Twin Concept of Fine Structure Constant as the 'Self Number-Archetype'
in Perspective of the Pauli-Jung Correspondence

Part I: Observation, Identification and Interpretation

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Abstract: The paper – similarly to our earlier publications since 1993 – is trying to 'synchronize' early quantum physics, the Kalmanian representation theory, Jungian analytic psychology, and certain aesthetical categories. The number '137', the so-called inverse Fine Structure Constant (IFSC), is placed at the centre of this heuristic and epistemological experiment, along with the scientific cooperation of Pauli and Jung. A new possibilistic twin concept of "controlling-observing equations" is proposed for the reinterpretation of the FSC and other Number Archetypes on the basis of the Hermeneutic and symbolic languages found in the W. Pauli and C. G. Jung "Correspondence". The first part of the paper deals in first line with the introduction of the possibilistic twin concept of FSC together with its interpretation according to the hermeneutical "tradition" of the Pauli-Jung collaboration.

Keywords: system and control theory, fine structure constant (FSC), inverse (reciprocal) fine structure constant (IFSC), number archetype, W. Pauli and C. G. Jung correspondence

Introduction

In our earlier papers, we discussed the interpretation and the possibility of the identification of so-called unconscious creative background processes [52, 53, 55]. The concept was introduced by W. Pauli in scientific cooperation with C. G. JUNG, explaining the background of scientific discoveries and a world view

(*Weltanschauung*). Their "correspondence"[1] on physical, philosophical and psychological topics has led many authors since Heisenberg [68], from the 1960s onwards, to discuss and analyze these issues [5, 16, 33, 37, etc.].

Similarly, the term *number archetype* was defined by Jung in cooperation with Pauli. According to Pauli, number archetypes play a decisive role in the structural part of the dream's manifestation and in the background processes, as well. Although background processes *per definitionem* operate in the unconsciousness, their existence can be hypostasized, as a relatively autonomous processes. This is a fact that cannot be directly established according to Jung [37].

However, in the consciousness, we can observe very specific and relatively improbable archetypical patterns, images in the dream processes, visions, and active imaginations, which can be treated as symbolic signals or symbol series. Thus, the concept of the creative *background process* can be defined and conceptualized as a dynamic system generated or – according to the Pauli's view – regulated by unobservable, not directly measurable input processes [45]. In this case, the output process, via the transfer operator of this dynamic system, can be used to approximate and identify the above-mentioned patterns (e.g., a regular image series occurring in dreams, visions, and imaginations). The epistemological "advantage" of this approach is that the background processes can be interpreted using the paradigms and concepts of the modern mathematical system and control theory.

In this case, we can also apply the approach of *system identification*. In this way the series of hypothetical unconscious manifestations (consciously observed) of a given person or group of cooperating persons, can be treated as output processes of the specific structural and dynamic patterns of the actual background processes. According to Jung they can be approximated as an 'establishable' identification of the archetypical patterns and images [37].

It was discussed in our earlier papers that Pauli took the not-directly-measurable archetypical influences as regulating and ordering processes [52, 55]. Along with the manifestation of the unconscious in the consciousness in the form of images and ideas, he considered the whole "system" as a control system, according to the general view of this concept prior to 1958. Therefore, the conceptualization of the background processes as input/output dynamic systems reinterprets Pauli's view of regulating dynamic systems applied between the unconscious (input) and conscious (output) processes for the treatment of the sophisticated cognitive problems (partly on the basis of the probabilistic concept of archetype introduced by Pauli and Jung [45]).

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[1] The interesting semantic feature of the "Pauli–Jung correspondence" is that Pauli suggested using the word 'correspondence' to denote the phenomena of synchronicity. "*In Princeton I unexpectedly had the opportunity to discuss the synchronicity phenomenon on several occasions. In doing so, I prefer to use the term 'meaning – correspondence' rather than 'synchronicity', so as to place more emphasis on meaning rather than on simultaneity and to link up with the old 'correspondentia'.*" [37]

On the basis of this approach we introduce a new mathematical formula, as a possibilistic - probabilistic twin concept, simple *controlling-observing equations* for computation and symbolical interpretation of the *fine structure constant* and number-archetype 137.

This concept of FSC on one hand is '*generative*' because there is a constant motivation on the part of the "observer" to create different mathematical and symbolic interpretations inside and outside of physics. (This has been considered a psychical fact since Sommerfeld, Eddington, Pauli, etc. until nowadays). On the other hand, it is also '*receptive*' because there is a 'constant' endeavour to build up new interpretative formulas using other important number archetypes which can hold other meaningful "hermeneutical" possibilities.

According to the geometric and arithmetic Self (Selbst) representation, i.e. the Mandala, using a circle with divisions of natural numbers, we introduce the concept of the joint geometric and arithmetic number archetype. It can be simple functions consisting of the basic geometric number archetype π and natural numbers. These approximating and meaningfully interpretable formulas of the FSC can be considered as the generative-receptive number archetype of the Self (Selbst).[2]

To anticipate, we shall stress that our approach is basically *empirical* and *heuristic* and it concerns the questions of discovery rather than that of philosophical legitimacy.

1   Pauli on the Fine Structure Constant

The "classical" concept of the *fine structure constant* (Feinbaukonstante) was introduced in the early 1910s by A. SOMMERFELD and explained the spectral lines of hydrogen atom radiation.

Definition 1: the Fine structure constant is a ratio which characterizes the "amount" of the electromagnetic (mutual) effect (independent of the selection of the dimension) and can be found in the description of the fine structure of the hydrogen spectrum:

$$\alpha = \frac{e^2}{4\pi\varepsilon_0 hc}, \tag{1}$$

where e is the elementary charge of electron, c is the speed of light, h is the Planck-constant and ε_0 is the vacuum permittivity.

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[2]   As is well known, synchronicity, according to Jung, is the parapsychological equivalent of the psychological manifestation of the Self (Selbst), i.e. the Mandala phenomena [24].

On the other hand, the value of the fine structure constant can be calculated from the direct spectroscopic measurement of the hydrogen spectrum as well, without knowing the concrete values of the above non-dimensionless fundamental constants. However, the specific "value of the concept" obtained from the spectroscopic measurements depends upon the type (and accuracy) of the concrete quantum-electrodynamic model, which can describe the fine and hyperfine structure of hydrogen spectrum very naturally.

Consequently, despite the fact that FSC cannot be directly determined from measurements, it can be considered from a "hermeneutic point of view" as an empirical concept "interpreted minimally" on the basis of the three most important constants of physics and from theoretical calculations as well [65]. At the same time it also defines (from experimental point of view) the fine (and hyperfine) structure of hydrogen spectrum. As Pauli writes:

"It must, however, not be forgotten that here, on account of the well-known divergencies in the results following from the quantum theory of wave fields, we already find ourselves outside the range of a logically closed theory, and are once more reduced to guessing the correct final formulae. The smallness of these new effects is a consequence of the smallness of the so-called fine structure constant, which is often linked with Sommerfeld's name, since its fundamental significance first came clearly to light through his theory of 1916 of the fine structure of hydrogenic spectra. The theoretical interpretation of its numerical value is one of the most important unsolved problems of atomic physics." [41]

While the other fundamental physical constants of *Nature* are all immensely small or enormously large, this fine structure constant $\approx 1/137$ (precisely unknown value) turns out to be a human-sized number. The number '137' and its (possible) place in the scale of the universe fascinated and at the same time puzzled Pauli[3] and continues to challenge physicists even today [46]. Citing Pauli again,

