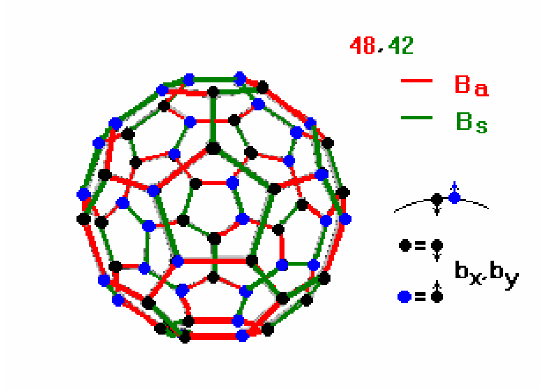


Fig.2 Example of spreading biquarks and bonds between them into biquark fullerene $^{90}\mathbf{f}_{60}$

Division of numbers of bonds B_a: B_s ≈ from 1 : 2 to 2 : 1 in structures of Platonic and Archimedean solids.

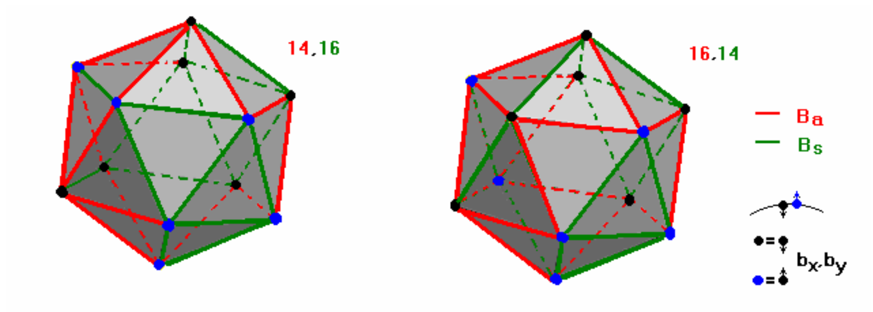


Fig.3 Example of spreading biquarks and bonds between them into icosahedron $^{30}\mathbf{f}^{\Delta}_{12}$

Radius of fullerene structures

Values of radii for Platonic Archimedean solids were taken from sides:

http://mathworld.wolfram.com/PlatonicSolid.html

http://mathworld.wolfram.com/ArchimedeanSolid.html

Fullerene radii having begun from $\mathbf{f}_{180}$ (C180) are coarse estimated from comparing the sum of fields of solid faces (12 pentagons + (n-12)*hexagons) to the surface area of sphere having the R radius. This way the calculated approximation fullerene radius is a bit undervalued. Whereas structure of bigger fullerenes differs from the perfect sphere (bumps are turning up at places where situated pentagons are), so we cannot for them appoint the exact radius. Apart from that biquarks put in fullerene vertexes also have their size (they aren't point particles). On that account we should treat these rays with a rough approximation.

For fullerenes $\mathbf{f}_{180}$ and bigger we will appoint the approximate radius from the formula:

$$R \approx a^* \text{ sqrt}(0.206748^*n - 0.838043),$$

where: a - length of the bond, n – number of faces of fullerene.

Table 1 of less massive biquark solids (Platonic and Archimedean)

Order according to increasing mass

accepted name	mathematical name of the solid	number of bonds (edges)	number of faces: S3,S4,S5,S6 ,..,S10	bond division B_a, B_s	calculated mass [MeV]	radius		number of full suits of biquarks	cl.
						· a	[fm]		
$^{6}f^{\Delta}_{4}$	*tetrahedron*	6	4,0,0,0	3,3 (S=1) 4,2 (S=0)	259.8969 278.9854	0.612	1.20	- 1	o
$^{9}f^{\Delta}_{5}$ **	*triangular dipyramid*	9	6,0,0,0	6,3	418.4781	0.577 -0.816	1.13 -1.60	-	o
$^{12}f_{8}$	*cube*	12	0,6,0,0	4,8	481.6169	0.866	1.70	2	o
$^{12}f^{\Delta}_{6}$	*octahedron*	12	8,0,0,0	6,6	519.7939	0.707	1.39	1+1/2	o
$^{18}f^{\Delta}_{12}$	*truncated tetrahedron*	18	4,0,0,4	10,8(S=0) 9,9 (S=1)	798.7793 779.6908	1.17	2.29	3	o
$^{24}f^{\Delta}_{12}$	*cuboctahedron*	24	8,6,0,0	12,12	1 039.588	1	1.96	3	o
$^{30}f^{\Delta}_{12}$	*icosahedron*	30	20,0,0,0	(14,16) 16,14	(1 280.396) 1 318.573	0.95	1.86	3	o
$^{30}f_{20}$ *	*dodecahedron*	30	0,0,12,0	16,14	1 318.573	1.40	2.75	5	o
$^{36}f_{24}$	*truncated octahedron*	36	0,6,0,8	18,18	1 559.382	1.58	3.10	6	o
$^{36}f^{\Delta}_{24}$	*truncated cube*	36	8,0,0,0,0,6	18,18	1 559.382	1.78	3.49	6	x
$^{40}f^{\Delta}_{14}$ **	*tetrakishexahedron*	40	24,0,0,0	24,16	1 809.000	0.87 -1.21	1.71 -2.37	3+1/2	o
$^{48}f^{\Delta}_{24}$	*small rhombicuboctahedron*	48	8,18,0,0	24,24	2 079.176	1.40	2.75	6	o
$^{60}f^{\Delta}_{24}$	*snub cube*	60	32,6,0,0	32,28	2 637.146	1.34	2.63	6	o
$^{60}f^{\Delta}_{30}$	*icosidodecahedron*	60	20,0,12,0	32,28	2 637.146	1.62	3.18	7+1/2	o
$^{72}f_{48}$	*great rhombicuboctahedron*	72	0,12,0,8,0, 6	36,36	3 118.763	2.32	4.55	12	x
$^{90}f^{\Delta}_{32}$ **	*pentakis dodecahedron*	90	60,0,0,0	48,42	3 955.720	~1.40	2.75	8	o
$^{90}f_{60}$ *	*truncated icosahedron*	90	0,0,12,20	48,42	3 955.720	2.5	4.90	15	o
$^{90}f^{\Delta}_{60}$	*truncated dodecahedron*	90	20,0,0,0,0, 0,0,12	48,42	3 955.720	2.97	5.83	15	x
$^{105}f_{70}$ *	fulleren C70	105	0,0,12,25	56,49	4 615.006	2.5 -2.6	4.90 -5.10	17+1/2	o
$^{120}f^{\Delta}_{60}$	*small rhombicosidodecahedron*	120	20,30,12,0	64,56	5 274.293	2.23	4.37	15	o
$^{150}f^{\Delta}_{60}$	*snub dodecahedron*	150	80,0,12,0	80,70	6 592.866	2.16	4.24	15	o
$^{180}f_{120}$	*great rhombicosidodecahedron*	180	0,30,0,20,0 ,0,0,12	96,84	7 911.439	3.80	7.45	30	x

