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Connecting Hidden Spaces in Scalar Strong Interaction Hadron Theory SSI

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ABSTRACT

In the rather successful SSI, scalar strong interaction hadron theory for elementary particle physics, the main physics resides in two "hidden" spaces that differ basically from each other. These are the relative space-time between the quarks in a hadron and an abstract flavor space created artificially for the quark flavor properties.. It is demonstrated that these two widely different spaces, both invisible or "hidden" and associated with a meson can be connected to each other under special circumstances. The connection here is limited to the life and size of a neutral pion π^0. The consequences of such a connection may influence the basics and boundaries of present day epistemology.

Keywords: scalar strong interaction hadron theory SSI, "hidden" space, relative space between quarks, flavor space for quarks, connection between "hidden" spaces, epistemology

1. INTRODUCTION

Two of the basic differences between the current mainstream approach to elementary particle physics, the standard model SM [1] and the more successful scalar strong interaction hadron theory SSI [2] are highlighted and analysed in greater detail. These are the two independent “hidden” spaces associated with the interquark relative space and the quark flavor space, respectively. SSI’s physics reside in these two spaces.

In SSI, electromagnetic interaction takes place in the laboratory space X^μ only but not in the relative space x^μ between the quarks; it is “hidden” there.

Existence of these two “hidden” spaces has not been contradicted by data. On the contrary, data require their existence in SSI.

A possible connection between these two mutually independent, abstract, “hidden” spaces is demonstrated. Influences of such developments on present epistemology are briefly discussd..

2. QUARK WAVE AND “HIDDEN” FLAVOR SPACE FUNCTIONS

The main impetus behind SM and SSI emerged in the early 1960´s when the quark hypothesis was introduced [3, 4]. Quarks are building blocks of hadrons but are themselves invisible, or more specifically, do not interact with electromagnetic field. In SM, quarks are described by Dirac type of equations, are “colored”, interact with each other via colored vector particles, called gluons, and are confined at high energies [5]. The quark masses and charges are, like those of electron and proton, natural constants. Their masses have however not been fixed, unlike those of the electron and proton. SM works in the conventional Minkowski spacetime X^μ. The invisibility of quarks and the relative time between them in hadron do not appear to enter the SM predictions in decisive manners.

In SSI, a quark A located at x_I^μ, interacting with an antiquark B located at x_{II}^μ via scalar potential $V_{SB}(x_I)$, is described by a wave function in the form of van der Waerden´s spinors $\chi_{A\dot{b}}(x_I)$ and $\psi_A^a(x_I)$ [2 (2.1.1)]. The dotted and undotted spinor indices run from 1 to 2. These spinors are a transformed form of the corresponding Dirac bispinors. The corresponding van der Waerden equations are, unlike Dirac´s equation, manifestly Lorentz covariant. These spinors and equations have been analogously taken over to apply to the antiquark B [2 (2.1.3)].

However, quarks have different flavors associated with different masses and charges. In SSI, the above van der Waerden´s spinors for quark A are complemented by a flavor function ξ [2 (2.3.11)] containing such information [2 §2.3.3]. The origin of such a function, in the present case, is a paper by Bég and Ruegg [6] following the quark proposal [3, 4].

[6] proposed an abstract n-dimensional complex vector space z^n, $z_n =(z^n)^*$, a differentiable manifold, and defines a metric and an invariant Laplace-Beltrami operator whose eigenfunctions are harmonic functions representing basis vectors transforming irreducibly under SU(n). These functions are not used here. But z^n, z_n, for n=3, provide a point field for implementing the transformations of SU(3) [$z^1z_1+z^2z_2+z^3z_3=1$]. Let $n\to p$ here. z^p, in itself an abstract, "hidden" variable, is taken over here to represent quark flavors p, r=1, 2, 3, 4, 5, 6 referring to the u, d, s, c, b, and t quarks, respectively. Denoting the flavor function of quark A with flavor p by ξ^p, the total quark A wave function becomes now $\chi_{A\dot{b}}(x_I)\xi^p(z_I)$ and $\psi_A^a(x_I)\xi^p(z_I)$. Similarly, the total antiquark B wave function now reads $\chi_{B\dot{b}}(x_{II})\xi_r(z_{II})$ and $\psi_{B'}^a(x_I)\xi_r(z_{II})$.

