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BASIC CONSIDERATIONS ABOUT KOZYREV'S THEORY OF TIME FROM RECENT ADVANCES IN SPECIALIST BIOLOGY, MATHEMATICAL PHYSICS AND PHILOSOPHICAL INFORMATICS[1]

Time involves the most profound and completely unknown properties of the World which can scarcely be envisaged by the bravest flight of human fancy.

N. A. Kozyrev

Время сближает нас с глубочайшими и совершенно неизвестными свойствами Мира, которые едва ли может предвидеть самый смелый полет человеческой мысли.

Н. А. Козырев

Йохансен С. **Общие соображения о теории Времени Козырева, связанные с последними достижениями в специализированных областях биологии, математической физики и философии информатики.** Высокооригинальная и важная исследовательская работа Николая Александровича Козырева нашла продолжение после его ухода из жизни (в 1983 году) в значимых исследованиях российских ученых, подтвердивших его основные теоретические и экспериментальные результаты, а также внесших некоторые дополнения и вариации. Ключевые теоретические идеи Козырева, касающиеся в первую очередь нетривиальных свойств Времени, получили дальнейшее подкрепление в свете последних достижений науки в областях, не зависимых от исследовательской школы Козырева. Статья сфокусирована на прорыве в специализированной области биологии (конхологии), совершенном Крисом Иллертом, а также на его теоретическом базисе в адронной математике и механике с Руггеро Мария Сантилли в роли одного из ведущих ученых. Констатируется поразительное соответствие между базовыми положениями теории Козырева и результатами, полученными в новых адронных научных исследованиях. Кратко отмечена аналогичная совместимость с другими новейшими фундаментальными теориями, выработанными на основе математической физики Питером Роуландсом (универсальная нильпотентная си-

[1] Публикуется в авторской редакции.

стема перезаписи), Гартмутом Мюллером (теория глобальной соизмеримости) и Матти Питкёненом (топологическая геометродинамика). Наконец, рассмотрена совместимость теории Козырева с последними достижениями дифференциальной философии информатики.

Делается заключительный вывод о том, что исследовательская работа Козырева обладает высокой степенью совместимости с другими амбициозными инициативами по достижению более высокой формы научного знания и что существует значительный потенциал для взаимообогащения указанных теорий с перспективой превращения их в более когерентное образование.

The highly original and important work by Nikolai Aleksandrovich Kozyrev has after his passing in 1983 been followed up with much significant research by Russian scientists, which has basically confirmed his basic theories and experimental results, as well as added some further developments and modifications. Key notions in Kozyrev's theories, especially with regard to non-trivial properties of Time, have also gained increasing support from recent scientific advances achieved independently of the Kozyrev tradition. The article focuses the break through in specialist biology (conchology) by Chris Illert, as well as its general underpinning in hadronic mathematics and mechanics with Ruggero Maria Santilli as the most prominent scientist. It is argued that there is a striking compatibility between basic notions in Kozyrev's theory and the results achieved in the new hadronic sciences. Also, a similar compatibility is shortly pointed out with other recent grand theories worked out from mathematical physics by Peter Rowlands (universal nilpotent rewrite system), Hartmut Muller (Global Scaling Theory) and Matti Pitkanen (topological geometrodynamics). Finally, Kozyrev compatibility with recent developments in differential philosophical informatics is also discussed. The overall conclusion is that the work of Kozyrev is highly compatible with other ambitious enterprises to establish a superior science, and that there is a significant potential for cross-fertilization between said theories into a more coherent cluster.

I. KOZYREV COMPATIBILITY WITH CONCHOLOGY AND THE TIME OF THE SEA SHELL

Chris Illert is the world leading expert in conchology, and succeeded in specialist studies during the 1980's and early 1990's to find a universal algorithm to explain the growth pattern of all known sea shells (Illert 1983, 1987, 1989, 1990a,b, 1992, 1993, 1995, 1995b). This modeling of sea shell growth was only possible by a primary description of the growth trajectory in a certain supra-Euclidean space, projected through geometric deformation into sea shell growth as it appears for human perception. The supra-Euclidean description of the growth trajectory required was not possible with traditional supra-Euclidean geometry, such as Riemannian or Minkowskian, but required

a more general geometry, which it is appropriate to name *hadronic geometry*. The mathematical physicist Ruggero Maria Santilli (IBR Ia) initiated the development of huge new classes of number fields with corresponding geometries and mathematical techniques, named *hadronic mathematics,* a scientific enterprise with revolutionary and already well established implications for physics as well as other disciplines. This development has now gone on for four decades and with a rising numbers of contributions from professional mathematicians. Hadronic mathematics encompasses, in progressive complexity, the new and more general fields of *isonumbers, genonumbers* and Santilli *hypernumbers,* with corresponding liftings of the totality of preceding mathematics, and with corresponding development of iso- , geno- and hypergeometries.

