The "Smart Dreamcatcher" (SD) Physical Particle Model: First Day-Dreams Of The Hermit

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Abstract

In this part we introduce the Smart Dreamcatcher (SD) network, a visualization of the Microcosmos. The SD-network is a geometrical structure (3-uniform hypergraph) which allows a comprehensible explanation of quantitative characteristics of hadron particles at the level of elaboration by physics of 1970's – 80's. The elementary particles correspond to special walks on the network in this representation. The SD-network itself implicates the laws and features of subatomic particles and the numeric values of their charges as a necessarily true unity explainable even for juniors. The didactic explanation and the 'references' section composed of animated YouTube videos, offer linkage to the world of physics for followers of different tends and orientations.

Keywords: Smart dreamcatcher (SD), microcosmos, subatomic particles.

INTRODUCTION

There has been an acceptable picture of the larger-scale structure of the Universe in the public consciousness since the Copernican paradigm shift[1]. The image of planets orbiting the Sun is a cultural meme that we learn as children. In the children's drawings, the planetary orbits drawn may be only potato-shaped, around a smiley of sun-rays, but their significance still forms a worldview.

Figure 1. The Dreamcatcher Collection In The Picture And The Photo Were Taken By Stephanie Dürrmüller

On the other hand, almost nothing of the knowledge gained about the lower half of the scale, the subatomic structure of the Universe, has been incorporated into public thinking. The lack of knowledge is more than a century, which can be attributed to the lack of easily accepted models consistent with everyday experience.

The following structural model, which is easily transparent for primary school children, can help to bridge the gap between the directly experienced and the directly not experienced world. In this form, this model reflects the state that particle physics reached in the 1960s to the 1970s[2] and can be generalized to a wider range of phenomena.

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[1] Copernicus: A Revolution of Astronomical Proportions.
    https://www.youtube.com/watch?v=GXi6YSkddD8&ab_channel=Biographics
History of Astronomy Part 3: Copernicus and Heliocentrism.
    https://www.youtube.com/watch?v=ZGr1nHdzLyk&ab_channel=ProfessorDaveExplains
Chasing the Revolutions of Nicolaus Copernicus: The History of Cosmology (2004).
    https://www.youtube.com/watch?v=qqhiLdevD7s&ab_channel=TheFilmArchives
[2] Murray Gell-Mann on The Quark Model.
    https://www.youtube.com/watch?v=KDkaMuN0DA0&ab_channel=MuonRay
Murray Gell-Mann - The Eightfold Way (92/200).
    https://www.youtube.com/watch?v=th_dgQM493M&ab_channel=WebofStories-
    LifeStoriesofRemarkablePeople

The Smart Dreamcatcher (SD) model is not much more complex than the planetary orbits of children's drawings, but in return it reflects reality with numerical accuracy. Hopefully, it will help to integrate the laws of the subatomic world into the worldview. Spatial or temporal analogs of the model exist in the Nature such as covalent skeleton of graphene nanotubes (Iijima, 1991) or time crystals (Shapere and Wilczek, 2012).

Also, girls who make dreamcatchers known worldwide from Indian tribal cultures, create similar structures on a daily basis[3]. They share their creative ideas and wonderful arts and crafts creations in many workshops. I hope, they will not be piqued at the microcosm lurking among their captivated dreams.

RESULTS

The Planispheric Smart Dreamcatcher (SD) Network

The Smart Dreamcatcher (SD) network is a periodic structure (for fans of mathematical terms: 3-uniform simple hypergraph stretched on a cylindrical surface. It consists of periodically repeating zones.[4]

The zones consist of three congruent, three-branched basic units (hyperedges of the graph) that fit the vertices symbolized by the circles on the figures. The planar section of the SD-network is shown in the figure 2. To imagine the cylindrical shape, we may look at the figure as if we were looking into a deep well.

The SD-network carries a quark model, a description of material particles. The problem of it is that it doesn't show up on it right at first glance. We break it down and then put it together and walk around the network to discover its astonishing properties.