The mass in the van der Waerden equations is now replaced by a mass operator $m_{1op}(z_I)$ operating on the "hidden" flavor function $\xi^p(z_I)$ in [2 (2.3.11)]. Analogously, the quark charge q has been replaced by a charge operator $q_{op}(z_I)$. In this way, quark masses and charges are eigenvalues of their respective operators, the quark mass summing operator $m_{1op}(z)$ and quark charge operator $q_{op}(z)$, respectively. These in their simplest forms are [2 (2.3.12-14)]

$$\xi^p(z) = z^p, \qquad \xi_p(z) = z_p \tag{1}$$

$$m_{1op}(z) = m_q\left(z^q\partial/\partial z^q + z_q\partial/\partial z_q\right) \tag{2}$$

$$q_{op}(z) = q_r(z^r\partial/\partial z^r - z_r\partial/\partial z_r) =- q^*_{op}(z), \qquad q, r = 1, 2, 3, 4, 5, 6 \tag{3a}$$

$$q_1 = q_4 = q_6 = \frac{2e}{3}, \qquad q_2 = q_3 = q_5 =- e/3 \tag{3b}$$

where $-e$ is the electron charge and m_q the mass of a quark with flavor q, From [2 (2.3.16)] and on, the simplifying notations

$$z_I = z, \quad z_{II} = u \tag{4}$$

have been adopted when there is no confusion.

3. MESON WAVE FUNCTIONS IN "HIDDEN" RELATIVE AND FLAVOR SPACES

The so-generalized van der Waerden quark equations, of the form [2 (2.3.11)] for quark A and antiquark B above, are multiplied together. The product wave functions of quark A and antiquark B, separable in x_I^μ and x_{II}^μ, are generalized to become nonseparable meson wave functions according to [2 (2.2.1a, 3)],

$$\chi_{A\dot{b}}(x_I)\chi_B^f(x_{II}) \to \chi_{\dot{b}}^f(x_I,x_{II}), \psi_A^c(x_I)\psi_{B\dot{e}}(x_{II}) \to \psi_{\dot{e}}^c(x_I,x_{II})$$

$$V_{SA}(x_{II})V_{SB}(x_I) \to \Phi_m(x_I,x_{II}) \tag{5}$$

Other, similar generalizations are given by [2 (2.2.1b, 2.2.2)]. The corresponding generalization in the flavor space, according to (1), is given by [2 (2.3.18)],

$$\xi_A^p(z)\xi_{Br}(u) = z^p u_r \leftrightarrow \xi_r^p(z,u), \qquad m_{1op}(z)m_{1op}(u) \to m_{2op}(z,u) \tag{6}$$

for a meson consisting of a p flavored quark and a r flavored antiquark. The equations of motion of a meson are now [2 (2.3.19)],

$$\partial_I^{a\dot{b}}\partial_{II\dot{e}f}\chi_{\dot{b}}^f(x_I,x_{II})\xi_r^p(z,u) + \big(m_{2op}(z,u) - \Phi_m(x_I,x_{II})\big)\psi_{\dot{e}}^a(x_I,x_{II})\xi_r^p(z,u) = 0 \tag{7a}$$

$$\partial_{I\dot{b}c}\partial_{II}^{d\dot{e}}\psi_{\dot{e}}^c(x_I,x_{II})\xi_r^p(z,u) + \big(m_{2op}(z,u) - \Phi_m(x_I,x_{II})\big)\chi_{\dot{b}}^d(x_I,x_{II})\xi_r^p(z,u) = 0 \tag{7b}$$

where the ∂ operators are given by [2 (3.1.4)].

The spacetime positions of a quark at x_I^μ and an antiquark at x_{II}^μ are transformed into a visible laboratory meson coordinate X^μ and a "hidden" relative coordinate x^μ according to [2 (3.1.3a)],

$$x^\mu = x_{II}^\mu - x_I^\mu = (x^0, \boldsymbol{x}), \qquad X^\mu = (1-a_m)x_I^\mu + a_m x_{II}^\mu = (X^0, \boldsymbol{X}) \tag{8}$$

where a_m is a real transformation constant. Conventionally, a_m is a ratio of the quark masses. Since the quarks are invisible, their masses cannot be measured and are unknown so that a_m becomes a free parameter. This new degree of freedom has far-reaching consequences in SSI and leads to the presence of dark matter and dark energy [2 Ch 15-16]. In (8), the quark positions cannot be determined, in agreement with the invisibility of the quarks.