"On the other hand, the law of conservation of electric charge occupies a fundamental and equally important place side by side with the laws of conservation of energy and momentum. There are some interesting attempts among classical field theories which, by using a formally more unified representation of the connection of electromagnetic and gravitational fields, unite the law of conservation of electric charge with the laws of conservation of energy and momentum into a single structure, consisting of five equations. But so far these theories have no natural connection with quantum theory, and are unable to interpret the additional fundamental property of charge, namely that it is atomic. By this latter property we mean the fact that every electric charge occurring in nature is always a (positive or negative) multiple of the elementary electric charge

$$e = 4.8 \times 10^{-10} \text{ e.s.u.}$$

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[3]   *"Pauli once said that if the Lord allowed him to ask anything he wanted his first question would be Why 1/137?"* [6]

This constant of nature has not yet found its appropriate place beside the constants c, h and κ. A new formulation of quantum theory would be satisfactory only if by an interpretation of the numerical value of the dimensionless number

$$\frac{hc}{2\pi e^2} = 136.8 \pm 0.2$$

It were to oppose the atomic nature of charge to the classical law of its conservation as its quantum-theoretical correlate in the same way as it opposes as complementary the laws of conservation of momentum and energy to the description in space-time. Nor do we yet know if such a future theory will or will not modify the connection between the notion of charge and that of space-time, which is so characteristic of theories available at present." [39]

"One of the most assured empirical results of physics is the atomistic structure of electric charge. Charge values are integral multiples of a fundamental unit, the electric elementary quantum, from which, along with the quantum of action and velocity of light, one can form a dimensionless number, 137.04. To reach this result one requires a considerable part of the classical theory of electricity. In the 17th century, for instance, when it was not known how to measure electric charges and how they are defined quantitatively, this empirical result could never have been obtained and formulated. But we are unable to understand or explain the above number." [44]

The central question, properly speaking, is what the "true" or "best" value of the fine structure constant is since the values "obtained" from the above two possible numerical determinations are not equal to each other. This result is natural because we can measure "precisely" neither the speed of light, nor the Planck-constant nor the elementary charge of electron; furthermore, the accuracy of spectroscopic measurements of the hydrogen spectrum is also very limited, not to mention the "higher members" of the intermediate calculations. As Pauli stated in his Nobel prize lecture,

"From the point of view of logic, my report on 'Exclusion principle and quantum mechanics' has no conclusion. I believe that it will only be possible to write the conclusion if a theory will be established which will determine the value of the fine structure constant and will thus explain the atomistic structure of electricity, which is such an essential quality of all atomic sources of electric fields actually occurring in nature." [40]

Therefore, after 1910 the demand arose, in addition the definitive calculations and spectroscopic measurements, to determine the "true value" of the fine structure constant on a geometric basis, first of all using the value of π, cf. Table 1. This concept was to a certain degree intuitively advanced by Einstein. [42]

Table 1

Theoretical and measured values for the fine structure constant

Date	Author(s)	Expression	Value
1914	Lewis and Adams	$8\pi\left(8\pi^5/15\right)^{1/3}$	137.348
1928	Perles	$\left[2\pi\left(\pi-1\right)\right]^{-1}m_p/m_e$	136.455 7
1930	Eddington	$\left(16^2-16\right)/2+16+1$	137 (exactly)
1931	Beck et al.	$T_0=-\left(2/\alpha-1\right)°C$	137.075
1970	Wyler	$\left(8\pi^4/9\right)\left(2^4 5!/\pi^5\right)^{1/4}$	137.036 082
1972	Aspden and Eagles	$108\pi\left(8/1843\right)^{1/6}$	137.035 915
1973	Cohen and Taylor	Review value	137.036 04
2006	CODATA	Recommended value	1/137.035 999 679(94)

Without knowing the "accepted" probably most accurate values (considering just the 137.03… value of FSC), the following formula for the general (synchronistic) definition of the inverse fine structure constant was proposed by Stanbury [63]:

$$\alpha^{-1}=4\pi^3+\pi^2+\pi^1=\pi\left(4\pi^2+\pi+1\right)=$$
$$=137.0363037...=\alpha^{-1}\left(\pi\right)$$

(2)

It can be seen that this formula is simple, general, self-expressive and also aesthetically "pleasing". Furthermore, in addition to π, – according to certain alchemical and traditionally hermeneutical rules – the formula consists only of the first four integer numbers. The first three numbers (as powers) have some "generative characteristics", but the fourth one (i.e., 4) with certain topological characteristics (as a multiple) also meets the usual "symbolic demands".

Therefore, the above formula of IFSC is able to symbolize completeness or perfectness according to the mentioned Caballo–Alchemistic and hermeneutical principles. On the other hand, the first three integer numbers appear in generative way as powers of π, while the fourth one, the '4', hints at a topological structure (as a multiple), thus satisfying the usual Jungian interpretations as well [22].

The essence of these interpretations is that the tetragonal substitution of π can be 4 as outside the square-measure or 2 as inside square-measure of the "generative circle" with unit radius.

The quaternary substitutive interpretation of $\pi\sim 4$ or $\pi\sim 2$ numbers rewritten into the expression of $\alpha^{-1}(\pi)$ the following natural (integer) structure numbers can be obtained:

$$\alpha^{-1}(4) = 4\cdot 4^3 + 4^2 + 4^1 = 4\cdot 64 + 16 + 4 = 256 + 16 + 4$$

$$\alpha^{-1}(2) = 4\cdot 2^3 + 2^2 + 2^1 = 4\cdot 8 + 4 + 2 = 32 + 4 + 2 \tag{3}$$

$$\frac{\alpha^{-1}(4)}{2} - 1 = 137 < \alpha^{-1}(\pi) < 138 = \frac{\alpha^{-1}(4)}{2}$$

According to the latest research, and on the basis of the more precise astronomical measurements, it seems (hypothetically) that the empirical value of the fine structure constant has also continued to be *dependent on time* [58]. Not concerning ourselves with the details, we can say that in certain "earlier age" of the Universe, the value of the inverse fine structure constant was approximately 137.037… although the actual accepted value is roughly 137.036… [56]. (The above formula of the inverse α has the value of 137,0363037… that „occurred" in the given time interval of the Universe).

It can be seen that this formula and value can probably be considered as a "basic parameter" which is not the empirical inverse fine structure constant itself. It is also obvious, that from the point of view of life, the value of the FSC can not change arbitrarily. Were its value very different, carbon atoms would not be stable and organic life, as we know it, would not be possible. This evidence increasing underlines the significance of 137 as an integer and, at the same time, as a mediator or controlling number. The latter seems to be a perfect manifestation of the mutual concept of the arithmetic and geometric number archetype and at the same time a central number archetype of the Self (*Selbst*).

2 Controlling-Observing and Possibilistic Twin Concept of FSC

On the basis of Stanbury's note Sherbon suggested the next interesting and important corrected formula [62]:

$$\alpha^{-1} \cong 4\pi^3 + \left(1 - \pi_r^{-2}\right)\pi^2 + \pi \cong 137.03599916 \tag{4}$$

where π_r is the harmonic of π radians = 180 [62].

This formula can be considered as a further step to a hypothetical controlling-observing expression of the fine structure constant. However, on the basis of the revised interpretation of Pauli's famous "World Clock dream family" (see in chapter 4), in which Pauli unconsciously observed the "spontaneous expression" of the fine structure constant in the complex plane as well, we may propose (following and extending Sherbon's "corrective formula") a new possibilistic twin-concept of

FSC. Our proposition tries to give a modest paradigmatic answer to the question on the stability of value of fine structure constant [65]. [4]

Recently, a joint possibility distribution a bivariate (twin interactive) fuzzy number(s) of FSC (interpreted on the complex plane) was introduced by the authors in following way [70]:

$$C_\alpha\left(x, yi\right) = ALPHA\left(x, yi\right) = ALPHA\left(\alpha_\pi^{-1}\left(x\right), \alpha_\pi^{-1}\left(yi\right)\right)$$

where $\alpha_\pi^{-1}(x)$ is the real version of the so-called "Pauli's equation"[70] for the experimental results meanwhile $\alpha_\pi^{-1}\left(yi\right)$ is the imaginary part for the theoretical result of FSC, respectively as interactive twin fuzzy numbers.

