SUBATOMIC PARTICLES AND A MAGIC STAR

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The article considers a paradoxical geometric figure that is constructed of two equal but unspecified in their form and dimensions triangles. It appears to be a carrier of the values of the conserved additive quantum numbers of the real strongly and weakly interacting particles, though we didn't use any data from the particle physics while constructing it.

1 Introduction

It is known that as a result of complex and labor consuming experiments a lot of hadrons, leptons have been discovered, their quantum numbers have been determined and mutual transformations have been studied. It might seem that there isn't any other way to obtain the similar information. But in the meantime rather a large portion of such information about subatomic particles is contained in a hidden way in a simple geometric figure that will be named as "magic star". The mentioned above figure refers directly to the physics of subatomic particles. The magic star is an unusual and probably seldom phenomenon in physics when some part of data about subatomic particles is concentrated in a simple geometric figure in spite of the fact that the above mentioned figure is a simple geometric object and according to the way of its construction it doesn't refer to the particle physics at all.

2 Construction and features of the magic star

Let us take two equal but unspecified in their form and dimensions triangles. We superpose them and then turn one of them in the plane of the other by 180° round the common point of their medians intersection. These two triangles together form a flat figure with the centre of symmetry in the point of the medians intersection C (Fig. 1, a). We call the obtained figure as "magic star". The striking features of this figure are due to the intersection points of the triangles sides that form the figure. There are 12 such points. Let us number them and designate as M_k, where k is the point number. These points will be named as magic. We circle them and the symmetry centre C in the figures.

With the help of elementary geometrical reasoning it is not difficult to prove the following main feature of the magic star: magic points are located on the constructed figure so that many different flat oblique-angled coordinate systems with uniform scales along the coordinate axes can be applied to it, where all the magic points M_k without any exceptions and the point C coincide exactly with the nods of the coordinate grids of such coordinate systems. Let us call these coordinate systems as proper. We superpose the origin of their coordinates with the point C. The coordinate values for the points M_k of the magic star in the proper coordinate systems are always integer positive and negative numbers. The proper coordinates of the magic points don't depend on either dimensions or form of the magic star. They are invariant with any linear transformations of the magic star.

3 Proper coordinates of the magic points and additive quantum numbers of hadrons

One of the proper coordinate systems of the magic star with the axes Y and X is shown in Fig. 1, b. The origin of the coordinates coincides with the point C. Let us assign number 1 to this system. The values of the proper coordinates of the magic points in system 1 are given in Tab. 1. A specialist in the field of physics of elementary particles will notice that the proper coordinates of the magic points of the figure under consideration presented in table 1 most directly concern hadrons.

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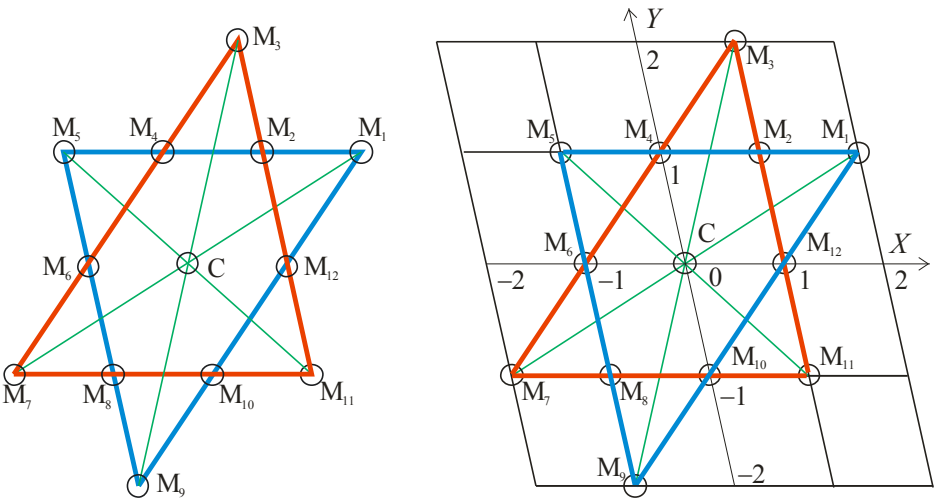

a) *b)*

Figure 1: *a) The magic star.*
b) The magic star with the proper coordinate system 1.