Further developments from (7) or [2 (2.3.19)] show that the main physics of hadrons, the strong interaction between quarks, lie in such an invisible "hidden relative space" x^μ. Thus, the interquark potential Φ_m in (7) or [2 (2.3.23)] will depend only upon the interquark distance $r=|\boldsymbol{x}|$ and is given by [2 (3.2.8a)]. The first two terms on its right side drop out later so that

$$\Phi_m(r) = d_{m0} + d_{m2}r^2 = d_{m0} - d_h r^2 \tag{9a}$$

Here, $d_h \approx 0.07$ GeV^2 [2 (5.2.2)] and d_{m0}=0.64113 GeV^2 [2 table 5.2]. The meson wave functions in (7) contains the form $exp(-iE_J X^0)$, where E is the rest frame meson mass and J its spin, times radial wave functions for ground state mesons [2 (4.3.4)],

$$\psi_{00}(r) = \frac{1}{\sqrt{\Omega}}\alpha_{00}\, exp\left(-\frac{d_h}{2}r^2\right), \alpha_{00} = \left(\frac{d_h}{\pi}\right)^{3/4} = 0.0577\text{GeV}^{3/2}, \quad J = 0 \qquad (9b)$$

$$\psi_{10}(r) = \frac{1}{\sqrt{\Omega}}\alpha_{10} r(1 - 2d_h r^2)\, exp\left(-\frac{d_h}{2}r^2\right), \alpha_{10} = 2.443 \times 10^{-3}\text{GeV}^{5/2}, \quad J = 1 \qquad (9c)$$

where Ω a large normalization volume.

4. PREDICTED MESON SPECTRA AND DEVIATIONS FROM DATA

In addition, (7-9) also leads to the mass formula [2 (5.1.1)]

$$E_J = \sqrt{\left(m_p + m_r\right)^2 - 4d_{m0} + 8d_h\left(J + \frac{3}{2}\right)} \qquad (10)$$

for ground state meson masses. It consists of a quark masses part (m_p+m_r) which derives from the "hidden" flavor space z^p, z_p in Sec. 2 using (2) and a strong quark-antiquark interaction part containing the d_h and d_{m0} constants which comes from the "hidden" relative space x^μ from (9). It enters the observable laboratory space X^μ part $exp(-iE_J X^0)$ mentioned in (9). This formula has been largely confirmed by data [7]. Deviations from it are mostly limited to ~1.5% %.

This discrepancy led to the "variable quark mass hypothesis" [8]; *a quark´s mass in a meson is not a natural constant like the lepton and baryon masses but can vary somewhat from some mean value dependent upon the flavor and spin of its accompanying antiquark.* Nature utilizes the fact that a quark never exists alone but always share the same hadron with another quark (meson) or two other quarks (baryon) and hence can allow some unspecified interactions between them.

5. CONNECTION BETWEEN THE TWO KINDS OF "HIDDEN" SPACES

The successful (10) needs both the "hidden" x^μ space and the "hidden" flavor z, u space. Such an abstract manifold z, u originally created in [6] for some other purposes or another equivalent "hidden" space must exist; although its presence can neither be proved nor disproved.

This seemingly big leap is actually not totally new; the Schrödinger wave function $\psi(X)$ is of a similar nature. What this ψ is and what is its dimension are unknown. It needs only be an eigenfunction to some operators in X^μ space. Yet it is a central constituent in quantum theory. Here, the laboratory frame X^μ is in addition replaced by the abstract, complex z, u vector space.

In Sec. 2 and 3 above, both "hidden" spaces are separated from each other and each contains its own physical content. The existence of the small discrepancies of ~1.5 % mentioned in Sec. 3 indicates that there may exist some connection or coupling between these two, hitherto independent, "hidden" spaces.

In [6] and Sec. 2, the complex flavor coordinate z^p is dimensionless, as is shown for the SU(3) case there with

$$z_p z^p = R_f^2 \to 1 \tag{11}$$

which has been adopted in SSI [2 (2.3.5)].