* Solids $^{30}f_{20}$, $^{90}f_{60}$ i $^{105}f_{70}$ are repeated in the fullerene Table 2.
** $^{9}f^{\Delta}_{5}$ - non regular; $^{40}f^{\Delta}_{14}$ - non regular (dual Archimedean); $^{90}f^{\Delta}_{32}$ – Catalan solid.

Table 2 of biquark fullerenes

accepted name	number of biquarks (vertexes)	number of bonds (edges)	number of faces: S3,S4,S5,S6,.., S10	bond division B_a, B_s	calculated mass [MeV]	radius (of fullerene)		number of full suits of biquarks	classific.		
						· a	[fm]		1	2	3
$^{30}f_{20}$	20	30	0,0,12, 0	16, 14	1 318.573	1.4	2.75	5	x	o	o
$^{90}f_{60}$	60	90	0,0,12, 20	48, 42	3 955.720	2.5	4.90	15	o	o	o
$^{105}f_{70}$	70	105	0,0,12, 25	56, 49	4 615.006	2.5 -2.6	4.90 -5.10	17+1/2	x	x	x
$^{120}f_{80}$	80	120	0,0,12, 30	64, 56	5 274.293	2.8	5.49	30	x	x	x
$^{270}f_{180}$	180	270	0,0,12, 80	144, 126	11 867.16	4.3	8.43	45	x	o	o
$^{360}f_{240}$	240	360	0,0,12,110	192, 168	15 822.88	4.9	9.61	60	o	o	o
$^{810}f_{540}$	540	810	0,0,12,260	432, 378	35 601.48	7.4	14.5	135	o	o	o
$^{1080}f_{720}$	720	1080	0,0,12,350	576, 504	47 468.64	8.6	16.9	180	x	o	o
$^{1440}f_{960}$	960	1440	0,0,12,470	768, 672	63 291.51	9.9	19.4	240	o	o	x
$^{2250}f_{1500}$	1500	2250	0,0,12,740	1200, 1050	98 892.99	12.4	24.3	375	o	o	x
$^{2430}f_{1620}$	1620	2430	0,0,12,800	1296, 1134	106 804.43	12.9	25.3	405	x	o	o
$^{3240}f_{2160}$	2160	3240	0,0,12,1070	1728, 1512	142 405.90	14.9	29.2	540	o	o	o
$^{4320}f_{2880}$	2880	4320	0,0,12,1430	2304, 2016	189 874.54	17.2	33.7	720	x	o	x
$^{4410}f_{2940}$	2940	4410	0,0,12,1460	2352, 2058	193 830.26	17.4	34.1	735	o	o	x
$^{5760}f_{3840}$	3840	5760	0,0,12,1910	3072, 2688	253 166.05	19.9	39.0	960	o	o	o
$^{6750}f_{4500}$	4500	6750	0,0,12,2240	3600, 3150	296 678.97	21.6	42.4	1125	x	o	x
$^{7290}f_{4860}$	4860	7290	0,0,12,2420	3888, 3402	320 413.28	22.4	43.9	1215	o	o	o
$^{9000}f_{6000}$	6000	9000	0,0,12,2990	4800, 4200	395 571.96	24.9	48.8	1500	o	o	x
$^{9720}f_{6480}$	6480	9720	0,0,12,3230	5184, 4536	427 217.71	25.9	50.8	1620	x	o	o
$^{10890}f_{7260}$	7260	10890	0,0,12,3620	5808, 5082	478 642.07	27.4	53.7	1815	o	o	x
$^{12960}f_{8640}$	8640	12960	0,0,12,4310	6912, 6048	569 623.62	29.9	58.6	2160	o	o	o
and so on …											

In the above table we have the list of all fullerene structures (?) in the range from smallest fullerene $^{30}f_{20}$ to $^{12960}f_{8640}$.

Whether all biquark fullerenes can come into existence?

If we are analyzing solids from Table 1, we should rule out solids having faces about the structure bigger than hexagons. It is improbable that such rings with 8-12 connected with oneself biquarks come into existence.