Table 1.

Values of the coordinates of the magic points in the coordinate system 1, and the values of the conserved additive quantum numbers B and Q of hadrons

Magic points M_k	Values of the coordinates for the points M_k		Values of the additive numbers B and Q		Structures from quarks and antiquarks of the first generation	Values of the additive numbers Q and B		Structures from quarks and antiquarks of the first generation
	Y	X	$B=Y$	$Q=X$		$Q=Y$	$B=X$	
M_1	1	2	1	2	uuu	1	2	$uuuddd$
M_2	1	1	1	1	uud	1	1	uud
M_3	2	1	2	1	$uuuddd$	2	1	uuu
M_4	1	0	1	0	udd	1	0	$u\bar{d}$
M_5	1	−1	1	−1	ddd	1	−1	$\bar{d}\bar{d}\bar{d}$
M_6	0	−1	0	−1	$\bar{u}d$	0	−1	$\bar{u}\bar{d}\bar{d}$
M_7	−1	−2	−1	−2	$\bar{u}\bar{u}\bar{u}$	−1	−2	$\bar{u}\bar{u}\bar{u}\bar{d}\bar{d}\bar{d}$
M_8	−1	−1	−1	−1	$\bar{u}\bar{u}\bar{d}$	−1	−1	$\bar{u}\bar{u}\bar{d}$
M_9	−2	−1	−2	−1	$\bar{u}\bar{u}\bar{u}\bar{d}\bar{d}\bar{d}$	−2	−1	$\bar{u}\bar{u}\bar{u}$
M_{10}	−1	0	−1	0	$\bar{u}\bar{d}\bar{d}$	−1	0	$\bar{u}d$
M_{11}	−1	1	−1	1	$\bar{d}\bar{d}\bar{d}$	−1	1	ddd
M_{12}	0	1	0	1	$u\bar{d}$	0	1	udd
C	0	0	0	0	$u\bar{u}$, $d\bar{d}$	0	0	$u\bar{u}$, $d\bar{d}$

It is not difficult to notice that the values for each pair of coordinates in Y and X directions of any magic point exactly coincide with the values for the pair of the conserved additive numbers B (barion

number) and Q (electric charge in the system of units where a module of an electron charge is taken equal to one) for hadron structures [1], indicated in Tab. 1.

As it can be seen from Tab. 1, the equalities $B = Y$, $Q = X$ and $Q = Y$, $B = X$ take place. This follows from the fact that the axes of the coordinates Y and X don't have anything different from each other. Therefore, the magic star contains data about the values for the pairs of the conserved additive quantum numbers B and Q of the hadrons observed in nature. From Tab. 1 we can see the following permutation symmetry for hadrons: if the hadron for which $B = a_1$ and $Q = a_2$ is real, then the hadron for which $B = a_2$ and $Q = a_1$ will be real too [2].

Now let us consider the proper coordinate system of the magic star with number 2 (Fig.2). The proper coordinates of the magic points of the figure under consideration represented in Tab.1 also have a direct bearing to hadrons.