For a certain class of sea shells, namely sea shells with bifurcation, Illert proved that sea shell growth could only be understood by the acknowledgement of certain NON-TRIVIAL time categories presupposing hadronic mathematics and mechanics for a precise comprehension. For this class of shells, such nontrivial information flows in supra-Euclidean space is projected from isospacetime (and its asymmetric isodual spacetime) through deformation into the ordinary Euclidean time line, where these information flows manifest as forward and backward LEAPS in time.

For this discovery and break-through in theoretical biology, Illert in 1995 was honored by winning the *IBR International Prize for Biology*. In the announcement of the nomination it is stated that Illert established «the inapplicability of conventional geometries (such as the Euclidean, Minkowskian or Riemannian geometries) for quantitative representations of sea shells growth, thus providing the foundations for potentially historical advances in biology» (IBR Ib).

Illert has also made far-reaching contributions to nuclear physics, chemistry and linguistics. Due to inertia and inoptimal information flows in the global science ecology, these contributions are still not much known. However, in the *SPIE Milestone Series,* volume 15, «a reprint collection of outstanding papers from the world literature on optical and optoelectronic science, engineering, and technology» from last century (1900–1990), section one («Chirality and optical activity»), Illert was the only scientist honored by being represented with

more than one paper of the eight papers picked. Both of Illert's papers (1987, 1989) were dedicated to «formulation and solution of the classical sea shell problem» (Lakhtakia 1990).

Due to the importance of Illert's results in conchology for supporting basic notions of Kozyrev, especially with regard to the nature of Time, we will present Illert's extensive sea shell research in some detail.

Illert's contributions to conchology consist of many publications, but the most important and extensive is Illert and Santilli 1995 where Illert has written the first part (p. 1–112) named *Mathematical Representations of Sea Shells from Self-similiarity in Non-conservative Mechanics* (i.e. a mechanics more extended than quantum mechanics). Illert's representation reveals a UNIVERSAL algorithm (cf. eqs. 3.1 p. 72 and 3.2 p. 73, and equation 5 in Illert 1989:768) for sea shell growth, «from a solid empirical base encompassing 100.000 or so (living or extinct) molluscan shell varieties» (p. 4), more specifically «a unique second-order coupled differential equation (3.2) describing all of the several major categories of shell geometries found in the real world» (p. 101). The universal algorithm was tested against the most intricate and complex sea shell structures (among them *Nipponites mirabilis* — cf. p. 91) through extensive computer simulations, and with impressing empirical matching.

The most general assumption in Illert's systematic presentation — as in most theoretical mechanics — is the concept of energy (p. 3) and the principle of least action for energy flow to «dissipate stresses» during sea shell growth to resemble optimal tensile clocksprings» (p. 9). To reveal the hidden universal growth algorithm, Illert uses the principle of self-similarity (including scale-invariance) of growth — elaborated from Aristotle's notion of *gnomon*. (p. 27–64) from which Illert derives and explains «in a natural way» the self-similarity differential equations with two specified constraints (eqs. 2.41 and 2.42, p. 67), this leaving only two arbitrary constants which values Illert groups in different classes leading to various classes of clock-spring trajectories (p. 1 and p. 9) corresponding with the empirical variations of sea shell forms (p. 72–105).

In developing the equation for the universal growth algorithm, Illert discovered the necessity of moving — technically speaking — from a real to a complex Langrangian which requires a LIFTING from Euclid-

ean space to what is called ISO-EUCLIDEAN space in the modern iso-mathematic branch of mathematics (cf. p. 101). This was necessary because the two mentioned «critical constants, associated with trajectory "curvature" and "torsion" often have to be complex numbers» (p. 2). Iso-Euclidean space is a certain multidimensional complex space, in Illert's case basically with SIX dimensions. The concept of such space was NOT known before the initiation of iso-mathematics (Santilli 1988), and is not to be confused with trivial multidimensional modeling or with hyperdimensional geometry in general, dating back to Riemann in 1854. Iso-mathematics is a new and more extensive landscape of mathematics where ALL earlier known mathematical operations, supposing the number of 1 as the basic unit, is GENERALIZED and LIFTED to encompass ANY other unit which COINCIDES with the original basic unit, and at the same time has an ARBITRARY functional dependence on other variables. Hence, iso-mathematics rose from detrivializing and generalizing the conventional unit of mathematics.