6. B^- WEAK DECAY AND CONNECTION BETWEEN "HIDDEN" SPACES

Consider the following chain of weak decays of a B^-meson [9]

$$\begin{aligned} &B^-(b\bar{u}) \to W^-(X) + \bar{D}^0(c\bar{u})\ (2.26\%) \\ &\qquad \bar{D}^0(c\bar{u}) \to W^+(X) + K^-(s\bar{u})\ (6.98\%) \\ &\qquad\qquad K^-(s\bar{u}) \to W^-(X) + \pi^0(u\bar{u})\ \ (8.42\%) \end{aligned} \tag{12}$$

$$W^\pm(X) \to l^\pm + \bar{\nu}_l \tag{13}$$

$$b = z_I{}^5 = z^5, \qquad c = z_I{}^4 = z^4, \qquad s = z_I{}^3 = z^3, \qquad \bar{u} = z_{II1} = u_1 \tag{14}$$

where the notation (4) and quark flavor p, r=1, 2,… assignments of Sec. 2 have been employed. Parentheses with % give the fractions of the total decays [9]. The gauge bosons in their turn decay according to (13) where l=e or μ and ν denotes the accompanying neutrino.

In the chain (12), it has been tacitly assumed that a $d\bar{d}$ pair has been created from the vacuum to join $u\bar{u}$ to form a π^0. Further, the antiquark $\bar{u} = z_{II1} = u_1$ via (4 or 14) remains unchanged. Only the quarks denoted by z_I^q , q=5, 4, and 3, decay. In each meson, the strong quark-antiquark interaction in the "hidden" relative x^μ space also remains the same according to (9) and does not enter these processes. Thus, this decay chain actually takes place only in the "hidden" flavor z, u space (see second line of Sec. 5). It is equivalent to the following weak decay chain at quark level,

$$b(z^5) \to W^-(X) + c(z^4)$$
$$c(z^4) \to W^+(X) + s(z^3)$$
$$s(z^3) \to W^-(X) + u(z^1) \tag{15}$$

In (12), the initial $B^-(b\bar{u})$ decays to the $u\bar{u}$ pair in π^0 with an unchanged wave function (9b) in the "hidden" relative space x^μ. The associated flavor function is

$$\xi_1^1(z) = u\bar{u} = z_I^1 z_{II1} = z^1 u_1, \tag{16}$$

where the $z's$ and $u's$ are complex numbers like those in [6] cited in Sec. 2 and subjected to the limit (11). Let

$$z_I^s = z^s = a_s + ib_s, \qquad z_{IIs} = u_s = a_s - ib_s, \quad s=1,2\ldots6 \tag{17}$$

where a_s and b_s are real numbers. The "hidden" flavor function of the end decay product $u\bar{u}$ by (16-17) is then

$$u\bar{u} = (a_1 + ib_1)(a_1 - ib_1) = a_1^2 + {b_1}^2 = C_1 = \text{real constant} \tag{18}$$

As this pseudoscalar isosinglet $u\bar{u}$ (18) is prohibited by U(1) gauge invariance [2 Sec. 6.2], it has been joined by the tacitly assumed $d\bar{d}$ pair in (12) to form the observed π^0. This last pair will similarly contribute

$$\xi_2^2(u) = d\bar{d} = (a_2 + ib_2)(a_2 - ib_2) = a_2^2 + {b_2}^2 = C_2 = \text{real constant} \tag{19}$$

Noting (11),

$$0 < C_1 + C_2 = \text{real constant} \leq 1 \tag{20}$$

The flavor function in $\xi_r^p(z,u)$ in (6, 7) applied to π^0 may now be estimated to be

$$\xi_r^p(z,u) \to \xi_{\pi 0}(z,u) = \frac{(u\bar{u} - d\bar{d})}{\sqrt{2}} \to (C_1 + C_2)/\sqrt{2} < 1 \tag{21}$$

If the decaying quark does not end up in a u quark, the end product in (12) will have 2 flavors. Then, its flavor function will in general be complex according to (17).

7. TOTAL WAVE FUNCTIONS AND CONNECTION MECHANISM

7.1 **Meson Case**

Consider the total meson wave function $\chi_b^f(x_I, x_{II})\xi_r^p(z,u)$ in (7) for the pseudoscalar π^0 at the end of the decay chain (12). The "hidden" flavor part ξ_r^p is a number between 0 and 1 given by

(21). At rest, the laboratory space part of χ_b^f is $\exp(-iE_0X^0)$ mentioned beneath (9a). The "hidden" relative space x^μ part is given by (9b), The $\sqrt{\Omega}$ factor there comes from normalization in laboratory space and α_{00} is the corresponding normalization constant in the "hidden" relative x^μ space in (8). The same kind of normalization has been employed in the "hidden" flavor space in (11). The remaining $exp\left(-\frac{d_h}{2}r^2\right)$ is the "hidden" relative space x^μ counterpart to the "hidden" flavor function in (21).