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[3] Dreamcatcher, From Wikipedia, the free encyclopedia. https://en.wikipedia.org/wiki/Dreamcatcher
DIY Super Easy Way to Make a Dreamcatcher, Step by Step! Easy Tutorial.
   https://www.youtube.com/watch?v=PGpiHzxooTo&ab_channel=DiYana

[4] Hypergraph, From Wikipedia, the free encyclopedia. https://en.wikipedia.org/wiki/Hypergraph
Hypergraphs. https://www.youtube.com/watch?v=Sb7Xw7SYmlE&ab_channel=beautywithbrains
Graph Theory - Quick Guide. https://www.tutorialspoint.com/graph_theory/graph_theory_quick_guide.htm
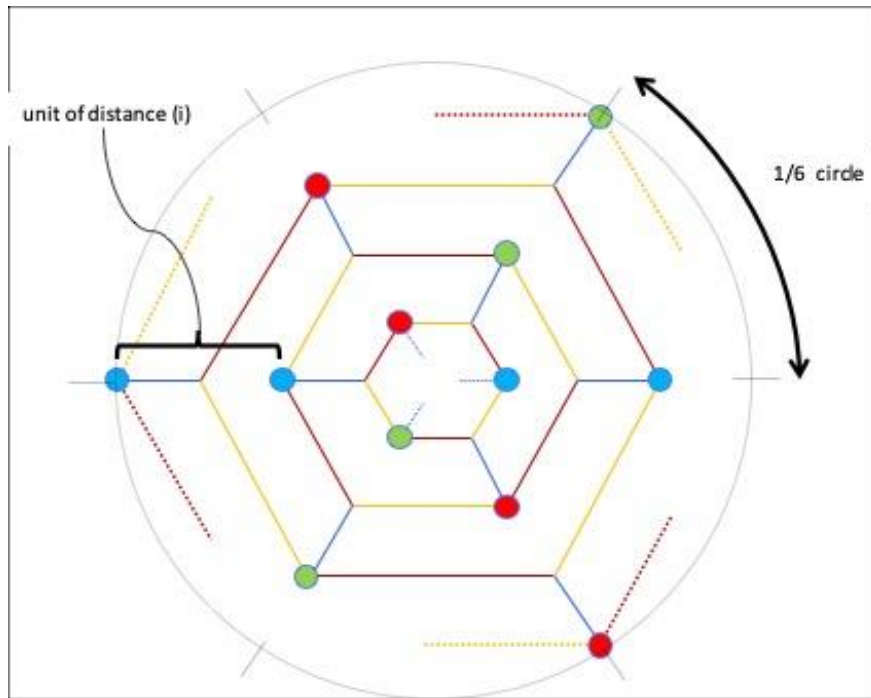
Figure 2*. A section of the "Smart Dreamcatcher" (SD) network, (the pattern is "inward" and "outward" infinitely repeated).*

The Repeated Zones Of The SD-Network

The SD-network is made up of zones with the same structure. A highlighted zone of the SD-network is shown in Figure 2. The planar representation of interconnected zones can only be achieved by drawing zones of decreasing size "inward" and increasing in size "outward". When drawn on a cylindrical surface, the zones of the SD-network could be congruent, but the plane representation also serves the purpose wanted.
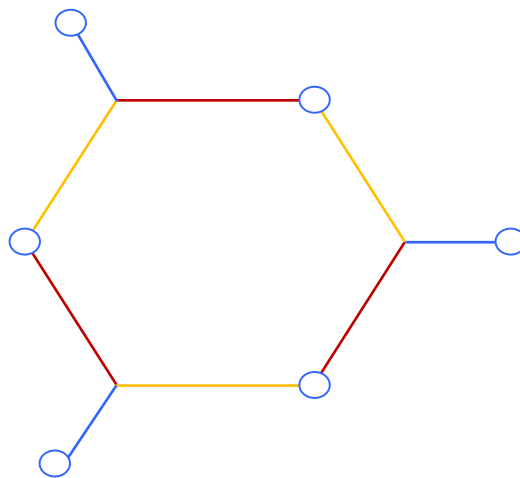
Figure 3. *One zone of the SD-network*

Elements Of The SD-Network's Zones

The zones of the SD-network consist of three congruent base elements (the edges of the hypergraph) interconnected at one point of contact. The base element can be represented as a "star" (Left on the figure 4) or a triangle contacted (Right on the figure 4).