For more massive solids we should find the mathematical recipe for such a numerical series to choosing fullerenes, which presumably fullerene onions can make (magic numbers for biquark fullerenes). There are put 3 different classifications of fullerenes in three last columns of the Table 2. They are a conclusion of different interpretation of the series described below, with different placing of the iteration after $\boldsymbol{n}$ and $\boldsymbol{i}$ indicators:

$\mathbf{f_x}$, where $\mathbf{x = 3^{\boldsymbol{i}} \cdot \boldsymbol{n}^2 \cdot 20}$, for: $\boldsymbol{i} = 1,2$ ..and $\boldsymbol{n} = 1,2$ .. and for $\boldsymbol{i}=0$ and $\boldsymbol{n}=1$

We will do calculations for $\boldsymbol{n}<=12$ and for $\boldsymbol{i}<=6$.

We receive the **Table 3** of values of the number of vertices (biquarks) in fullerene.

„x =”	***i*** =	0 3^0	1 3^1 (Kroto)	2 3^2	3 3^3	4 3^4	5 3^5	6 3^6
n	n^2	**1** n^2	**3** n^2	**9** n^2	**27** n^2	**81** n^2	**243** n^2	**729** n^2
1	**1**	(1)**20**	(3)**60**	(9)**180**	(27)540	(81)1620	(243)4860	(729)14580
2	**4**		(12)**240**	(36)**720**	(108)2160	(324)6480	(972)19440	(2916)58320
3	**9**		(27)**540**	(81)**1620**	(243)4860	(729)14580	(2187)43740	(..)....
4	**16**		(48)**960**	(144)**2880**	(432)8640	(1296)25920	(..)....	(..)....
5	**25**		(75)**1500**	(225)**4500**	(675)13500	(2025)40500	(..)....	(..)....
6	**36**		(108)**2160**	(324)**6480**	(972)19440		(..)....	(..)....
7	**49**		(147)**2940**	(441)**8820**	(1323)26460			(..)....
8	**64**		(192)**3840**	(576)**11520**				
9	**81**		(243)**4860**	(729)**14580**				
10	**100**		(300)**6000**	(900)**18000**				
11	**121**		(363)**7260**	(1089)**21780**				
12	**144**		(432)**8640**	(1296)**25920**				

In brackets are given enumerated values ($3^i \cdot n^2$) before multiplying · 20 (magic numbers).

Three classifications are favoring only certain groups of fullerenes:

1. Classification according to Kroto (as in carbon fullerenes + C20)
   for ***n***=1,2,3,4,5…,*k* ***i***=1 as well as for ***n***=1 and ***i***=0; column ***i***=1 and cell(1,0) [$\mathbf{f_{20}}$]
2. **Full Classification** – all fullerenes:
   for ***n***=1,2,3,6,9,12,… ***i***=1,2 as well as for ***n***=1 and ***i***=0; **column 1,2 and cell(1,0)** [$\mathbf{f_{20}}$]
3. Classification, who is an effect of choice connected with analysis given in the literature of many breakdowns of particles: quark t, bosons W and Z and of less massive particles:
   for ***n***=1,2,.. ,*k* ***i***=(***n***-1),(***n***),… ,*m* *k*,*m* ∊ *N* from the diagonal up

biquark magic numbers: **1, 3, 9, 12, 27, 36, 81, 108, 243, 324, 432, 729, 972, 1296, ...**

Two additional fullerenes not included in classifications are put in the Table 2. It are:

$^{105}\mathbf{f_{70}}$ - fullerene „rugby ball” – we should rank it on account of numerous appearing such carbon fullerenes what shows on „permanence” of such a structure.

$^{120}\mathbf{f_{80}}$ - this fullerene rather isn't appearing, although its mass is fulfilling the certain gap in the energy series.

Complementary character of masses of fullerene

Fullerenes with pentagonal and hexagonal faces are characterized by it, that everyone biquark (vertex) is bonding to three different. It means that the number of bonds is directly proportional to the number of biquarks. An important property results from it, that the fullerene of the higher class can be replaced with the small onion with a few fullerenes of a lower order (it can disintegrate without the slippage). And these are a few examples in the simplified notation:

2160 = 1620@540
2160@240@60 = 1500@960
1500 = 960@540
960 = 720@240 = 720@180@60 = 540@240@180
240 = 180@60

2. The structure and decays of massive elementary particles

At a detailed analysis of the structure of light mesons (pions, kaons, eta) and SM quarks in the publication[7] it already resulted, that the majority of particles has the "crystalline" structure and they are appearing in many variants about similar mass. As a result of appearing of these variants decays and lifetimes are different on account of the different number of lepton and biquark bonds. So we should expect different variants of the structure of more massive particles also.

For the beginning let us analyze the decay of the ***B*** meson anew discovered particle ***Y***(4140)[8].

B^+ => ***Y(4140)*** + K^+(494)

Y(4140) => ***J/ψ*** + ***φ***

J/ψ (3096) is break down into two muons,
φ (1019) is break down frequently on two kaons.