This means that Illert's systematic examination revealed a highly non-trivial general result: that the hidden universal algorithm for sea shell growth could ONLY be discovered with the extension of 3D space to «at least five space-like and one time-like dimensions» (p. 2). This has far-reaching implications for an adequate understanding of the ontological architecture of space itself, degrading the ordinary 3D perception of space to a MANIFESTATION of a higher order (in the sense of David Bohm) of space organization. Some quotes from Illert in this regard: (In this article comments of mine are in brackets, and emphasizes of mine are in boldface.)

the growth-trajectory that we see (hereafter called a CLOCK-SPRING) is only the real part of a **more general** (–) *curve through a multi-dimensional space. Even the underlying physical principles (such as HOOKE'S LAW)* **only** *emerge coherently, and seem to make sense, within our full complex-space formalism* (–). *Real space <Euclidean 3D> just doesn't seem adequate. So are seashell geometries profound enough to tell us that we live in a world that doesn't quite* **make sense** *unless we assume that it has at least five space-like and one time-like dimensions?* (–) *Certainly, if we do take shell geometries seriously, our insights are all the more powerful because they emerge from totally* **classical,** *non-quantum, reasoning* (p. 2)

forms that are **different** *in normal* **Euclidean** *space may be* **unified** *in this more* **general** *geometry <i.e. isospace>.* **(–)** *We already* **know** *that shell growth trajectories are iso-euclidean, but, if we tried to force them into purely Euclidean space,* **they would wrinkle and the shells would crack or explode. (–)** *the iso-euclidean trajectory of* Nipponites mirabilis *starts out in a* **regular planar spiral** *before eventually becoming serpentine. But if we force it to exist in a more «Euclideanish» space* **(–)** *the whole curve* **meanders grossly** *from beginning to end, it is just like stuffing elastic piano-wire into a smaller box thereby forcing it to wrinkle more severely* (p. 101–102).

Illert classifies clocksprings in first and second kind, depending on if their representation requires first or second order discrete mathematics. Even quite simple sea shells, classified as clocksprings of the first kind, can have a growth trajectory where the imagined «wire» may pass through itself. Illert argues this to not represent any crucial difficulty since the «wire» is imagined as INFINITELY thin in his approach (cf. p. 82). (However, there exists ONE topological structure, the *diagonal woven Klein-bottle* discovered by Morgan (and further discussed by Purcell (2006), where the wire passes through itself in 3D WITHOUT being infinitely thin.) While sea shells with self-intersection as such may not be too big a deal in Illert's theory, there is a certain subclass of such shells that poses a huge and highly interesting challenge for the scientific understanding, namely the so-called BRANCHING clocksprings. I prefer to quote Illert at length here, because this may be a discovery in the history of science of uttermost importance for a more profound and extended understanding of the nature of time:

shells such as Yochelcionella, Rhaphaulus, Rhiostoma and Spiraculum *all utilize self-intersecting clockspring trajectories; actually* **BRANCHING at points of trajectory-intersection,** *there after growing* **simultaneously along** *two separate branches of the clockspring! Some shells branch during the* **earliest** *developmental stages (as in Yochelcionella daleki, a self-intersecting clockspring of the* **First** *Kind* **(–)***), whilst others (such as Janospira nodus, a self-intersecting clockspring of the* **Second** *Kind) wait almost till the* **end** *of ontogeny before branching. The palaeontologists who first studied these branching clockspring geometries described the shells as «curious», «ridiculous» «absurdities» but we can now see them as the*

same *optimale tensile spirals which other* **non-branching** *shells also utilize. And as trajectory-branching seems to occur widely, in* **unrelated** *species, the usual «once-off» biological explanations won't suffice... there is a deeper geometrical principle at work! (–) how can the trajectory at the branchpoint* **(–)** *be causally linked to the* **FUTURE** *ongoing pathway* **(–)**? *It seems as if Janospira, at the instant of branching,* **«knew» (ahead of time)** *about the existence and location of a future portion of the clockspring trajectory even though the outermost whorl had not, at the time of branching,* **actually** *looped about to (and indeed, never ultimately would)* **physically** *create the future intersection-point. We are talking here, about* **action with foreknowledge,** *action outside the expected linear Newtonian sequence, rather as if an impending future event acted* **BACKWARD** *THROUGH (future) TIME to influence the present* (p. 93–94).

Illert illustrates the issue with t he following vector-spiral diagram from his vector-equation for the clockspring trajectory (p. 95):