Figure 4. *Representations Of Structural Element Of The SD-Network*

A Mini (SD) Network Consisting Of Three Elements Of An SD-Network

The simplest network of SD-type (mini-SD) consists of three basic elements (thin, thick, dashed) shown in figure 5. Similarly to the SD-network, the edges of different colors match the contact points (A, B, C) of the basic elements.
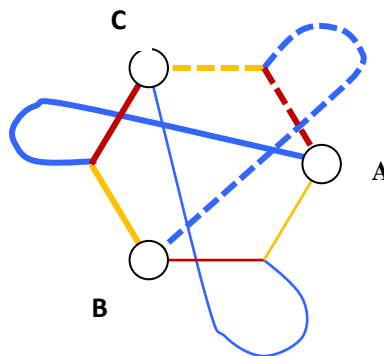
Figure 5. *Mini (SD) Network Composed Of Three Basic Elements*

Converting A Mini (SD) Network To An SD-Zone

By separating the blue-colored edges from the junctions from the mini (SD) network of the figure 5, a zone of the SD network is obtained.
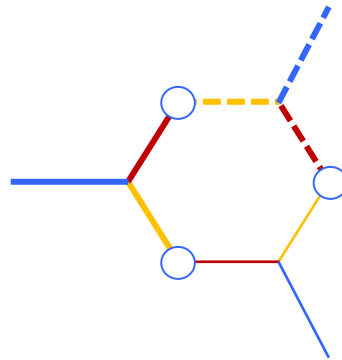
Figure 6. *Mini (SD) Network With Relaxed Blue Edges*

Construction Of The SD-Network By Interconnecting Zones

By interconnecting the SD-zones, we get back the SD-network shown in the figure 1, which is used as a model of the particles. The purpose of deconstruction and reconstruction of the SD-network was getting familiar with the structure which is the enforcing discipline of the laws and actions in the micro-universum.

WALKING ON THE SD NETWORK

Shortest Paths (Steps) On The Basic Element Of The SD-Network

In the model described, the elementary particles correspond to the special walks on the SD-network. The three vertices (marked 0, 1, 2) of each repetitive structural element of the SD-network can be traversed in two circumferential directions (+ and −). The shortest paths (steps) between the two vertices are grouped according to the two (+ and −) angular directions in the figure 7. Each step takes an angular turn of $b = \pm 1/3$ circle around the middle of the element.
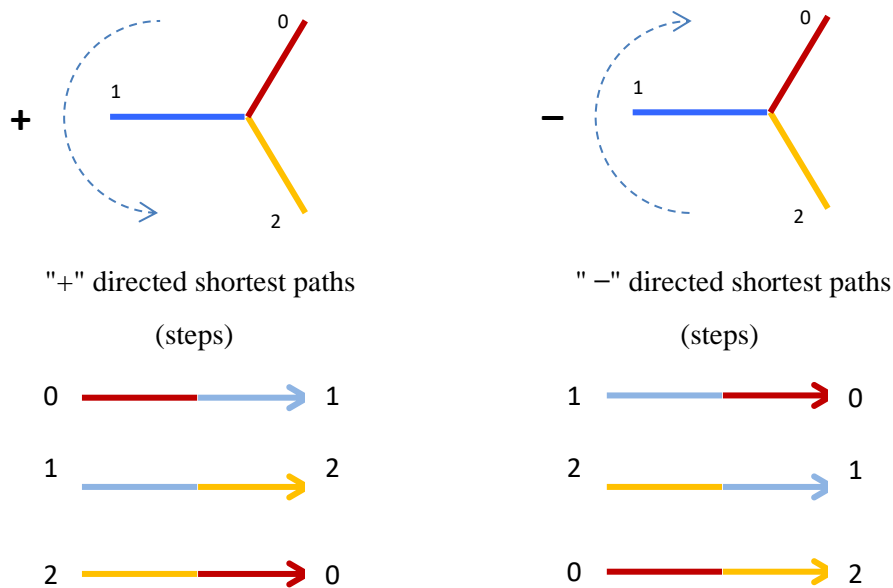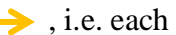

Figure 7. *List Of The Shortest (1-Step) Paths Between The Vertices Of The SD-Network's Basic Element*

Stable Walks (Graph-Circles) Of The Mini (Sd) Network

In the ordinary sense, the stability of things means that their state does not change or they regularly return to the same state as they move. To correspond to graphs and stable elementary particles, by analogy with the ordinary interpretation of stability, consider the stable SD-particles as walks leading back to the starting point, i.e. the simple circuits of the SD-network.