Parameters of the decay:

	B^+ ($\mathbf{f}_{60}$@$^{30}\mathbf{f}^{\Delta}_{12}$) =>	***Y(4140)***($\mathbf{f}_{60}$) +	K^+(sześcian $^{12}\mathbf{f}_8$) +	(4 biquarks => leptons)
B_a,B_s{n}	64,56 {72}	48,42 {60}	4,8 {8}	+4 bq
mass	5.27429 [GeV]	3.95572 [GeV]	0.48162 [GeV] +	ΔE = +0.84 [GeV]
radius	(4.90@1.86) [fm]	(4.90) [fm]	(1.70) [fm]	

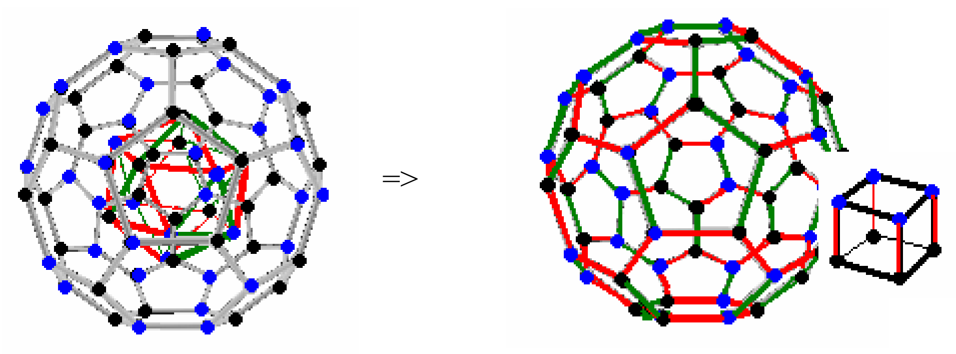


Fig.4 Decay of the internal $^{30}\mathbf{f}^{\Delta}_{12}$ into $^{12}\mathbf{f}_8$ (K^+). $\mathbf{f}_{60}$ remains alone, that is ***Y(4140)***.

Decay of the *Y(4140)* for three variants of the structure *J/ψ(3097)*

v.1

Y(4140)($\mathbf{f}_{60}$) =>	***J/ψ*** ($^{30}\mathbf{f}_{20}$@$^{30}\mathbf{f}^{\Delta}_{12}$)	+ ***φ*** ($^{18}\mathbf{f}^{\Delta}_{12}$@$^{6}\mathbf{f}^{\Delta}_{4}$)	
48,42 {60}	32,28 {32}	12,12 {16}	+12 bq
3.95572 [GeV]	2.63714 [GeV]	1.03959 [GeV] +	ΔE = +0.82 [GeV]
4.90 [fm]	(2.75@1.86) [fm]	(2.29@1.20) [fm]	

[7] Ampel Leszek, *The Subquark Model of the structure of elementary particles,* (2009), http://all-subquarks.pl/ (publication - 150 pages in PDF format – available after registering).
[8] Fermilab http://www.fnal.gov/, „*Particle oddball surprises CDF physicists*", (18.03.2009), http://www.fnal.gov/pub/presspass/press_releases/Y-particle-20090318.html

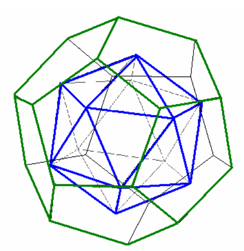
v.2

Y(4140) (f_{60}) =>	J/ψ ($^{30}f_{20}$@ $^{30}f^{\Delta}_{12}$@ $^{6}f^{\Delta}_{4}$) +	φ ($^{18}f^{\Delta}_{12}$@ $^{6}f^{\Delta}_{4}$)	
48,42 {60}	36,30 {36}	12,12 {16}	+8 bq
3.95572 [GeV]	2.91613 [GeV]	1.03959 [GeV] +	ΔE = 0 [GeV]
4.90 [fm]	(2.75@1.86@1.20) [fm]	(2.29@1.20) [fm]	

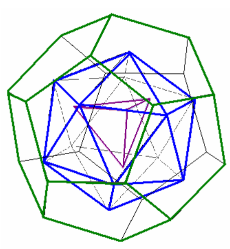
v.3

Y(4140) (f_{60}) =>	J/ψ ($^{48}f^{\Delta}_{24}$@ $^{24}f^{\Delta}_{12}$) +	φ ($^{18}f^{\Delta}_{12}$@ $^{6}f^{\Delta}_{4}$)	
48,42 {60}	36,36 {36}	12,12 {16}	+8 bq
3.95572 [GeV]	3.11876 [GeV]	1.03959 [GeV] +	ΔE = -0.2 [GeV]
4.90 [fm]	(2.75@1.96) [fm]	(2.29@1.20) [fm]	

v.1



v.2



v.3

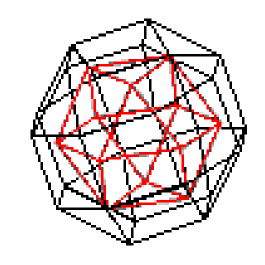
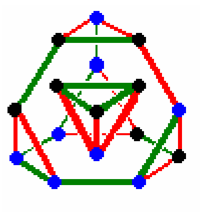


Fig.5 Three variants of the biquark structure of the particle ***J/ψ***

Particle ***J/ψ*** contains 32 or 36 biquarks. After decay of the majority of biquarks (of annihilation of biquark suits) are coming into existence two muons.