Remark: A fuzzy number A is a fuzzy set R with a normal, fuzzy convex and continuous membership function of bounded support. The family of fuzzy numbers is denoted by F Fuzzy numbers can be considered as possibility distributions [70]. A fuzzy set C in R^2 is said to be a joint possibility distribution of fuzzy numbers $A, B \in F$, if it satisfies the relationships $\max\{x \mid C(x, y)\} = B(y)$ and $\max\{y \mid C(x, y)\} = A(x)$ for all $x, y \in R$. Furthermore, A and B are called the marginal possibility distributions of C as twin interactive fuzzy numbers.

Applying "Pauli's equation" we obtain the following formulas

$$\alpha_\pi^{-1}\left(x\right) = 4\pi^3 + \pi^2 + \pi - \frac{\delta_x}{1-\delta_x}\frac{\delta_x}{1+\delta_x}, \ \delta_x = \frac{2\pi}{x}$$

$$\alpha_\pi^{-1}\left(x\right) = 4\pi^3 + \pi^2 + \pi - \sum_{n=1}^{\infty}\left(\frac{2\pi}{x}\right)^{2n} \tag{5}$$

$$\alpha_\pi^{-1}\left(yi\right) = 4\pi^3 + \pi^2 + \pi + \frac{\delta_y}{1-\delta_y}\frac{\delta_y}{1+\delta_y}, \ \delta_y = \frac{2\pi}{yi}$$

$$\alpha_\pi^{-1}\left(yi\right) = 4\pi^3 + \pi^2 + \pi + \sum_{n=1}^{\infty}\left(\frac{2\pi}{yi}\right)^{2n}$$

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[4]   Recently, "*based on the standing wave model of the macroscopically resting electron, classical electrodynamics and quantum mechanics, a theoretical relation for the fine structure constant α has been derived.*" [65] According to our possibilistic-probabilistic approach and Pauli's paradigm of undetached observer, it is worth to cite the declarations of the authors of the above important and interesting result: "*According to our result α seems to be a real constant in time and space.*" and "*A statement about the stability of the value of the fine structure constant derived from a pure theory would be very desirable.*" [65]

Here we rise up to hypothesis that the most likely value of the real marginal possibility distribution of FSC (for experimental results) $\alpha_\pi^{-1}(x)$ can be obtained when x=360. From other side according to our conjecture the most likely value of the imaginary marginal possibility distribution of FSC (for theoretical results) $\alpha_\pi^{-1}(yi)$ can be obtained when y=360, i.e.

$$\alpha_\pi^{-1}\left(x=360\right)=4\pi^3+\pi^2+\pi-\frac{\delta_x}{1-\delta_x}\frac{\delta_x}{1+\delta_x}\ ,\ \delta_x=\frac{2\pi}{360}$$

$$\alpha_\pi^{-1}\left(x=360\right)=4\pi^3+\pi^2+\pi-\sum_{n=1}^{\infty}\left(\frac{2\pi}{360}\right)^{2n} \tag{6}$$

$$\alpha_\pi^{-1}\left(y=360\right)=4\pi^3+\pi^2+\pi+\frac{\delta_y}{1-\delta_y}\frac{\delta_y}{1+\delta_y}\ ,\ \delta_y=i\frac{2\pi}{360}$$

$$\alpha_\pi^{-1}\left(y=360\right)=4\pi^3+\pi^2+\pi+\sum_{n=1}^{\infty}\left(i\frac{2\pi}{360}\right)^{2n}$$

Consequently the FSC as number archetype is a two dimensional possibility distribution or in other words a bivariate fuzzy number (two interactive fuzzy numbers), which is realized by its two marginal possibility distributions as interactive "twin fuzzy numbers" [70]. As we have shown there is a complementary probabilistic interpretation of the two dimensional possibility distribution trough a suitable undistinguishable bivariate uniform probability distribution [70]. In other words in the complementarity concept of the possibilistic and probabilistic approaches there is a final indistinguishability between the two dimensional possibility and bivariate uniform probability distributions.

More specifically we apply the most likely value of both marginal possibility distributions for the characterization of the experimental and theoretical results of FSC. One of these is related to the experimental and the other one is related to the theoretical result of FSC.

In our cases for the most likely values of the two marginal possibility distributions from the above formulas we obtain

$$\alpha_\pi^{-1}(x=360)=137{,}0359990656...\ ,\ \alpha_\pi^{-1}(y=360)=137{,}035999251...$$

The latest experimental results (2008 and 2007) and the latest theoretical result (2008) have the following values [65, 66] (see footnote 4)

$$\alpha_e^{-1}=137{,}035999084...\ (2008),\ \alpha_e^{-1}=137{,}035999070...(2007),$$

$$\alpha_t^{-1}=137{,}035999252...(2008).$$

This general formula expresses that there are different courses and rhythms for the circulation of the circle with unit radius. If x is 32, the value of the expression is 136.99…, which means that from a practical point of view $x = 32$ (33) generalizes the number archetype 137. In the following parts of the paper we shall give manifold interpretations for the twin concept of FSC and the controlling and observing character of this equation.

The selection of $360 = 36 \times 10$ seems to be very natural for us. In Pauli's dream, the number 32 in the given context and the "spiritual environment" generates the number 360. The 36 is a pair of 32 in Pauli's thinking (see his preoccupation with 32-36 and 137 [43]). The ten ($10 = 3 + 7$) is a permanent factor in Pauli's dreams. The 36 is a strong number archetype in a Jungian sense. It has a mediator role because it has objective importance as the first composed natural number ($6^2 = 36$, $3 \times 12 = 36$, $4 \times 9 = 2^2 \times 3^2 = 36$). As well, the number 36 has some human aspects.

Symbolically $1-\delta$ and $1+\delta$ can express an oppositional property for the two circulations using the step length of the rhythm of circulation. This oppositional character of delta can be interpreted in symbolic mathematics as an "orthogonal, perpendicular" relationship.[5]

3   The Dream of the World Clock as a "Geometric-Algebraic" Archetype of Control Systems and the Self

Jung quite frequently speaks of his patients' dreams containing symmetry structures which are very similar to the "Ezekiel pattern", without any knowledge of the vision of Ezekiel. He remarks that, despite its significance in the spiritual history of the Christian-Jewish world, even among highly educated people, there is an almost complete ignorance "of this field". Jung classified these kinds of dreams as *Mandala* dreams, which can be experienced as a kind of psychic synthesis of a psychoid transcendental background and real psychic "foreground". Furthermore, he interpreted the appearance of the possible synchronistic phenomena as the parapsychological equivalent of this transgressive totality (completeness) experience [21].

"I have always been particularly interested to see how people, if left to their own devices and not informed about the history of the symbol, would interpret it to themselves. I was careful, therefore, not to disturb them with my own opinions and

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[5]   It is interesting to note, concerning this dream, Pauli's crucial remark from one of his letters (to Heisenberg!) on the uncertainty principle (1927): "One can look at the world either with the p-eye or one can look at it with the q-eye, but if you will simultaneously open both eyes, you get lost." [58] (See footnote 7 in Part II!)

as a rule I discovered that people took it to symbolize themselves or rather something in themselves. They left it as belonging intimately to themselves as a sort of Creative background, a life-producing sun in the depths of the unconscious mind. Though it was easy to see that it was often almost a replica of Ezekiel's vision, it was very rare that people recognized the analogy, even when they knew the vision -which knowledge, by the way, is pretty rare nowadays."

Pauli was probably influenced by the concept of "creative background" from Jung's *Terry Lectures* (1937) [21].