From these two "hidden" spaces come the contribution $0 < \xi_r^p(z,u)\, exp\left(-\frac{d_h}{2}r^2\right) < 1$ to the total meson wave function. Both contributions are real numbers and lie between 0 and 1. Therefore, it is not possible to distinguish the "hidden" flavor space contribution from the "hidden" relative space contribution. Thus, when both these contributions are equal, i. e. when

$$(C_1 + C_2)/\sqrt{2} = exp\left(-\frac{d_h}{2}r^2\right) \leq 1, \tag{22}$$

they can interchange their positions and physical roles without altering the prediction (10). This leads to a connection or "bridge" between these two entirely different spaces. The numbers entering (22) are unknown but (22) can always be satisfied because the variable r runs between 0 and ∞.

This connection between these two different "hidden" spaces takes place only when the chain (12) reaches its end where a real π^0 is created. Only in this case, the flavor space contribution (21) is real and can interchange with the real $exp\left(-\frac{d_h}{2}r^2\right)$. If this were not the case, then $a_1 + ib_1$ in (18) will be replaced by $a_s + ib_s$ with $s\neq1$ so that (18) becomes complex, as was pointed out at the end of Sec. 7. It can then not interchange with the real number $exp\left(-\frac{d_h}{2}r^2\right)$.

This connection lasts only ~8×10^{-17} sec., the life time of π^0, and is limited to a "hidden" region of a few fm, the range of r in (22) of the size of a π^0 [2 (4.6.1)]. It takes place on earth neglecting gravitational effects.

The corresponding situation in cosmos, e. g. in intragalactic space with strong gravitational fields, is more complicated. The mesons in the chain (12) will be polarized by this field with the heavier quarks lying closer to the galactic center, analogous to the nucleon case [2 Ch 15]. The meson equations (7) need be modified to include gravity which will "turn on" dark matter or negative relative energy [2 (15.3.3)] and modify the real results (9) to include comple corrections. Under some circumstances, this may eventually lead to the above-mentioned connections before the decay chain (12) reaches the final π^0.

7.2 **Nucleon Case**

Both kinds of "hidden" spaces are also present and needed to account for nucleon data. The equations of motion for a baryon corresponding to (7) is [2 (9.3.9)]

$$\begin{aligned}
&\partial_I^{a\dot{b}}\partial_I^{g\dot{h}}\partial_{II\dot{e}f}\chi_{\dot{b}\dot{h}}^{\;\;f}(I,III,II)\xi^{psq}(z,v,u) = -i\big(m_{3op}(z,v,u)+\Phi_b(I,III,II)\big)\psi^{ag}_{\;\;\dot{e}}(I,III,II)\xi^{psq}(z,v,u) \\
&\partial_{I\dot{b}c}\partial_{I\dot{h}k}\partial_{II}^{d\dot{e}}\psi^{ck}_{\;\;\dot{e}}(I,III,II)\xi^{psq}(z,v,u) = -i\big(m_{3op}(z,v,u)+\Phi_b(I,III,II)\big)\chi_{\dot{b}\dot{h}}^{\;\;d}(I,III,II)\xi^{psq}(z,v,u) \qquad (23)
\end{aligned}$$

where *I, II* and *III* stand for x_I, x_{II} and x_{III}, respectively, and v for z_{III}. Φ_b has the same form as (5) but with an extra $V_{SC}(x_{III})$ on its left side. m_{3op} also has the same form as (6) but with one extra m_{1op} on its left.

The quark at x_{III} merges into that at x_I to form a diquark. Similarly, z_{III} merges into z_I. These mergers reduce the three-body problem into a tractable two-body problem treated from [2 (9.2.12)] and on for nucleon.

While the meson equations (7) are effectively 4 first order equations, the baryon equations (23) are 6 first order equations. Due to this complication, no analytical solutions like (9) and (10) could be found; numerical integration had to be employed. Apart from this inconvenience, the roles of the "hidden" relative space x^μ between the diquark and the quark and those of the flavor space are similar to those in the meson case.