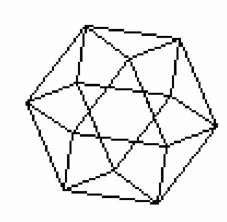
Particle ***φ(1019)*** decays frequently into two kaons:

φ ($^{18}f^{\Delta}_{12}$@ $^{6}f^{\Delta}_{4}$) =>	K^{+}(cube $^{12}f_{8}$) +	K^{-}(cube $^{12}f_{8}$)	
12,12 {16}	4,8 {8}	4,8 {8}	+0 bq
1.03959 [GeV]	0.48162 [GeV]	0.48162 [GeV] +	ΔE = +0.08 [GeV]
(2.29@1.20) [fm]	(1.70) [fm]	(1.70) [fm]	



Particle ***φ*** (for S=0) (tetrahedron into truncated tetrahedron)

φ ($^{18}f^{\Delta}_{12}$@ $^{6}f^{\Delta}_{4}$)
(2.29@1.20) [fm]



The ***φ*** particle can be also a solid: (cuboctahedron) $^{24}f^{\Delta}_{12}$:

12,12 {12}	or: 14,10 {12}
1.03959 [GeV]	1,07776 [GeV]
(1.96) [fm]	

Fig.6 Two variants of the biquark structure of the particle ***φ***

Table 4 of fullerene structures of load-bearing massive quarks

(different variants)

(Grey background: less probable structures on account of the accepted ranking no.3 from Table 3, ruling out **f** 960 and **f** 1500)

quark from SM	exsp. mass [GeV][9]	variants of the structure according to MSq	model mass [GeV]	sum of biquark bonds B_a, B_s {umber of biquarks}*	radius R [fm]
quark *c*	1.27 (11)	$^{30}f^{\Delta}_{12}$	**1.31857**	16,14 {12}	**1.86**
		$^{30}f_{20}$		16,14 {20}	2.75
		$^{40}f^{\Delta}_{14}$	1.80900	24,16 {14}	1.71-2.37
quark *b*	4.20 (17)	f_{60}	3.95572	48,42 {60}	4.90
		f_{60} @ $^{12}f_{8}$	**4.43734**	52,50 {68}	**(4.90@1.70)**
		$^{105}f_{70}$	4.61501	56,49 {70}	~5.10
		f_{60} @ $^{30}f_{20}$	**5.27429**	64,56 {80}	**(4.90@2.75)**
		f_{60} @ $^{30}f^{\Delta}_{12}$		64,56 {72}	**(4.90@1.86)**
quark *t*	171.2 (2.1)	f_{1620}@ f_{720}@ f_{180}@ $^{30}f_{20}$	**167.4588**	2032,1778 3810 **{2540}**	**(25.3@16.9@8.43@2.75)**
		f_{1500}@ f_{960}@ f_{60}@ $^{30}f_{20}$			(24.3@19.4@4.90@2.75)
		f_{1500}@ f_{540}@ f_{240}@ f_{180}@ f_{60}@ $^{30}f_{20}$			(24.3@14.5@9.61@8.43 @4.90@2.75)
		f_{1500}@ f_{960}@ f_{70}@ $^{30}f_{20}$	168.1181	2040,1785 {2550}	(24.3@19.4@5.10@2.75)
		f_{1500}@ f_{540}@ f_{240}@ f_{180}@ f_{70}@ $^{30}f_{20}$			(24.3@14.5@9.61@8.43@5.10@2.75)
		f_{2160}@ f_{240}@ f_{180}	**170.0959**	2064,1806 3870**{2580}**	**(29.2@9.61@8.43)**
		f_{1620}@ f_{720}@ f_{240}			**(25.3@16.9@9.61)**
		f_{1620}@ f_{960}			(25.3@19.4)a
		f_{1620}@ f_{540}@ f_{240}@ f_{180}			**(25.3@14.5@9.61@8.43)**
		f_{2160}@ f_{240}@ f_{180}@ $^{30}f_{20}$	**171.4145**	2080,1820 3900**{2600}**	**(29.2@9.61@8.43@2.75)**
		f_{1620}@ f_{540}@ f_{240}@ f_{180}@ $^{30}f_{20}$			**(25.3@14.5@9.61@8.43@2.75)**
		f_{1620}@ f_{960}@ $^{30}f_{20}$			(25.3@19.4@2.75)
		f_{2160}@ f_{240}@ f_{180}@ f_{60}	174.0517	2112, 1848 3960{2640}	**(29.2@9.61@8.43@4.90)**
		f_{2160}@ f_{240}@ f_{180}@ f_{60}@ $^{30}f_{20}$	175.3702	2128, 1862 3990{2660}	**(29.2@9.61@8.43@4.90@2.75)**
		f_{1500}@ f_{960}@ f_{180}@ $^{30}f_{20}$,			(24.3@19.4@8.43@2.75)
		f_{2160}@ f_{540}@ $^{30}f_{20}$	179.3260	2176, 1904 4080{2720}	**(29.2@14.5@2.75)**
		f_{1500}@ f_{960}@ f_{240}@ $^{30}f_{20}$			(24.3@19.4@9.61@2.75)
		f_{1500}@ f_{960}@ f_{180}@ f_{60}@ $^{30}f_{20}$			(24.3@19.4@8.43@4.90@2.75)
		f_{2160}@ f_{540}@ f_{60}@ $^{30}f_{20}$	183.2817	2224, 1946 4170{2780}	**(29.2@14.5@2.75)**
		f_{1500}@ f_{960}@ f_{240}@ f_{60}@ $^{30}f_{20}$			(24.3@19.4@9.61@4.90@2.75)

* To the structure of quarks we include one biquark less or more. This special biquark belongs to the different bonded quark, what mass of quarks should be slightly smaller (or bigger) by from 1 to a few bonds B_a and B_s than it results from geometry of fullerenes in Table 4. These bonds are treated as gluon connections from SM, bonding this quark with different in the particle, and more precisely – bonding two belonging biquarks to different quarks.