All three vertices (A, B, C) of the SD-network are potential starting and end points of the walks. The possible steps of the walks are the steps to be taken between the vertices of the basic elements, which are grouped according to the circumferential direction in the figure 7. As an example, we can get from vertex A to vertex C by ⟶ or ⟶ or step ⟶ , i.e. each step of "−" orbital direction. From C, we can get back to A with each "+" directed step.

It can be verified by counting in the figure 8 that any two steps in opposite circumferential directions (+ − and − +) form circle-walk, i.e. they are stable SD-particles. It can also be concluded that any of the 3 consecutive steps (+ + + and ⟶⟶⟶) compose circle-walk of the SD-network, i.e. stable SD-particle (+ + +) or SD-antiparticles (⟶⟶⟶). Walks longer than 3 steps are circle-walks only in that case if they composed of 2-steps or 3-steps circle-walks.

First and last, the walks on the SD-network are circle-walks (SD-particles) if and only if they composed of two reversely directed steps (+ — or — +) or three steps in the same direction (——— or + + +).
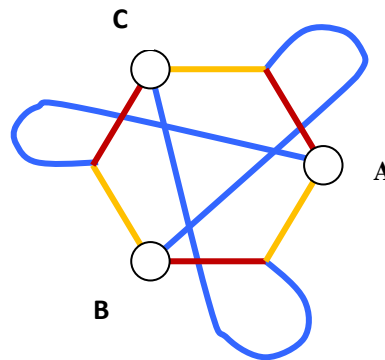

Figure 8. A Mini (Sd)-Network Of Three Basic Elements

Stable Walks On The SD-Network

By releasing the blue-colored end of the edges from the vertices (A, B, C) of SD-network of Figure 8, a zone of the SD-network is obtained, as that's written in "Converting a mini (SD) network to an SD-zone". In the resulting zone only red and green edges join to the vertices, and the ends of blue edges are free (Figure 3, Figure 6).

The three free ends of blue edges of the zone are connected to the vertices of a subsequent zone, from which the blue edge is also released. Several zones can be connected successively, resulting in the SD-network shown in Figure 2.

The new junctions of the blue edges of the consecutive zones fall on a line with the center of the SD-network. Consequently, *the start point and the endpoint of step-sequences fall to the same diameter on the SD-network* if and only if the same sequence of steps forms a circular walk on the SD-network. We use this distinctive feature as the definition for SD-particles. Only step-sequences of — +, — +, ———, + + + fulfill this definition.

CHARACTERIZATION OF CIRCULAR WALKS OF THE SD-NETWORK (SD-PARTICLES)

Characterization Of The Shortest Walks (Steps) On The Elements Of The SD-Network

The steps on the SD-element were characterized by the direction and size of angular rotation (b= ±1/3) around the center of the elements in the previous section (Shortest paths (steps) on the basic element of the SD-network). By traversing the SD-network made up of the basic elements, the steps rotate around the center of the element, and at the same time, they rotate around the center of the SD-network.

A remarkable feature of the ⟶ steps is that they take positive directed rotation (value b)around the center of the basic element, but they rotate in the negative direction (value y) around the axis of the SD-network.

Instead of marking by colors, the steps can be characterized by the two numbers that indicate the angular rotation (value y) of the steps around the center of the SD-network, and the radial distancing of the steps (value i).

The angular rotation (y) is measured in $2 * \pi$ (circle) units (counterclockwise: +). The radial distance between two adjacent vertices of the network is chosen as the unit of the radial distance (i). The sizing of the SD-network is shown in figure 2. The angular rotations (y), radial distances (i), and their sum (y + i) associated with the steps of different colors, are shown in Table 1. The values can be empirically checked in figure 2.

Table 1. *Characteristic Changes Of Angle And Radial Distance, Associated With The Basic Steps Of The SD-Network (Details In The Text).*

Characteristics Of +Directed Steps				**Characteristics Of – Directed Steps**			
step	turn	distance	turn+distance	step	turn	distance	turn+distance
	(y)	(i)	(y+i)		(y)	(i)	(y+i)
⟶	+1 / 6	+ 1 / 2	+ 2 / 3	⟶	– 1 / 6	– 1 / 2	– 2 / 3
⟶	+1 / 6	– 1 / 2	– 1 / 3	⟶	– 1 / 6	+ 1 / 2	+ 1 / 3
⟶	–1 / 3	0	– 1 / 3	⟶	+ 1 / 3	0	+ 1 / 3

Steps ⟶ and ⟶ differ only in the value i of radial distance. The steps are indistinguishable by value i in the mini (SD) network where the radial distance (i) is not interpreted.