Unfortunately, we have no possibility here to give even a short survey of the known analysis and interpretations for the symmetry structures of the vision of Ezekiel. It would demand a separate book. However, in the following, we shortly outline the background control system "interpretation" of the vision, as well as the 4+16+256 system representations. In this rare interpretation, one counts the four Cherubims standing at the four corners of the Chariot of God. All the Cherubims have 4×4 body-parts (4 faces, 4 wings, 4 hands, and 4 legs) according to the four natures (man, lion, bull, and eagle). This system of 4+16+256 can be related to the 39th dream of Pauli [22]:

"Dreamer is falling into the abyss. At the bottom, there is a bear whose eyes gleam alternately in four colours: red, yellow, green and blue. Actually, it has four eyes that change into four lights."[6]

It is well known that the bear symbolizes north and the Chariot in mythology, as well as, in astronomy (e.g. Ursa Maior). Furthermore, the Chariot of God arrives from north on the sky in the vision of Ezekiel. The algebraic variation system of the four lights of the four eyes can be linked in a natural way to the 4+16+256 system interpreted in the previous paragraphs. According to Pauli1s parity conception (right-left sides of space), the above structure can be simplified into 128+8+1. That is, the dream of Pauli connects the Merkabah (Ezekiel's Chariot) vision with the inverse fine structure constant – without any serious knowledge of "the tradition" and the mythology [22].

In the dream of four rectangles (dream No. 51) beside the four colours, we can identify 32 geometric elements (12 corners, 16 lines and 4 rectangles). It is originally formed from two basic rectangles, so the structure 32+4+2 is valid [22, 55].

This dream has a further interesting dynamic feature: namely, people move clockwise around the four coloured waters in the middle of the four derived rectangles. In the centre, however, people move counter-clockwise around the asterisk. This *contrary motion* of the centre already refers to the connection between

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[6]   It is interesting to note, concerning this dream, Pauli's crucial remark from one of his letters on the uncertainty principle (1927): "*One can look at the world either with the p-eye or one can look at it with the q-eye, but if you will simultaneously open both eyes, you get lost.*" [58]

the energy and the controlling systems. The etymology of the English word 'control' is in complete consonance with the background control image of Pauli's dream. The word 'control' originates from the medieval Latin expression *contra rotulare*, which is the linguistic mapping of the dream image mentioned above. This feature synchronistically connects the four colours with the World Clock dream, the number '137' and the concept of control, together with its dynamic system. The delineation reaches the English word *control* through the English-French *contreroller* and the French *controlle*.

The *Dream of the World Clock* essentially contracts the dream of the four-eyed bear (dream No. 39) with the dream of the four rectangles forming a geometric quaternion (dream No. 51). The exact text of the dream is the following [22]:

"There is a vertical and a horizontal circle, having a common centre. This is the world clock. It is supported by a black bird.

The vertical circle is a blue disc with a white border divided into 4×8=32 partitions. A pointer rotates upon it.

The horizontal circle consists of four colours. On it stand four little men with pendulums, and round about it is laid the ring that was once dark and is now golden (formerly carried by the children).
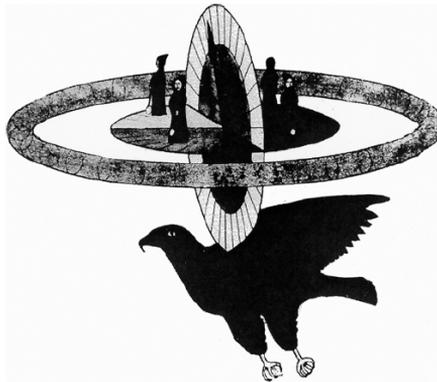

Figure 1

The World Clock with four 'cabirs'. An impression generated by W. Byer Brown based on accounts of Pauli's dream

The 'clock' has three rhythms or pulses:

1) The small pulse: the pointer on the blue vertical disc advances by 1/32.

2) The middle pulse: one complete revolution of the pointer. At the same time the horizontal circle advances by 1/32.

3) The great pulse: 32 middle pulses are equal to one revolution of the golden ring."

The rotations define three rhythms that are in an order of powers: 1/32, 1, 32, 32^2. The archetype number of rotation (or the circle) is naturally π. In the spatial structure – as Jung analyzes the dream – the number 4 dominates over the number 3 of temporality. The rotation itself symbolizes *Time*, and in this abstract manner the spatial and temporal structure of the Dream of World Clock is symbolically isomorphic with the formula of the inverse fine structure constant $\alpha^{-1} = 4\pi^3 + \pi^2 + \pi^1$.

In other words, the dream can be considered a central algebraic (system) archetype and, at the same time, as an automorphic mapping of the cardinal number archetype in the symbolic system of the dream (see Figs. 1 and 2).

From the Pauli–Jung letters [37], it is clear that the black bird is supported by the female symbolic figure of *anima*, where the anima is adorned with the number '7'. In this way, the black bird (1), the rotating discs and ring (3), and the figure of the anima (7) altogether associate to the number '137'.

Furthermore, the temporal structure (rotation scale) itself is double 32, and the spatial structure is also evidently 2×(32+4) (the four little men with pendulums – horizontal disc, and four cardinal positions of pointers – vertical disc), that altogether results in 1+2×32+2×36=137.

The dreams No. 39 and 51 naturally and evidently contained in the structure of the World Clock vision (four little men, four colours create an isomorphic map with the four eyes and four colours of the bear). Therefore, the three power-like rhythms with the four space-like quaternio (like a multiplicator) is naturally and evidently an isomorphic map of the $4\pi^3 + \pi^2 + \pi = 137,036\dots$ Consequently, the structure of the World Clock vision (together with dreams No. 39 and 51) is a perfect isomorphic structure of the above "abstract" formula of the fine-structure constant and its discussed isomorphic interpretations (if $\pi{\sim}4$ or $\pi{\sim}2$). Jung often refers to the old familiar saying: *on Olympus numbers reign*. Following this pattern, we regard the supreme ruler ("controller") of number archetypes the specific formula introduced for the inverse fine-structure constant.

Remark. The interpretation of the four wheels in the Ezekiel vision with the (then usual) 8 spokes can ensure a structure number of 32+4+2 in addition to the above 256+16+4 one. Since the number of the Hebrew word for 'wheel' (which is a fundamental concept in the tradition of the Ezekiel vision) counts 137 (אופן =137), so the isomorphy with the structure of the World Clock vision and the formula $4\pi^3 + \pi^2 + \pi$ can be considered as almost complete. The interpretation of three rhythms and the space quaternio also can be easily detected from the structure of the Ezekiel vision. (Other similar historical examples were mentioned in our earlier works [54, 55, 56]). From the point of view of depth psychology, the "numbers" 137 and $4\pi^3 + \pi^2 + \pi$ are also the twin number archetypes of the Self (Selbst).

Jung summarizes the structural meaning of the dream as follows:

"If we hark back to the old Pythagorean idea that the soul is a square, then the mandala would express the Deity through its threefold rhythm and the soul through its static quaternity, the circle divided into four colours. And thus its innermost meaning would simply be the union of the soul with God."

And later he says:

"… the quaternity is the sine qua non of divine birth and consequently of the inner life of the trinity. Thus circle and quaternity on one side and the threefold rhythm on the other interpenetrate so that each is contained in the other." [22]

According to Edinger:

"*It is clear from these quotations that Jung does not consider the quaternity a completely adequate symbol for totality: rather, a union of the quaternity with the trinity in a more complete synthesis is required. The trinity archetype seems to symbolize the process, while the quaternity symbolizes its goal or completed state*" [64].

On the basis of the above discussion and the equations (5) and (6) we may propose another more differentiated and "more general" symbolic mathematical interpretation of the dynamics of the World Clock dream according to a unified "more abstract" and a "more concrete" interpretation of circulations of the horizontal and vertical disk.