Thus, instead of the analytical (9), the nucleon wave functions have been plotted in [2 Fig. 11.1b]. These lead to that the mean quark-diquark distance in a proton is ~3.05 fm [2 (12.6.22)]; the proton is cigar shaped in the "hidden" relative space. Only the proton charge radius ~0.831 fm [9] has been measured. This resolves the proton radius puzzle [10]. Approximating the "cigar" by a "rod" model [11 Figure 1], the deuteron binding energy has been calculated to be 2.174 MeV [11 (3.1)], 2.3% smaller than data. The origin of nuclear force is the Coulomb interaction between the *u* and *d* quarks in neighboring nucleons, independent of the strong scalar interaction acting in the interquark space-time x^μ [11].

In galactical space, the proton "cigars" are polarized, with diquark closer to the galaxy´s black hole. This leads to the creation of negative relative energy between the diquark and the quark which behaves like "dark" matter [2 (15.3.3)]. The ratio between the ordinary matter and the "dark" matter it generates must range between 0 and ~8.94 or 4.5 on the average [2 (15.3.4)], in agreement with data, The “cigar” shaped neutron also prevents a heavy neutron star from falling into a singularity but remains as a ”black neutron star” [2 §15.3.2], [7 peach model of black hole]. These have been confirmed this year.

Because all these cosmic data come only from nucleon, the “hidden” flavor space is limited to p, r =1, 2 in Sec. 2. Therefore, we cannot look into any general connection between it and the “hidden” relative space. Further, any eventual such connection has to be, unlike the simple (22), worked out numerically, rendering it hard to interpret.

8. IMPACT ON EPISTEMOLOGY

The success of (10) requires the existence of the flavor space z^p, z_p in Sec. 2, a mathematical construction originally “grabbed from the air” for some other purposes [6]. This space is therefore abstract and “hidden” from scrutinization. The relative x^μ space in (8) between the quarks is more tangible. It is “hidden” because quarks are invisible.

Yet, these two “hidden” spaces, widely different in nature, can be connected to, hence may also affect the contents of, each other under special circumstances, here the reality of the flavor function (18) for π^0 and (22).

The connection in Sec. 5-7 was originally thought to be a possible cause of the ~1.5% discrepancy between the prediction (10) and data [9], mentioned near the end of Sec. 5. Whether this conjecture is correct or not is unknown. Having found the mechanism in Sec. 7, a task is to see whether it can be applied to account for such discrepancy.

The present epistemology of natural science may be considered to be the empiricism advocated by the Bacons, Roger and Francis, among others, of the last millenium. Since the advance of quantum mechanics, we are moving away from materialism and towards idealism. As we move into the quark region, its invisibility removes much of the tools needed by empiricism. We have to rely more on abstract, mathematical guesses, as R. Feynman pointed out. Schrödinger´s introduction of his ψ wave function provides a basic example. Here, the complex flavor space z^p, z_p in Sec. 2 is another one.

One may speculate that the above “invisible” connection between two “hidden” spaces of widely different basic nature may eventually be extended to other forms of “hidden” spaces, even outside physics. Here, the word “hidden” may assume a more general meaning than that used above (not interacting with electromagnetic field); conventional science needs be complemented by the linguistic branch of philosophy.

There are almost infinitely many kinds of “hidden” spaces in the universe, partly dependent upon the definition of “hidden” here. Can they all really be isolated from each other, like the two considered in Sec. 2-3?

If two them can be connected via a special “bridge”, as is shown in Sec, 7, perhaps other such “bridges” also may exist. If so, then a dichotomy of our universe arises; a visible universe, the one as we “see” it, and an underlying, “hidden” or unseen part of the universe in which the important physics is shaped.

A series of different types of “hidden” spaces with different contents may be coupled via a series of different kinds of connections or “bridges”. As a possible extreme case, the cyberspace in cryptofinance may be considered as a “hidden” space. Recently, some physicists have left physics for cryptofinance and some of them have drawn analogies between it and cosmic physics [12].

Such developments, if further supported by data, may influence the basics, including boundaries, of present epistemology. One may ask, can they hint on fortune-teller´s abilities or underlie superstitions? These two phenomena have existed in human history right from the beginning and cannot be swept aside arbitrarily. More likely, we do not understand them.

Looking back, the “hidden” spaces here echo Kant´s well-known thesis: “The thing in itself is unknowable”.

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