The addition of the angular rotation (y) and the radial distance is justified by the fact that the the helical isomerisation of the SD network can convert angular rotation to distance.

The + direction in the radial and orbital dimensions of the SD-network is arbitrary choice. Inversion of the orbital direction results in opposite y-values, and changes the value of y+i to i–y. Inversion of the radial axis results in opposite i-values, and changes the value of y+i to y–i. These two new data-sets are opposits of each other. Inversion of both y and i results in the opposite values of the table 1.

Characterization of Stable Walks in the SD-Network

As described in point 3.3 (Stable walks on the SD-network), the start and end of stable walks (SD-particles and antiparticles) fall onto same diameter of the SD-network. By other words, the sum of the angular rotations (value y) of the steps (Table 1) is an integer multiple of π. All and only of walks consisting of two opposite or three steps in the same direction (and their compositions) meet this requirement. The endpoint of the walk does not depend on the order of the steps.

Table 2 shows the composition of the walks of the SD-network consisting of two adverse-directed steps. Each '+'directed steps are paired with each of the '–' directed steps. In Table 2 the walks consisting of three positive directed steps are arranged into rows according to the number of steps ⟶ .

In figure 2, the vertices falling to the same diameter of the SD-network were given the same color marking. In this way, the stable walks of the SD-network can also be defined as all walks starting and ending at points of same color. As a sample, starting from the vertex of any color in figure 2, we can trace the walks consisting of any three steps of same turnaround (shown in Table 1), or walks consisting of any two steps of opposite turnaround.

Table 2. *Step-composition of the 3-steps- walks consisting of '+' directed steps. Sum of the angular rotation (y) and radial distance (i) shown above the corresponding three-step sequences. Number of steps ⟶ characteristic of the walks seen on the left side.*
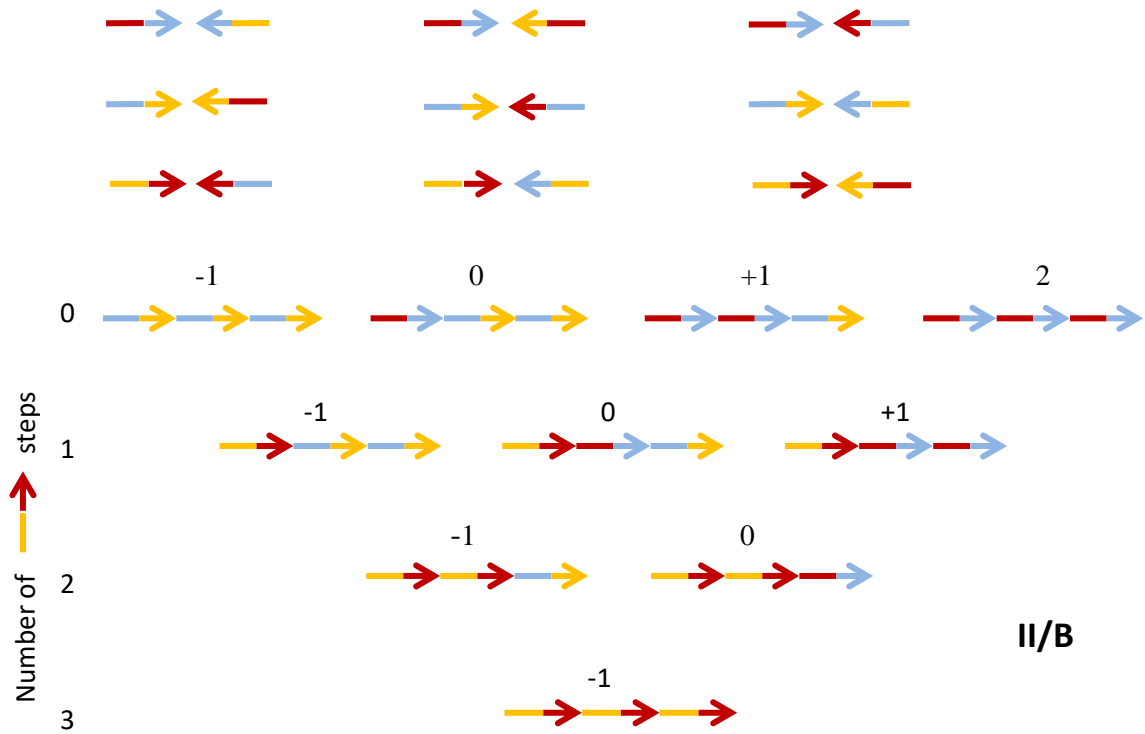
Coloring of the SD-Network

On the basic elements of the SD-network, the three positive directed steps can be colored with three colors. In figure 9, the positive steps joining any two-colored vertices got the color of the third vertex and symbolized by colored stepwise arrows running alongside the edges.