Figure 2

The alchemical figure of the rising double black eagle is hatched wearing the spiritual and temporal crowns as cosmic Anthropos with four evangelists. Codex Palatinus Latinus (15th Cent.). An illusration for Pauli's "Great Vision". [22]

According to this extended view, the abstract interpretation corresponds to the for-
mula $4\pi^3 + \pi^2 + \pi$. The "concrete" (or "concretistic") interpretation corresponds to
the usual elementary physical description of the circulation of the "orthogonal
disks" using 360 divisions of the unit circle. In this last case (symbolically), $\delta = 2\pi/360$, the basic pulse or rhythm of the circulation of the horizontal disk is consid-
ered a circle with unit radius. The whole circulation of the horizontal disk gives rise
to a δ step of the vertical disk. Symbolizing the third pulse or rhythm could be the
whole circulation of the vertical disk. Concerning the symbol of the perpendicular
relative position of the two disks, the dynamics of the World Clock vision can be
formulated by the relationship $1-\delta$ while $1+\delta$ can be symbolically considered as the
"orthogonal" relationship of the two disks or circulations[7]:

$$\frac{\delta}{1-\delta}\frac{\delta}{1+\delta}, \text{ where } \delta = 2\pi/360.$$

According to the modified "Black Bird" dream of Pauli from 1948 [37] (see later),
the twin-pair of the above formula is

$$\frac{\delta}{1-\delta}\frac{\delta}{1+\delta}, \text{ where } \delta = i2\pi/360.$$

Consequently, the above joint abstract and concrete interpretation of the spatial-
temporal structure of the "World Clock dynamics" for both the real and imaginary
interpretation of the "concretistic" circulation of the discs, all together can be char-
acterized by the formula (5 and 6), where the first part of the expressions corre-
sponds to its abstract, while the second part is its concrete (concretistic) interpreta-
tion.

It is worth to remark that the above formula and its interpretations, based upon the
Pauli's "Great Vision" (1932) and his "Black Bird" dream related to the FSC and
the complex plane with the unit circle (1948), can be considered a pure synchronic-
ity anticipating (implicitly), almost precisely, the latest (2008) experimental and
theoretical results, i.e. estimates of the FSC 76 (60) years later (the World Clock vi-
sion with the Black Bird is the 76th dream in the dream series of Psychology and
Alchemy with the footnote number 137) and with 50 years after the death of Pauli.
Naturally the number 76 at the same tine "belongs" to the "undetached observers"
in 2008.

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[7]   Accordig to Lindorff's commentary: *"This vision of two cosmic Clocks orthogonally
       related to each other by a common center challenges our rational prejudice as we
       contemplate the physical unrealizability of the construction of the World Clock. The
       image is a three-dimensional mandala, symbolically representing the structure of
       space and time, which have a common center point. The empty center shows that
       there is no Deity within the symbol. Taking this vision to have collective significance,
       Jung observed that modern humans have the task of relating to the whole person, or
       the self, rather than to a god-image that is a projection of the self."* [33]

In this case the first four number (especially to 2, 3, 4), the π as the abstract symbol of the circle the, 1 and i= $\sqrt{-1}$ and finally the 360, as the concretistic symbol of the circle, together are constituting the "double Pauli equation" of FSC. The interpretation of the complex plane partly indirectly, partly directly means an allusion of the number "**e**". Consequently for this point of view 1, 2, 3, 4, π, "**i**", 360 and "**e**" are the "main supports of the World". Thus, the double or twin black eagle in Fig. 3 chosen by Jung to illustrate this vision of Pauli, can be concerned as a perfect symbol of above twin concept of FSC.[8]

In the following, we extend our investigations to another set of Pauli's dreams, to the so-called *World Clock Family of Dreams*, in which we try to identify the underlying number archetypes "hidden" in background processes, using the usual hermeneutic principles of CARDANO and Jung (e.g. the principle of amplification). Furthermore, we demonstrate the spontaneous forms of geometric and algebraic system approximations, the primordial representational structures of stochastic control theory, and in the centre we reveal the number archetype of the inverse fine structure constant [22].

The World Clock Family in the narrow sense consists of four Dreams:

"Dream 55. A Silver bowl with four cracked nuts at the cardinal points.'

"Dream 56. Four children are carrying a large dark ring. They move in a circle. The dark unknown woman appears and says she will come again, for it is the festival of the solstice"

"Dream 57. A dark ring, with an egg in the middle".

"Dream 58. A black eagle comes out of the egg and seizes in its beak the ring, now turned to gold. Then the dreamer is on a ship and the bird flies ahead" (see Figs. 3 and 4).

According to the Pauli–Jung correspondence, the motif of the World Clock reappears in a later dream of Pauli, dated October 15, 1938.

"In summer I came across your book Psychology and Religion, and I saw that you have attached a certain importance to some of my early dreams, especially the vision with the 'World clock'. This now prompts me to tell you about a dream I had at the beginning of this year which, both in structure and content, is closely related to the dreams discussed in the book, especially the world-clock vision." [37]

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[8] Pauli writes to Jung: *"The imaginary unit i = $\sqrt{-1}$ is a typical symbol since it is not contained under the ordinary numbers; the introduction of this symbol gives many mathematical theorems a simple and distinct form. In this dream it has the irrational function of uniting the pairs of opposites and thus producing wholeness.*
Without going into mathematical detail, I should nevertheless like to stress here that I cannot acknowledge an antithesis between a mathematical and symbolic description of nature, since for me the mathematical representation is a symbolic description par excellence." [37]

The description of the dream is the following:

"At the top there is a window, to the right of it a clock. In the dream I draw an oscillation process beneath the window – actually two oscillations one beneath the other (see figure below). By turning to the right from the curves, I try to see the time on the clock. But the clock is too high, so that doesn't work.

Then the dream continues. The 'dark unknown woman' appears. She is crying because she wants to write a book but cannot find a publisher for it. In this book, there is apparently a great deal of material on time symbolism, e.g. how a period of time is constituted when certain symbols appear in it. And at the end of one page of the book there are the following words, read aloud by the 'voice':

'The definite hours have to be paid for with the definite life, the indefinite hours have to be paid for with the indefinite life.' "[37]

Pauli himself interpreted his own dream:

"In the dream described here, an attempt is first made to relate the two lowest of the 3 layers to a four-part object (the clock), but this does not work. This is why, in contrast to the earlier world-clock vision, the sense of harmony is missing.

The cry of the ecsatic 'voice' at the end of the dream is perhaps a way of showing the puzzling 'rhythms' from a new side, and they seem to be regulating that process which is here called 'paying'. One is inclined to connect the 'certain life' with the first (quickest) rhythm and the (temporally) indefinite life with the other two rhythms."[37]

In other words, according to Pauli himself this dream is a paraphrase of the World Clock Dream. The random oscillating waves contain information only in interval $[0,\pi)$; if we combine the three different temporal rhythms, the quaternity of space (represented by the four-part object, the clock), and number π (using Cardan's hermeneutical amplification's rule), we arrive at the $4\pi^3 + \pi^2 + \pi$ expression and at the same time harmonizes with the corrective (concretistic) member of "twin concept" of the fine structure constant.

The three signal processes and the three temporal rhythms explicitly refer to control (theory): in Pauli's own opinion "*they seem to be regulating that process*" which is called *"paying"* at the end of the dream.

Going back to the original thought, let us present a brief interpretation of the above dreams.

The cracking of the four nuts by dreamers at the cardinal points and their arranging them is an attempt to interpret unconscious patterns.

In the second dream, the four children rotate a large dark ring around a great egg. The dark unknown woman (Anima, *Shekinah*, chthonic *Sophia*) appears who informs us about her return at solstice – the midwinter solstice is the birth of Christ. That is, the four children help the birth of the Messiah, who is the symbol of Self ('Selbst').

In the next dream, a large black bird, born from the great egg, picks up the ring, which turns into gold. The dreamer is standing on a ship on the sea and is looking at the bird with the ring flying above him (see Fig. 2 in Part II). This can be interpreted as consciousness emerging from the unconscious and making a step towards the individuation process.