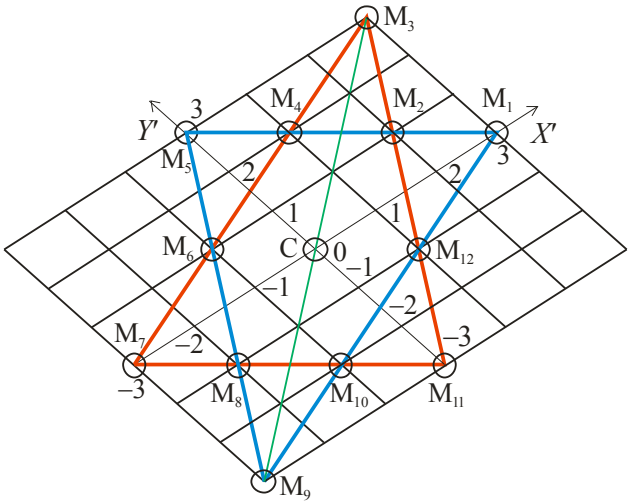

Figure2: *The magic star with the proper coordinate system 2.*

The values for the pairs of coordinates of the magic points in Y' and X' directions in system 2 coincide with the numbers of the valence quarks N_d and N_u, and accordingly of the quarks d and u in the structures presented in Tab. 2, if $N_d > 0$ and $N_u > 0$. If the coordinates $Y' < 0$ and $X' < 0$, then they coincide with $N_d < 0$ and $N_u < 0$ – the numbers of the valence antiquarks $\bar{d}$ и $\bar{u}$ accordingly taken with negative signs. As it can be seen from Tab. 2, the equalities $N_d = Y'$, $N_u = X'$, and $N_u = Y'$, $N_d = X'$ take place. This follows from the fact that the axes of the coordinates Y' and X' don't have any differences. Therefore, the magic star contains data about the values for the pairs of the quantum numbers N_d and N_u that can be observed in the nature of hadrons. In Tab. 2 we can see the following permutation symmetry for hadrons: if the hadron for which $N_d = c_1$ and $N_u = c_2$ is real, then the hadron for which $N_d = c_2$ and $N_u = c_1$ will be real too [2].

Table 2

Values of the coordinates of the magic points in the coordinate system 2, and the values of the quantum numbers N_d and N_u of hadrons

Magic points M_k	Values of the coordinates for the points M_k		Values of the numbers N_d and N_u		Structures from quarks and antiquarks of the first generation	Values of the numbers N_u and N_d		Structures from quarks and antiquarks of the first generation
	Y'	X'	$N_d = Y'$	$N_u = X'$		$N_u = Y'$	$N_d = X'$	
M_1	0	3	0	3	uuu	0	3	ddd
M_2	1	2	1	2	uud	1	2	udd
M_3	3	3	3	3	$uuuddd$	3	3	$uuuddd$
M_4	2	1	2	1	udd	2	1	uud
M_5	3	0	3	0	ddd	3	0	uuu
M_6	1	–1	1	–1	$\bar{u}d$	1	–1	$u\bar{d}$
M_7	0	–3	0	–3	$\bar{u}\bar{u}\bar{u}$	0	–3	$\bar{d}\bar{d}\bar{d}$
M_8	–1	–2	–1	–2	$\bar{u}\bar{u}\bar{d}$	–1	–2	$\bar{u}\bar{d}\bar{d}$
M_9	–3	–3	–3	–3	$\bar{u}\bar{u}\bar{u}\bar{d}\bar{d}\bar{d}$	–3	–3	$\bar{u}\bar{u}\bar{u}\bar{d}\bar{d}\bar{d}$
M_{10}	–2	–1	–2	–1	$\bar{u}\bar{d}\bar{d}$	–2	–1	$\bar{u}\bar{u}\bar{d}$
M_{11}	–3	0	–3	0	$\bar{d}\bar{d}\bar{d}$	–3	0	$\bar{u}\bar{u}\bar{u}$
M_{12}	1	–1	1	–1	$u\bar{d}$	1	–1	$\bar{u}d$
C	0	0	0	0	$u\bar{u}\,, d\bar{d}$	0	0	$u\bar{u}\,, d\bar{d}$

4 The proper coordinates of the magic points and the conserved additive quantum numbers of weakly interacting particles

The magic star also contains information about the conserved additive quantum numbers of the well-known weakly interacting particles. In order to make sure of it, let us consider the coordinates of the magic points with even numbers in the proper system of coordinates with number 3 (Fig. 3). It's easy to see that the values of each pair of the coordinates of any magic point with even number in Y'' and X'' directions (Fig. 3) coincide exactly with the values of the pair of the conserved additive numbers L, where L is any of lepton numbers L_e, L_μ, L_τ, and Q for all the known weakly interacting particles [1], indicated in Tab. 3.