For steps in the opposite (–) direction, are assigned the complementary color of the positive directed steps. The figure 9 shows the colored positive directed steps.
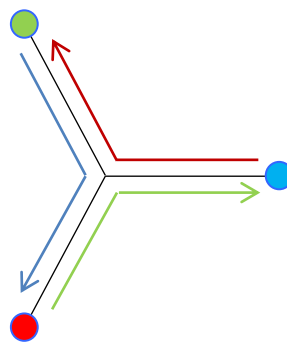

Figure 9*. A 3-colored SD-element*

Sequences of steps that contain an equal number of steps from all three colors, as well as any number of color-anti-color pairs, are called color-neutral. On the colored SD-network, every walks between vertices of same color are color-neutral (figure 9 and figure 10). Furthermore, the start- and end-points of every color-neutral walks of the colored SD-network bear the same color, i.e., stable walk of the SD-network.

Therefore, the color-neutrality and the $y = k * \pi$ angular rotation of the walks on the SD-network have the same meaning and are equally suitable for defining the stable SD-particles.
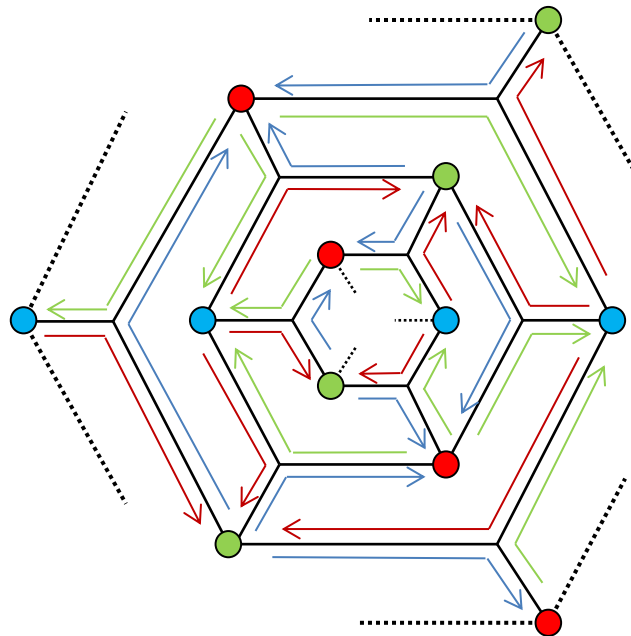

Figure 10. 3-Colored SD-Network

The rays of every star-shaped basic element of the SD-network are mutual symbols of two half steps. Each of the three steps are tightly bound to each other, by this way. The common sections of the step-pairs carry two different colors in the 3-colored basic element of the SD-network, and the two steps run face to face against each other on the track (figures 9-10).

DISCUSSION

Apart from the fact that we didn't use Greek letters and technical terms, we explored the full range of knowledge built into the 3-quark model by dealing with the SD-network.

The standard slogan says the comprehensibility is unavoidable in the quantum physics because the subatomic realm and rules are not comparable to macroscopic entity. Some physicists even play that the intellectual heights of their science are too high for the common sense.

The SD-network can change this opinion. We need to carry some serious experiments only, i.e. we follow quite a few paths on the SD-network with our fingers. Once we had that, we can boldly move into the backfield of physics, because there we find nothing incomprehensible except for the terminology. By and by, we may even feel like gaining abstract insight into the rules, as well.

Explore the Particle Physics in The SD-Universe

The 3-quark model[5] describes the hadron particles by 3 quarks and 3 antiquarks distinguished by quantum numbers (charges). Absolute values of the charges of quarks and that of corresponding antiquarks are equal but negatives of each other (table 3).