After these dreams, the next in the sequence is the World Clock Dream with its multiple 32–36 structures. The system by 32 of the four nuts can be related to the system of 32 of the blue vertical disc, and the four cardinal points are identical with the cardinal positions of the pointer. The four children transform into four little men with pendulums.

Apparently, the rotation of the golden ring causes the black bird give birth to the white egg. As a consequence, the golden ring turns dark, the four little men return to being children, and the discs recover their original unconscious forms.

In this vein, the symbol of white egg can be connected to the input process of dynamical systems, or generally, to the creative "chaos" of the *white noise* process that contains all the necessary and sufficient information to represent the dynamical system. The output process is symbolized by the black bird, and the dream explicitly refers to the general space–time projection structure of systems (observability, controllability, reachability, constructability) [38, 53]. It is also obvious that the egg–bird metamorphosis denotes the input-output transformation of a dynamical system.

In other words, we are given two isomorphic dynamic system representations: a dark, unconscious one, and a clear, conscious one (cf. background system theory).

The white noise hypotheses of the eggs can be confirmed by the second dream in March 1948 from Pauli's essay, "Modern Examples of Background Physics" (see Appendix of [37]). In that dream, there are seven phases:

"Seven pictures in a row. No words are spoken until right at the end and I am the one speaking.

Picture 1. *A woman comes with a bird, which lays a large egg.*

Picture 2. *This egg divides itself into two.*

Picture 3. *I go and notice that I have in my hand another egg, with a blue shell.*

Picture 4. *I divide this last egg into two. Miraculously, they remain whole, and I now have two eggs with blue shells.*

Picture 5. *The four eggs change into the following mathematical expressions.*

$$\cos \delta / 2 \sin \delta / 2$$
$$\cos \delta / 2 \sin \delta / 2$$

Picture 6. *This gives the formula*

$$\frac{\cos\delta/2 + i\sin\delta/2}{\cos\delta/2 + i\sin\delta/2}$$

Picture 7. *I say, 'The whole thing gives exp(iδ), and that is the circle.' The formula vanishes, and a circle appears."*

In other words, the eggs, the seven phases, and the four terms finally result in the formula of the complex unit circle. The random oscillations determined by the unit circle result in four so called "extremal" operators according to the placement of poles and zeros inside or outside of the circle. The four transfer functions, and the past and future subspaces of input give a differentiated description of temporal structure. This together with the four Kalmanian criteria yield 16 system representations, and if we consider the forward and backward flow of time as a "synchronistic" feedback, then we are given 32 system representations [38].

The potential canonical representations are the following:

- Forward extremal representations:

  1 Stable and minimum phase; there are no poles, and the zeros are inside the unit circle.
  2 Stable and maximum phase; the poles are out of the unit circle but the zeros are inside the unit circle.

- Backward extremal representations:

  3 Anti-stable and maximum phase; no poles and the zeros are out of unit circle.
  4 Anti-stable and minimum phase; the poles are inside the unit circle but the zeros are out of unit circle. [38]

Let us summarize the relationship between the @World Clock dream family@ and the optimal control system using a hypothetic theory of "background control". The World Clock dreams with the three oscillations or "random" signals using the hermeneutic amplification can be interpreted as an allusion to the four generating regulating process of a dynamic system. On the basis of the black bird and the four eggs dream, we see these random input processes as symbolically represented by the 4 eggs (two white and two blue ones). Eggs are appropriate symbols for "chaos", generating creative entities. As Lindorff writes:

"Pauli enters, bringing about a fundamental change involving the realization of the 4 eggs as a mirroring or twinning of the first two. The fact that the mathematical expression symbolizing these transformations defines a unit circle was a validation for Pauli – that mathematics can serve as a neutral language carrying over to psychology. Although he did not understand the dream, he recognised it had great meaning for science." [33] "It even seems that such interpretations would demand a further development of all sciences. The determining role which mathematical symbols play in the production of unity in the dream seems to me to say that the unifying power of mathematical symbolism has not yet been exhausted." [33]

Pauli's mathematics was inherently symbolic: *"like Galileo, Newton, Kepler, Pauli has also perceived the word of the manifestation of God, which can only be perceived mathematically. The physical and mathematical symbols human dimension he was suggesting that the psyche, the matter are connecting at the archetype level."* [33].

In this case we can see that the 4 random generating or regulating signals (as white noises) via the unit circle can be interpreted as dynamic „transforming" systems. This corresponds to the *a priori* specification of the positions of poles and zeros with respect to the unit circle. At the same time, as we have seen, parametrical canonization can be based on the *quaternary notion* of reachability, observability, controllability and constructability. They are naturally, the "realizations" of the time projections for the cases of output future and past as well as input future and past, respectively.

Looking at one of Pauli's favourite topics, we can obtain altogether 2×4×4=32 different possibilities, that is, 32 canonical forms of the random dynamic systems in a structural system of polarity (oppositions). At the same time, applying Pauli's world view, the archetype patterns can be considered probability fields. It is well known that Pauli tried to expand the concept of archetype to include probability: *"Thus speaks of the probability law instead of […] ordering factor."* Jung later accepted this probabilistic concept of archetype and archetypal patterns and applied it frequently in his later writings. Therefore, the above-mentioned white noises can be treated as isomorphic, "dynamic" entities of the suitable probability fields, which of course include the abstract control patterns as well.

Consequently the 32 canonical representations of the random dynamic systems can be applied for the twin states (state costate) of the optimal system. If we define a symbolic "cognitive" (mirroring or twinning) relationship between the given representations of the twin states, then we can interpret 32×32 relationships. Symbolically these 32×32 relationships are the *sine qua non* for the realization of a synchronistic (optimal), random systems.

This relationship is "anticipated" by Dream 55: "A silver bowl with four cracked nuts at the cardinal points." Dream 55 is the 72nd in the complete dream series. It is followed by the closing and summarizing four dreams with ring, black bird, four colours, 32 units, etc. The four nuts at the four cardinal points could mean 16 versions. One nut has 8 dominant poles. Consequently, with the one nut as unit element, the eight poles and $128 = 16 \times 8$ versions for the dominant poles in sum equal to 137. From another point of view, the possible topological cases of 8 dominant poles are $8 \times 8 = 64$. Thus the number of all versions is: $64 \times 16 = 1024 = 32 \times 32$. Thus, as the 72nd dream, it anticipates the structure and essence of the World Clock dream. It hints at the famous (14th) "Rubicon" dream of Pauli as well. In a previous dream (Dream 52), "*the dreamer has first to go into the adjoining room to crack some nuts.*" At the same time, the nut kernel is entirely isomorphic (8 corners) with the cube (8 corners) and its previously introduced "defini-

tion" using the relation-number 137. But the cube can be characterized also by number archetype 137:

"A central abstract concept of the cube (e. g. in rotation) can be defined in the following way: The cube is a unit element and its „cardinality" is naturally the eight i.e. the eight corners of the cube. The relationships among the corners can be uniquely defined as through the edges connecting the corners. Evidently, there are four types of directed connecting relations among the corners through the edges with measure of 0, 1, 2, 3, and so the numbers of the connecting relations 8, 24, 48, 48 respectively. Therefore the definition of the cube is 1+8+8+24+48+48 = 1+8+128 = 137. It is entirely isomorphic with the Eddington's interpretation of 137. Thereby, the cube symbolically is a hint for the Hebrew word of Cabala and the Holy Crown of Hungary, as well (see the Appendix in the second part of the paper). *Both are deeply related with the number archetype 137."* [61]

It can be seen that this is both task and solution (decision), referring in the context of the Rubicon dream to the problem, "the die is cast" (alea iacta est). It is also interesting that it can serve as Pauli's definite answer to Einstein's "God does not play dice".