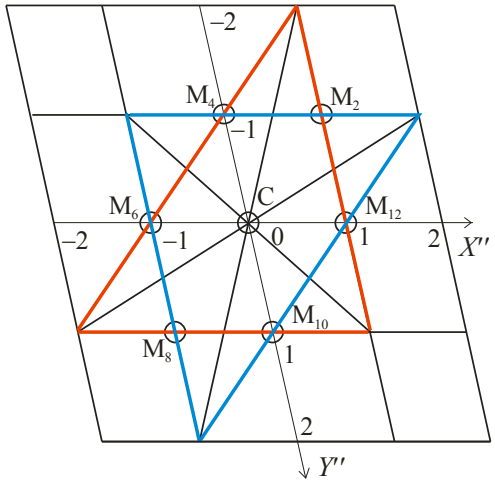

Figure 3: *The magic star with the proper coordinate system 3.*

Table 3.

The values of the coordinates of the magic points in the coordinate system 3, and the values of the conserved additive quantum numbers L (L_e, L_μ, L_τ) and Q for the weakly interacting particles.

Magic points M_k	Values of the coordinates for the points M_k		Values of the additive numbers L and Q		Weakly interacting particles	Values of the additive numbers Q and L		Weakly interacting particles
	Y''	X''	$L = Y''$	$Q = X''$		$Q = Y''$	$L = X''$	
M_2	–1	1	–1	1	e^+, μ^+, τ^+	–1	1	e^-, μ^-, τ^-
M_4	–1	0	–1	0	$\overline{\nu}_e, \overline{\nu}_\mu, \overline{\nu}_\tau$	–1	0	W^-
M_6	0	–1	0	–1	W^-	0	–1	$\overline{\nu}_e, \overline{\nu}_\mu, \overline{\nu}_\tau$
M_8	1	–1	1	–1	e^-, μ^-, τ^-	1	–1	e^+, μ^+, τ^+
M_{10}	1	0	1	0	ν_e, ν_μ, ν_τ	1	0	W^+
M_{12}	0	1	0	1	W^+	0	1	ν_e, ν_μ, ν_τ
C	0	0	0	0	Z^0	0	0	Z^0

As it can be seen from Tab. 3, the equalities $L = Y''$, $Q = X''$ and $Q = Y''$, $L = X''$ take place. This follows from that the axes of the coordinates Y'' and X'' don't have any differences. Therefore, the magic star contains data about the values of the pairs of the conserved additive quantum numbers L and Q of the weakly interacting particles observed in nature. In Tab. 3 we can see the following permutation symmetry for the weakly interacting particles: if the particle for which $L = d_1$ and $Q = d_2$ is real, then the particle for which $L = d_2$ and $Q = d_1$ will be also real [2].

5 Conclusion

An exotic phenomenon – a singular star-shaped hexagon named as a magic star has been described. This remarkable geometric figure contains information on the values of the pairs of the conserved additive quantum numbers B and Q of any real hadrons, and also on the values of the pairs of the conserved additive quantum numbers L and Q of the real weakly interacting particles. There are not any superfluous values of the mentioned pairs of numbers, i.e. those ones that are not observed in the experiment, that could have followed from the magic star. There are not also the values that are observed in the experiments but don't follow from the magic star. The above mentioned information doesn't depend on either the figure dimensions or its form. These rather enigmatic features of the magic star connecting it with the physics of subatomic particles are only possible in the case if it represents in geometrical form a uniform law determining the values of the pairs of the conserved additive quantum numbers of these particles. The assumption of existence of such law was described in [3]. This allows us to assert that the definite physical idea still lies in the magic star.

6 Reference

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[2]. E.N. Klenov, The bastron structure of elementary particles /RGASHM GOU, Rostov-on-Don, P.134. (2003).
[3]. E.N. Klenov, A bastron is a basis of the weakly and strongly interacting particles /RGASHM, Rostov-on-Don, P.156. (2005).