Name of 3 quarks is: up, down, strange. Names of the corresponding antiquarks: anti-up, anti-down, anti-strange. Their characteristic charges are in the 3-quark model: hyper charge (Y), isospin (I_3), electric charge (Q), baryon charge (b) and strangeness (S). The value of electric charge connects with the other two charges, $Q = Y/2 + I_3$ (Nishiyama formula).

***Table 3.** The Y/2, I_3, And Q Charges Assigned To The Quarks And Antiquarks*

Charges of quarks in the 3-quark model				Charges of antiquarks in the 3-quark model			
quark	Y / 2	I_3	Q	antiquark	Y / 2	I_3	Q
up (**u**)	+1 / 6	+ 1 / 2	+ 2 / 3	anti-up (ū)	− 1 / 6	− 1 / 2	− 2 / 3
down (**d**)	+1 / 6	− 1 / 2	− 1 / 3	anti-down (đ)	− 1 / 6	+ 1 / 2	+ 1 / 3
strange (**s**)	–1 / 3	0	− 1 / 3	anti-strange (š)	+ 1 / 3	0	+ 1 / 3

Walks in the Smart Dreamcatcher show the same structure. There're three different positive directed steps, and three steps of the opposite direction. These steps are characterized and identified by numerical value of the angular and radial components. The characteristics of each step are listed in the table 1.

***Table 4.** Quarks And Their Charges With The Corresponding SD-Quarks And SD-Charges*

Charges of quarks		Y/2	I_3	Q	B
Equivalent SD-Charge		angular (y)	radial (i)	y +i	b

Quark	up (u)	down (d)	strange (s)	antiup (ū)	antidown (đ)	antistrange (š)
SD-steps (SD-quarks)						

Consequently, the steps on the SD-structure represent the quarks and antiquarks of the 3-quark model. Each of the quarks can be identified as one of the steps, and the charges of quarks correspond to the characteristics of the steps (Table 4).

According to the Nishiyama formula, the electric charge of quarks and antiquarks is $Q = Y / 2 + I_3$, which is represented by the value of $q = y + i$ in the case of steps in the SD-network. The baryon charge $B = \pm 1/3$ of the quarks and antiquarks corresponds to the rotation around the axis of the base element $b = \pm 1/3$ in the SD-network.

The strangeness charge of quarks and antiquarks is $S = Y - B$. The value S of strangeness corresponds to value $s = 2 * y - b$ for the steps in the SD-network.

Variables y, i, q, b, s characterizing the steps in the SD-network are denominated as SD-charges. SD-charges of steps turning positive direction around the axis of SD-network correspond to the charges of quarks, and the SD-charges of negative directed steps correspond to the charges of antiquarks.

Steps are identified as up (**u**) quark: ⟶   down (**d**) quark: ⟶   strange (**s**) quark: ⟶   in the SD-network. Steps of opposite direction assigned to the corresponding antiquarks (Table 4).

Mesons And Baryons In The SD-Network

The 3-quark model describes two different hadron-structures, mesons and baryons. The mesons are composed of one quark and one antiquark. Their baryon charge is $B = 0$. The baryons are composed of three quarks, and their antiparticles composed of three antiquarks. Their baryon charge is $B = 1$.

Similarly, the stable walks of the SD-network consist of two steps directed antiparallel or three unidirected ($+ + +$ SD-quarks or $- - -$ SD-antiquarks) steps.

Quark-Composition Of Mesons And Baryons On The SD-Networks

The three quarks (u, d, s) and three antiquarks (ū, đ, ś) of the 3-quark model in respect of numeric values of their charges (Table 3) correspond to the steps of the SD-network (Table 1). The charges of hadrons consisting of quarks are equal to the sum of the charges of their quark-constituents. Therefore, the correspondence of quarks and SD-steps can be extended for the structure of hadrons.

The addition of charges of SD-steps is resulted in charges of SD-walks. Specially, the charges of stable SD-walks are equal to total charges of their step-constituents. Consequently, the charges of hadrons are equal to the SD-charges of the stable SD-walks (SD-particles).

The quark-composition of hadrons by 3-quark model[6] shown in Table 5 for meson particles and Table 5 for baryon particles. Recension of Table 2 with Table 5 convinces of hadron-structure – SD-particle congruency.