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[9] sources of masses: C. Amsler *et al.,* Physics Letters **B667**, 1 (2008)

Knowing the presumable construction of the load-bearing structures of quarks we can try to present several dozen known particles in the form of structures of fullerene onions.

Table 5 of fullerene load-bearing structures of massive particles
(not taken into consideration lepton bonds with virtual electrons, neutrinos and particles *g*)

particle (quarks)	**exsp.mass**[10] [GeV]	**structure according to MSq**	**model mass** [GeV]	**sum of biquark bonds** B_a, B_s {umber of biquarks}	**radius R** [fm]
ω (uu|dd)	0.78265 (16)	${}^{18}f^{\Delta}_{12}$	0.77970 0.79878	9,9 {12}(S=1) 10,8{12}(S=0)	2.29
φ (ss)	1.019455 (20)	${}^{18}f^{\Delta}_{12}@\ {}^{6}f^{\Delta}_{4}$	1.03959	12,12{16}(S=0)	(2.29@1.20)
		${}^{24}f^{\Delta}_{12}$	1.03959 1,07776	12,12 {12} 14,10 {12}	1.96
lepton *τ*	1.77684 (17)	${}^{30}f_{20}@\ {}^{12}f_{8}$ ${}^{40}f^{\Delta}_{14}$	1.80019 1.80900	20,22 {28} 24,16 {14}	(2.75@1.70) 1.71-2.37
D$^{\pm}$ (cd)	1.86962 (20)	${}^{40}f^{\Delta}_{14}$ ${}^{30}f_{20}@\ {}^{12}f^{\Delta}_{6}$	1.80900 1.83837	24,16 {14} 22,20 {26}	1.71-2.37 (2.75@1.39)
D^{o} (cu)	1.86484 (17)	${}^{40}f^{\Delta}_{14}$ ${}^{30}f_{20}@\ {}^{12}f^{\Delta}_{6}$	1.80900 1.83837	24,16 {14} 22,20 {26}	1.71-2.37 (2.75@1.39)
$D_s^{\pm}$ (cs)	1.96849 (34)	${}^{30}f_{20}@\ {}^{12}f^{\Delta}_{6}$ ${}^{48}f^{\Delta}_{24}$	1.83837 2.07918	22,20 {26} 24,24 {24}	(2.75@1.39) 2.75
J/ψ (cc)	3.096916 (11)	${}^{30}f_{20}@\ {}^{30}f^{\Delta}_{12}$ ${}^{30}f_{20}@\ {}^{30}f^{\Delta}_{12}@\ {}^{6}f^{\Delta}_{4}$ ${}^{48}f^{\Delta}_{24}@\ {}^{24}f^{\Delta}_{12}$ ${}^{30}f_{20}@\ {}^{40}f^{\Delta}_{14}$	2.63714 2.91613 3.11876 3.12757	32,28 {32} 36,30 {36} 36,36 {36} 40,30 {34}	(2.75@1.86) (2.75@1.86@1.20) (2.75@1.96) (2.75@1.71-2.37)
ψ(2S)	3.68609 (4)	${}^{60}f^{\Delta}_{24}@\ {}^{24}f^{\Delta}_{12}$	3.67673	44,40 {36}	(2.63@1.96)
Y*(3940)*	3.943 (13)	f_{60}	3.95572	48,42 {60}	4.90
Y*(4140)*	4.1430 (29)[11]	f_{60}	3.95572	48,42 {60}	4.90
Y*(4260)*	4.260 ()[12]	$f_{60}@\ {}^{6}f^{\Delta}_{4}$	4.23471	52,44 {64}	(4.90@1.20)
Y*(4350)*	4.324 (24)[13] 4.361 (9)[14]	$f_{60}@\ {}^{12}f_{8}$	4.39945	52,50 {68}	(4.90@1.70)
Y*(4620)*	4.664 (11)[15]	f_{70} $f_{60}@\ {}^{18}f^{\Delta}_{12}$	4.61501 4.75450	56,49 {70} 58,50 {72}	5.10 (4.90@2.29)
B$^{\pm}$ (ub)	5.27915 (31)	$f_{60}@\ {}^{30}f^{\Delta}_{12}$ $f_{60}@\ f_{20}$	5.27429	64,56 {72} 64,56 {80}	(4.90@1.86) (4.90@2.75)
B^{o} (db)	5.27953 (33)	$f_{60}@\ {}^{30}f^{\Delta}_{12}$ $f_{60}@\ f_{20}$	5.27429	64,56 {72} 64,56 {80}	(4.90@1.86) (4.90@2.75)
B_s^{o} (sb)	5.3663 (6)	${}^{120}f^{\Delta}_{60}$	5.27429	64,56 {60}	4.37
$B_c^{\pm}$ (cb)	6.276 (4)	${}^{120}f^{\Delta}_{60}@\ {}^{24}f^{\Delta}_{12}$ ${}^{150}f^{\Delta}_{60}$ $f_{60}@\ f_{20}@\ {}^{30}f^{\Delta}_{12}$	6.31388 6.59287 6.59287	76,68 {72} 80,70 {60} 80,70 {92}	(4.37@1.96) 4.24 (4.90@2.75@1.86)