Naturally, among the 32 representations, the most important representations have the highest degree of the possible polarities. Obviously, it is the backward innovation process (anti-stable) with spectral factor of maximum phase (there are no poles and zeros are out of the unit circle); and the other is forward (stable) innovation realization with spectral factor that is stable and with minimum phase (there are no poles and zeros are inside the unit circle). Naturally, the above oppositional relationship can be completed with positive time direction for the first state and negative time direction for the other. Furthermore, the first state representation is related to the input and the future, while the second state is related to the output and past specification.

The most significant 4 representations – two for the state and mirror symmetrically the two for the co-state, all together mean, with the appropriate inverse spectral factors, 8 exposed (dominant) representations. Thus 2×32 for state co-state and the other 2×32 for the inverse representations all together with 8 representations and original unique all-pass function representation in sum equal 137. In this way, the three dreams may ensure the almost total description of a background control system, namely a synchronistic random control dynamic system based upon the a priori probability fields of a given archetypal pattern.

On the basis of the above "system representational relationship description" we may conclude that the above "32×32 system" is also in isomorphic relation with the expression of

$$\frac{\delta}{1-\delta}\frac{\delta}{1+\delta}, \quad \delta = \frac{2\pi}{32} \tag{7}$$

Consequently, the delta formula member of controlling-observing equation of FSC can be concerned as a symbolical mathematical form of the representational relationship structure of the optimal control systems too. Our conjectures as we mentioned above that Pauli trough the observation of his World Clock dream carried out a mainly unconscious measurement and calculation of the fine structure constant measured and calculated 76 years later. Maybe it is related synchronistically to the so called Pauli effect. It is his permanent confrontation with the measurement equipment of the quantum physical laboratories. It seems to be that he was better "convinced" about his intuition and imaginations concerning the results of quantum physical measurements of un-detached observer.

Pauli was deeply fascinated and involved together with Jung in the different interpretations of the problem of "Quadratura circuli". Therefore the mapping of the interval $x=[0; 360]$ to the numbers divisible by 4 (1–90) can play an important role. The mapping can be written as follows:

$$x = \begin{cases} x_{4k} & \text{if } x_{4k-2} \leq x < x_{4k+2} \\ 0 & \text{otherwise} \end{cases} \tag{8}$$

where $k=1\dots90$. In this case, considering our formula (5 and 6) the number 137 corresponds to $x=32$, i.e. to Pauli's division in the World Clock Dream. If we take the most precise estimate value of the latest measurements 137,035999070 and 137.035999084 then the corresponding x value will be approximately 360,0014…and 360.0018 degree [70,71].[9]

The role of the twins naturally plays a central role in the interpretation and active imagination opus of Pauli .They occur in other impressions and speculations of the correspondence, for example see the doublets as twins and the myth of *Dioscuri [33]* (in 1948).[10] Finally, they are mentioned in one of the most important letter of Pauli to Jung dated 1956 October 23. Thus, the twin concept (bivariate fuzzy number or interactive twin fuzzy numbers) of FSC and the twin states of the optimal systems are in isomorphic relationship with the oppositional predispositions

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[9]   As usually concerned, the fine structure constant may slightly depend upon the time of the Universe, the specific physical phenomena, the system of measurements and finally the observer ("interpretator") as well. As we have shown especially from the angle of the undetached observers it can be treated as a (hidden) interactive fuzzy numbers archetype. It means that it could have an appropriate narrow interval with a membership function depending upon the observer.
From another point of view according to the probabilistic archetype hypothesis of Pauli and Jung we may imagine that the FSC can be concerned as a changing number, which is permanently controlled by deep layer of probabilistic patterns of a rather "universal" archetype. Our conjecture about the controlling-observing equation of the FSC may correspond to this hypothesis. Naturally in this case there is a hypothetical controlling-observing phenomenon.

[10]   "*…the Dioscuri myth on the one hand and doublet splitting of spectral lines.. on the other*" [33]

of the mythical brothers (Gemini) of *Castor and Pollux*, as well as, *Phares and Zara*. Both are, in the same way, symbolizing the Sun and the Moon, Hades and Olympos, day and night, past and future, forwarding and backwarding, etc.

In Pauli's dreams, the doublets, dipoles etc. where treated as mythological twins or, abstractly, as twins states. Therefore, the following statement from Jung's letter to Pauli (14.10. 1935) can be viewed as joint precognition of state costate condition for optimal control systems: *"The dipoles probably indicate first and foremost the complementary relationship in a self-regulating system."* The complementary relationships are embodied by the forward-backward time flows and future-past projections. The self-regulating system in this context is a pre-image of an optimal control system according to modern mathematical system theory.

From the above oppositional backward and forward pairs of white noise processes we may represent, i.e. entirely determine the whole dynamics and the output of the stochastic systems. [38] At the same time this condition of the representability of the system can be considered as the condition of the optimality for the dynamic system concerning the oppositional disposition of the twin states (state-costate). Thus, the representability also depends upon "characteristic twin-processes"[11].

On the basis of the Pauli concept of two kinds of mathematics one can constitute a hermeneutical system as well for the explanation of the World Clock dream. The comparison between the control and hermeneutical systems is illustrated on Tab 2.

Table 2
Comparison between the control and hermeneutical systems

Control System	Hermeneutical System
Input-Output	Unconscious-Conscious
Future-Past	Archaeological-Teleological (or Final-Causal)
Maximal-Minimal Phases	Progressive-Regressive View ("looking" forward-backward)
Moving Forward-Backward	Forward-Backward movements of Libido
Straight-Inverse model forms	Extraverted-Introverted attitude
Positive-Negative time streams	Double Time-direction in synchronistic phenomena
Twin stales (state, co-state of control model representations)	"Twin states" of Ego-Self " "

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[11]   Hopefully, the above representation structure can be generalized into a bilinear stochastic systems, as well. In this case the above approach of representability and optimality can be used probably, for the identification and control of the quantum teleportation models and systems, as well.

The optimality of the hermeneutical (and at the same time mythological and psychological) system can be derived from the dual task of the pleasure maximization and the suffering minimization principle of the libido (psychical energetic system, see Ricoeur [69]). However, the realization (condition) of optimality demands the polar existence of the twin states (state / co-state). In a hermeneutical system, this condition is embodied by the dual Ego-Self aspects of the interpretations. For these dual aspects, the hermeneutical system, according to the comparison in Table 2, also has 32 representations. Ricoeur's concept of meaning control in hidden time [49, 69] leads us to the optimal behaviour of the hermeneutical system along with its development. It is worth noting that Jung's choice of the alchemical picture illustrated by the World Clock dream shows a double headed black eagle emerging from the World Egg. The black bird bears a sacral and a mundane crown on his head. It is a perfect symbol for the mythological twins, and also for the psychological and hermeneutical (Ego-Self) twin states (see Fig. 3). Thus, there seems to be perfect isomorphy between the mythological and psychological as well as the hermeneutical and background control system's representations, and of course, it corresponds to the background physics interpretation as well, The above 4+1 background languages are discussed in detail at the second part of the paper.

Consequently, the World Clock Dream provides an excellent opportunity to introduce the above mentioned five (4 + 1) background languages. In the centre of the four languages (mythological, psychological, physical and hermeneutical) we can find the unifying language of the "background control theory".

4 The "World Clock Model" and the Reinterpretation of the Five Concepts of FSC

On the "imagined" vertical axes of the well known Pauli-Jung quaternion [27, 53, 55] we can see the concepts of the spatial-temporal continuum and indestructible energy. The fine structure constant (FSC) appears as a connecting constant. Its value can be considered a wavelength. It plays a vital role in the spatial-temporal structure of the hydrogen atom as it matches the ratio of the reduced radiation and the *Compton wavelength*. The same ratio is determined between the *Bohr radius* and the elementary radius of the electron. According to the "classical" approach the hydrogen atom gives the measure of the component of relativistic energy during energy emission and can easily be measured from the spectrum of the hydrogen atom by well-known spectroscopic measurements. These two concepts stand in complementary relationship to one other. Here we can "interpret" the twin concept, the experimental and theoretical result (see in Chapter 2) of FSC. The horizontal axes illustrate the contingent (synchronistic) and causal concept of FSC.