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[6] Introduction to Elementary Particle Physics, p. 7-8.
    http://www.phys.ufl.edu/~korytov/phz6355/note_A20_three_quarks.pdf

Taking into account the data given in Table 1 and Table 3 we can calculate the values y, i, q, b of every stable SD-walks and the corresponding charges Y, I_3, Q, B, S of hadron-particles.

Table 5 (A/B). *Quark-Composition Of Mesons (General Structure: **Q Q**) And Quark-Composition Of Baryons (General Structure: **Q Q Q**)*

đu -- π^+ , **đs** -- K^0 , **ūd** -- π^- , **ūs** -- K^- , **ṡu** -- K^+ , **ṡd** -- K^0 ,
ūu --đd -- ṡs mix together to make three orthogonal states π^0, η, η

uuu -- Δ^{++} , **uud** -- Δ^+ , **udd** -- Δ^0 , **ddd** -- Δ^- , **suu** -- Σ^{*+} , **sud** -- Σ^{*0} , **sdd** -- Σ^{*-} ,
ssu -- Ξ^{*0} , **ssd** -- Ξ^{*-} , **sss** -- Ω^-

The quarks must be present in distinguishable states in the hadrons. The distinctive feature is the color charge of the quarks.[7] The quarks can own one of the three different color charge or anti-color charge. and the color neutrality is required for each hadrons. The hadron particle is color-neutral if it is composed of three quarks carrying three different colors or composed of two quarks carrying a pair of color and anticolor.

This recognition is a result of the later development in physics, and we see that the color-neutrality of the stable SD-particles is an inherent feature inseparable from other characteristics of the SD-network (Figure 10).

The color charge is the source of the force strongly attracting the quarks to each other. This force is transmitted by a pair of a colored gluon and antigluon of anti-color.[8] Gluon-antigluon entities are symbolized by the antiparallel colored arrows on the attached halves of the SD-steps (Figure 9 and Figure 10).

AFTERWARDS

Once upon a time there're lived a wise hermit, Bruder Klaus in the Swiss mountains. He was joined several times by the secular powers of the age, acted for advice. What I am talking about is his peculiar habit of meditating in his home in a strange pattern he pondered the great contexts of the world.

It is not known where the form drew its ideas in which he saw eternal rules embodied. He tried to share the secrets of the figure with others, but his audience could hardly attribute a deep meaning to the representation, which is most like a wheel, cluttered with spokes. Three spokes stood outward, and another three inward.

A pilgrim who visited him described his experience as follows:

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[7] What are Quarks? (Quark Color | Flavor | Quark Confinement).
     https://www.youtube.com/watch?v=fWPvhFcDjEs&ab_channel=FortheLoveofPhysics
[8] Quarks, Gluon flux tubes, Strong Nuclear Force, & Quantum Chromodynamics.
     https://www.youtube.com/watch?v=FoR3hq5b5yE&ab_channel=PhysicsVideosbyEugeneKhutoryansky

The Wheel Picture

"Brother Klaus looks at a meditation picture in his cell. Brother Klaus explains to a pilgrim who is recording his conversation with the hermit about this picture: "Do you see this figure? Such is the divine being. The middle means the undivided deity in which all saints enjoy. The three points that go in in the middle, at the inner ring, mean the three people. They proceed from the one deity and have embraced heaven and the whole world. And just as they go out in divine power, so they also go in; they are one and undivided in eternal rule. That is what this figure means. "

(after: An unnamed pilgrim (probably Heinrich von Gundelfingen), around 1480)

A white wheel with six spokes: three spokes flow outwards, three inwards. In the center there is an antique glass pane with a red dot. The question that Brother Klaus asked himself is just as relevant today: *What connects the world in its depth?* Brother Klaus found his answer in faith. For him it is God's love that holds everything together in the middle".[9]

Figure 11. *Bruder Klaus Radbild (reconstruction)*[10]

- How could the strange figure have captured a medieval philosopher living away from the world?
- What's stunning about dreamcatchers photographed on the front page?

Their mysterious beauty connects two worlds. By intense meditation, that begins to convey the message of the Universe to us. By allegories, by mathematical form, right-well or awkwardly, we look for the most appropriate language of symmetries and harmony.

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[9] The wheel picture. https://www.bruder-klaus-visionenweg.com/z/vision-14/

[10] Bruder Klaus Radbild. https://bruderklaus.com/shop/andenken/bruder-klaus-radbild/bruder-klaus-radbild-zwei-hoelzer-zusammengesteckt/

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