[10] sources of masses: C. Amsler *et al.,* Physics Letters **B667**, 1 (2008)
[11] sources: Fermilab http://www.fnal.gov/
[12] source: BaBar: 4.259(8); Belle: 4.247(12); Cleo: 4284(4) [GeV]
[13] source: exp. BaBar
[14] source: exp. Belle
[15] source: exp. Belle

boson ***W***	80.398 (25)	f_{960}@ f_{240}@ f_{20} f_{960}@ f_{180}@ f_{60}@ f_{20} f_{720}@ f_{240}@ f_{180}@ f_{60}@ f_{20}	**80.4330**	976,854 **{1220}**	(19.4@9.61@2.75) (19.4@8.43@4.90@2.75) (16.9@9.61@8.43@4.90@2.75)
boson ***Z***	91.1876 (21)	f_{720}@ f_{540}@ 2x(f_{20}@ ${}^{40}f^{\Delta}_{14}$)	89.3253	1088,942 {1328}	(16.9@14.5@2x(4.90@1.71-2.37))
		f_{960}@ 2x(f_{180}@ f_{20}) f_{960}@ f_{240}@ 2x(f_{60}@ f_{20})	89.6630	1088,952 {1360}	(19.4@2x(8.43@2.75)) (19.4@9.61@2x(4.90@2.75))
		f_{960}@ f_{240}@ f_{180} f_{960}@ f_{240}@ 2x(f_{70}@ f_{20}) f_{720}@ f_{540}@ 2x(f_{60})	**90.9816**	1104,966 **{1380}**	(19.4@9.61@8.43) (19.4@9.61@2x(5.10@2.75)) (16.9@14.5@2x(4.90))
		f_{720}@ f_{540}@ 2x(${}^{60}f^{\Delta}_{30}$@ ${}^{40}f^{\Delta}_{14}$)	91.9624	1120,970 {1348}	(16.9@14.5@ 2x(3.18@1.71-2.37))

(Grey background: less probable structures on account of the accepted ranking no.3 from Table 3, ruling out **f** 960 and **f** 1500)

Example of the collapse of the *t* quark structure into the boson *W* and *b* quark

Let us establish, that in the fullerene series aren't formed biquark fullerenes f_{960} and f_{1500} (according to classification 3. in Table 3).

Let us choose two most probable variants of quark *t*:

1. f_{2160}@ f_{240}@ f_{180}@${}^{30}f_{20}$ (171.4145 [GeV]) 2600 biquarks 3900 bonds

2. f_{2160}@ f_{240}@ f_{180} (170.0959 [GeV]) 2580 biquarks 3870 bonds

From the energy balance (of masses of particles) of this breakdown results, that half of bonds quark *t* is undergoing the exchange to the kinetic energy and remaining are creating fullerenes of lower classes. Since number of bonds in typical fullerenes is having good proportions to the number of biquarks (3:2), so for simple counting and the identification of structures we can make numerical operations on biquarks instead of on bonds.

1. After the breakdown *t* from 2600 biquarks (the half is undergoing the annihilation) remains 1300:

From 1300 biquarks can come into existence only fullerene f_{720}.

1300 => f_{720} + remainder 580
r=580 => f_{240} +
r=340 => f_{180} +
r=160 => f_{60} + f_{60} +
r=40 => f_{20} + f_{20} (or ${}^{30}f^{\Delta}_{12}$)

created: $W = f_{720}$@ f_{240}@ f_{180}@ f_{60}@ f_{20}
and
$b = f_{60}$ @ ${}^{30}f_{20}$ (f_{60} @ ${}^{30}f^{\Delta}_{12}$).

2. Similarly is in the second case - after the breakdown ***t*** from 2580 biquarks (the half is undergoing the annihilation) remains 1290 (rather should stay 1288 or 1292 after the breakdown - annihilations of n of full suits compound of 4 biquarks):

1288 => $\mathbf{f_{720}}$ + remainder 568
r=568 => $\mathbf{f_{240}}$ +
r=328 => $\mathbf{f_{180}}$ +
r=148 => $\mathbf{f_{60}} + \mathbf{f_{60}}$ +
r=28 => $\mathbf{f_{20}} + {}^{12}\mathbf{f_8}$

created: $W = \mathbf{f_{720}} @ \mathbf{f_{240}} @ \mathbf{f_{180}} @ \mathbf{f_{60}} @ \mathbf{f_{20}}$
and

$b = \mathbf{f_{60}} @ {}^{12}\mathbf{f_8}$ (or = $\mathbf{f_{60}} @ {}^{30}\mathbf{f}^{\Delta}_{12}$ for the decay with 1292 biquarks).

However if exactly a half of biquarks will undergo the initial breakdown, it is staying 1290 can created the boson ***W*** and the ***b*** quark as the $\mathbf{f_{70}}$ structure.

Structures from biquark fullerene onions in energy wavebands not yet examined

From compounds into different biquark fullerene onions we can theoretically get any values of the spectrum of masses distant from oneself about a few GeV. However if we will remove the part of fullerenes from the entire series from Table 3 (with only biquark magic numbers according to suggested), it is a layout of mass will be less homogeneous. In Table 6 is shown the energy area, whom scientists are interested in. There scientists are planning finding the hypothetical Higgs boson.