Table 3

The role of the fine structure constant **α** in the topological and dynamical structure of the hydrogen atom, where R is the **Rydberg Constant** (see also in Appendix 2)

Combination	Atomic property	Characteristic length (m)
$\alpha^3/4\pi R_\infty$	The classical electron radius, r_e	$2.8179380(70) \times 10^{-15}$
$\alpha^2/2R_\infty$	The Compton wavelength of the electron, λ_e	$2.4263089(40) \times 10^{-12}$
$\alpha/4\pi R_\infty$	The Bohr radius of the hydrogen atom, a_0	$5.2917706(44) \times 10^{-11}$
$1/R_\infty$	The reduced wavelength of hydrogen radiation	$9.11267034(83) \times 10^{-8}$

EDDINGTON's model, already mentioned in our earlier papers, matches the causal descriptive mode in which the four variables of the spatial temporal continuum gives 16 equations, where the number of the independent variables arranged in a matrix is $137 = (16^2 - 16)/2 + 16 + 1$ [15]. This approach seems to be synchronistic from the perspective of classical physics while it seems causal in character from the perspective of modern quantum physics. As opposed to the real physical phenomena of the previous axis, it is obvious that we do not have concepts emerging from immediate experience but rather an intuitively appealing mathematical (or meta-mathematical) interpretation coming out of physics. Although it originates from physical thought, the result – properly speaking – is not physical, but it is the concept of a background language. This solution is near to Pauli's mental world since he often makes references to the problem of FSC, and his explanation lies outside quantum physics. Pauli applies the same line of thought to the Einstein's criticism of quantum theory. According to Pauli these "life" questions are outside physics (*In Sinne des Lebens betrachtet*) or, in other words, these questions should be interpreted and approached within a wider framework [33, 45].

Figure 3

An alchemical picture of „World Clock" with the four cherubs (evangelists) and the Cross as Anthropos (Christ). Thomas Aquinas (pseud.). De Alchimia (16th Cent.). An illusration for Pauli's "Great Vision". [22]

"An important detail in this thinking about duality is the meaning of the numerical value of the electric charge, which, in the form of Sommerfeld's fine-structure constant, is approximately 1/137. Pauli repeatedly stressed that progress in quantum field theory was linked to an understanding of this number [...].

The enigmatic conjecture 'that the observer in present-day physics is still too completely detached' also has a meaning beyond physics. Indeed, in his article for Jung's 80th birthday [...], Pauli compares the observational situation in physics with that in psychology: 'Since the unconscious is not quantitatively measurable, and therefore not capable of mathematical description, and since every extension of consciousness ('bringing into consciousness') must be reaction alter the unconscious, we may expect a 'problem of observation' in relation to the unconscious, which, while it present analogies with that in atomic physics, nevertheless involves considerably greater difficulties.'

For Pauli this analogy had implications in both directions: On the one hand, in the concluding remarks of the birthday article for Jung [...,] he expresses the expectation that in the future the idea of the unconscious should emerge from the purely therapeutic realm and become more a problem of objective research. On the other hand, he thought that in physics the remedy for the too complete detachment of the observer may lie in the integration of the subjective, the psychic. Indeed, in Science and Western Thought [...], Pauli asks the question: 'Shall we able to realize, on a higher plane, alchemy's old dream of psycho-physical unity, by the creation of a unified conceptual foundation for the scientific comprehension of the physical as well as the psychical?'.

This quest for a unity of physics and psyche is a recurrent theme in the exchange between Pauli and Jung and is the main concern in Pauli's Background Physics*, in which he was guided by his dream motives (Hintergrundsphysik [...])."* [32, 33].

On the basis of the above approach and perspective of the synchronistic interpretation of the FSC, we propose (with the extension of the expression $4\pi^3+\pi^2+\pi$) *the abstract and the same time anthropomorphic equation (5).*

We conclude that the synchronistic concept of FSC fulfils the claim of maximal simplicity, while also ensuring the value matches exactly measurements of FSC. Simplicity is fulfilled by the four integers and the π appearing in the first part of the equation. The connection opens the possibility of interpretations on the basis of approaching the circle by quadrates, and so it gives the expressions 256+16+4, and 32+4+2. The former also reflects the Eddington approach.

This way the determination of the IFSC of the horizontal axis is complementary as well, but also mutually containing. In a similar way the contingency ("correspondentia") approach and the causal approach are complementary. Obviously this connection also comes out of physics. Although the measured values are within the error limit and are derived from π, it can be interpreted only in the wider con-

ceptual framework called "life realization" by Pauli. We place the centre of our hypothesis a unifying concept, which is in contrast to the Pauli–Jung idea. Jung did the same in the case of the four orientation functions, where the unifying transcendent function is in the centre. With regard to the IFSC the central "entity" is intimately connected to the possibilistic twin concept of the *controlling-observing equations* of the IFSC (5) and (6).

Remark 1. According to Dirac's hypothesis the electron trajectories are stable up to a nucleus containing a maximum of 137 protons (as we discussed '137' can be seen as the structure number of mathematical optimal control systems). Thus we can reach the unique number '137' in five different ways. From the point of view of depth psychology, the number '137' could be the number archetype of Self (Selbst).

Remark 2. The Pauli-Jung quaternion with the central concept of the "unus mundus" seems to be isomorphic with the 4+1 background languages (see at the second part of the paper) and at the same time with the four ontic layers (spiritual, psychical, material and transcendental).

Remark 3. The synchronistic feature of the dream and the 4+1 scheme interpretation is unambiguously demonstrated by the fact that in Jung's *Collected Works* (Psychology and Alchemy) the number of the footnotes referring to the dream is astonishingly '137' [22]

Conclusion

In this paper we have introduced a general twin concept of IFSC and a "background system theory" as well. We have attempted to show that, just as the archetypes can be "imagined" around the central archetype, i.e. the Self (Selbst), rather wide, partly possibilistic (fuzzy), partly probabilistic (random) interpretations of the fine structure constant correspond to a hypothetical central number archetype, in other words to the number archetype of the Self (Selbst).

On the basis of earlier experiences, taking into consideration the extended and deepened interpretation of Pauli's "World Clock" dream, we generalized a double controlling-observing interpretation of the fine structure constant. This might mean that both the experimental (measured) and the so-called theoretical results also dependent on time probably in short run and long run as well. According to this conjecture the results of specific experiments and "theoretical calculationss" can be treated as specific values of the measured "output processes" of a hypothetical synchronistic dynamic system, excited by a hypothetical joint possibility-probability fields of a central archetypal pattern of the Nature and Psyche, where we again are applying the terminology and Weltanschauung of the two Great Minds.

Concerning the FSC we may be closing with the Pauli's words on the future problem of 'observation, identification and interpretation' in the quantum theory. In a letter to Fierz (on Oct. 13, 1951) Pauli writes:

"Now there comes the major crisis of the quantum of action: one has to sacrifice the unique individual and the "sense" of it in order to save an objective and rational description of the phenomena. If two observers do the same thing even physically it is, indeed, really no longer the same: only the statistical averages remain, in general, the same. The physically unique individual is no longer separable from the observer – and for this reason it goes through the meshes of the net of physics. The individual case is occasio and not causa. I am inclined to see in this occasion which includes within itself the observer and the selection of the experimental procedure which he has hit upon – a revenue of the anima mundi which was pushed aside in the seventeenth century (naturally "in an altered form"). La donna e mobile – so are the anima mundi and the occasion. Here something has remained open which previously appeared to be closed, and it is my hope that new concepts, which are uniformly simultaneously physical and "psychological" (concerning the undetached observer), can force themselves through this gap in place of "parallelism". May "more successful offspring" attain this." [32]

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