Table 6. Examples of load-bearing fullerene structures possible to observe in energy area 115 - 165 [GeV]

(Grey background: less probable structures on account of the accepted ranking no.3 from Table 3, ruling out **f** 960 and **f** 1500)

particle ?	**exsp. mass** [GeV]	**structure according to MSq**	**model mass** [GeV]	**sum of biquark bonds** B_a, B_s {umber of biquarks}	**radius R** [fm]
Area of seeking the Higgs boson (2009)	115–165[16]	f_{960}@ f_{540}@ f_{240}@ f_{60}@ f_{20} f_{1500}@ f_{240}@ f_{60}@ f_{20}	119.9902	1456,1274 {1820}	(19.4@14.5@9.61@4.90@2.75) (24.3@9.61@4.90@2.75)
		f_{960}@ f_{540}@ 2x(f_{180}@ f_{20}) f_{1500}@ 2x(f_{180}@ f_{20}) f_{1620}@ f_{240}@ 2x(f_{20})	125.2645	1520,1330 {1900}	(19.4@14.5@2x(8.43@2.75)) (24.3@2x(8.43@2.75)) (25.3@9.61@2x(2.75))
		f_{960}@ f_{540}@ f_{240}@ f_{180}@ f_{60}@ f_{20} f_{1500}@ f_{240}@ f_{180}@ f_{60}@ f_{20}	131.8573	1600,1400 {2000}	(19.4@14.5@9.61@8.43@4.90@ 2.75) (24.3@9.61@8.43@4.90@2.75)
		f_{1500}@ 2x(f_{240}@ f_{20}) f_{1500}@ 2x(f_{180}@ f_{60}@ f_{20}) f_{1620}@ f_{240}@ 2x(f_{60}@ f_{20})	133.1759	1616,1414 {2020}	(24.3@2x(9.61@2.75)) (24.3@2x(8.43@4.90@2.75)) (25.3@9.61@2x(4.90@2.75))
		f_{2160} f_{1620}@ f_{540}	142.4059	1728,1512 {2160}	29.2 (25.3@14.5)
		f_{2160}@ 2x(f_{20}) f_{1620}@ f_{540}@ 2x(f_{20})	145.0431	1760,1540 {2200}	(29.2@2x(2.75)) (25.3@14.5@)2x(2.75))
		f_{2160}@ 2x(f_{60}@ f_{20}) f_{1620}@ f_{540}@2x(f_{60}@ f_{20})	152.9545	1856, 1624 {2320}	(29.2@2x(4.90@2.75)) (25.3@14.5@2x(4.90@2.75))
		and so on ...			
	165	f_{1620}@ f_{720}@ 2x(f_{60}@ f_{20})	164.8216	2000, 1750 {2500}	(25.3@16.9@2x(4.90@2.75))

3. Is the Higgs boson needed for us?

Whether the Higgs boson is needed for us especially with strictly defined own mass? **NO!**

Higgs boson[17] and especially a field of Higgs were implemented into the Standard Model in order to explain appearing of masses in massless particles (for example of bosons *W* and *Z*) by spontaneous breaking the symmetry[18].

How we can see from this paper (as well as from the entire The Subquark Model) aren't needed for us to search for an intricate mechanisms for explaining generating masses of particles detected in experiments and their breakdowns (CERN, Fermilab, etc). Multidimensional spaces are not needed for us (String Theory). Particles from straightest and massless to of the ones most massive (certainly not yet discovered) are built from subquark pairs creating: photons, neutrinos, electrons, biquarks,......, all the way to very massive fullerene onions (quickly disintegrating), and mass is a frozen energy in bonds between

[16] Expected area of finding the Higgs boson in Fermilab (2009) http://www.fnal.gov/
[17] http://en.wikipedia.org/wiki/Higgs_boson
[18] http://en.wikipedia.org/wiki/Spontaneous_symmetry_breaking

subquarks and with their pairs between oneself and what's more in the three-dimensional space (+time). Mass is being calculated from one universal formula having only two constants characteristic of strong (and lepton) interaction and its variety with two constants for weak interaction (small masses of virtual quanta, neutrinos and gravitons).

If however somebody thinks that we should explicitly show the Higgs boson in MSq theory, that clearly Tables: 1, 2, 4, 5 and 6 are showing it. **It is nothing else as biquark load-bearing structure of every particle** (having zero quantum numbers – outside quantum numbers of the smell which are describing the type of the "crystalline" structure of quarks from SM).

4. Summary

Biquark fullerene structures as in atomic world (carbon fullerenes) can form elementary particles. The difference consists in the fact that they are briefly living (apart from the specific proton structure) and they are disintegrating on more and more smaller fullerene onions creating next less and less massive groups of particles, until a total breakdown won't follow of biquark structures into light and massless lepton structures: photons, virtual quanta, gravitons, neutrinos an real electrons.

Alone biquark load-bearing structures of particles aren't deciding their spins and charges. However they are spreading among the masses them, accumulating the huge quantities of energy for a moment in their bonds. Inside these structures should be imprisoned lepton biquark-electron-neutrino structures connected additionally with pairs of particles *g*. This they are granting properties for the entire particle, i.e. spin and baryon and lepton charge. They are also deciding the final decomposition of the particle on a few smaller. It seems, that particle in the moment of the coming into existence „already knows” in what way it in the future will disintegrate (spontaneously). In the moment of its coming into existence in its interior the lepton pairs are creating, e.g. from disintegrating pairs of biquarks can come into existence electron-positron pairs connected with their electron neutrinos, and so on.

The hypothetical Higgs boson is such biquark structure which is creating the fundamental mass of the entire particle and in principle is deciding what is its lifetime of breakdown. For bigger biquark fulleren (onion) all the more quickly it is undergoing the breakdown. Fullerene $\mathbf{f}_{60}$ is an exception here, which so as in carbon fullerene has special ownerships of the stability. We can see it at comparing the structure of ***B*** mesons (outside fulleren is $\mathbf{f}_{60}$) with less massive ***D*** mesons ($^{30}\mathbf{f}_{20}$ or $^{40}\mathbf{f}^{\Delta}_{14}$), which at least smaller, it a little bit more quickly are disintegrating.