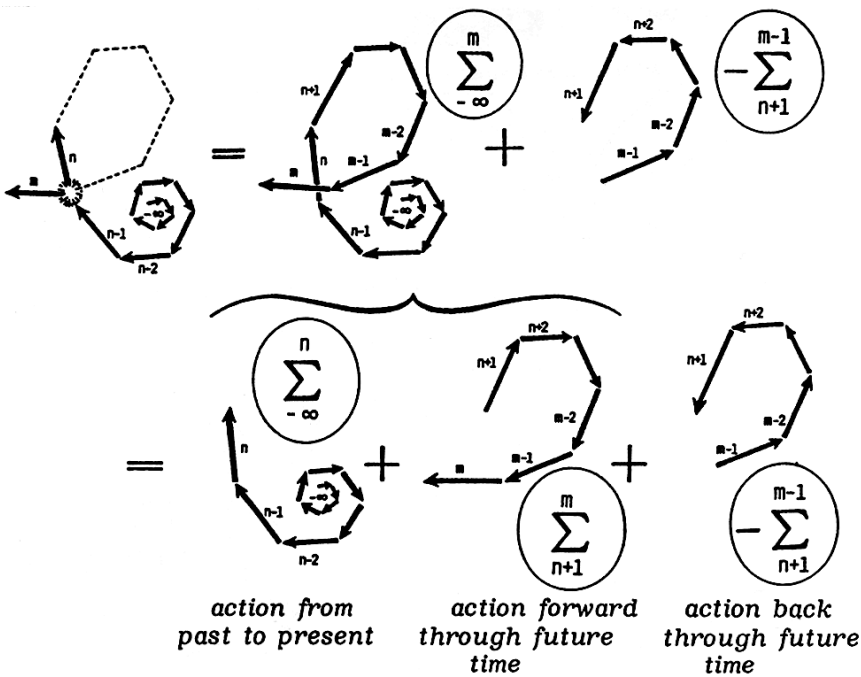

Fig. 1. (from Illert in Illert and Santilli 1995:95)

The universal algorithm with the adequate value of the two critical constants gives the growth trajectory for this sea shell INCLUDING the dotted part of the trajectory. The dotted trajectory is NOT manifested in the physical structure, but the PROLONGED trajectory (m) from the branching point CONTINUING this dotted and 3D-VIRTUAL trajectory is. Hence, the prolonged trajectory (m) can ONLY be discovered from assuming that the dotted part has a crucial HIDDEN reality, obviously because the universal algorithm has an even HIGHER reality. Also, for this to be the case, the hidden algorithm has to include a determination of the LENGTH in space (both in hyperspace and 3D space) and time (cf. later) of the hidden part, and by this also the exact LOCATION in space and time of the branching point.

Illert's interpretation in and of fig. 1 is to view the growth trajectory as a combined result of three different trajectory parts with three corresponding different categories of time:

1) Interval [-infinity, n] with ordinary time flow or «action from past to present». We may name it «PLAY» for a convenient video analogy.

2) Interval [n+1, m] with «action forward through future time», by Illert coined *Sheldrake propagator* after Rupert Sheldrake's notion of such a time category (1981). We may name it «FORWARD» for short.

3) Interval [n+1, m−1] with «action back through future time», by Illert coined *Gatlin propagator* after Lisa Gatlin's notion of time-reversed information flow (1980). We may name it «BACKWARD» for short.

The combined result is established in the succession from 1) to 2) to 3). 2) represents an addition to interval 1), while 3) represents a subtraction or deletion of and from interval 2) with the remaining exception of the «head» of 2): the new branch m anchored in the branching point.

2) and 3) represent highly non-trivial categories of time, and if Illert's theory is adequate, this of course must have crucial implications for ALL sciences. With regard to the non-triviality Illert writes:

The main thing to realize is that branching clocksprings arize naturally from the **same** *theory that describes* **all** *other known shell geometries, and that examples such as Janospira occur in Nature.*

To be **predicted** *by theory and* **observed** *in practice is a powerful* **metaphysical** *position: how one mentally reconciles the causal implications is a* **psychological** *problem* (p. 96).

The discovery of the universal growth algorithm was only possible by looking for it and formulating it in ISO-Euclidean space. However, the nature of isospace also has DIRECT and UNIVERSAL implications for the understanding of TIME, consistent with Illert's highly non-trivial results in the case of the sea shell branching phenomenon.

It is interesting to note that Illert himself argues that non-trivial Sheldrake and Gatlin propagators also are highly relevant for understanding of PARTICLES, and presents a case inside physics itself: *charged lepton decay and neutrino production* (p. 96–100), with the possibility of description from Illert's Langrangian antiparticles as well as particles, and with the possibility of charged particles to travel in clockspring trajectories which sometimes branch. Also, Illert argues the possibility of the muon-antineutrino existing OUTSIDE the normal time flow as a time-reversed electron-neutrino, and the muon as NOT pointlike Newtonian, but smeared over a region of space-time as a TEMPORAL version of Young's famous double-slit experiment.

Illert's conchology studies do not discuss any relation between mass changes and non-trivial time flows. However, others of his results are highly relevant with regard to Kozyrev's theory of time, such as:

1) Time exists in classes and modes that are FAR FROM TRIVIAL, and not recognized — or recognizable — by most physics.

2) Hidden or supra-Euclidean time categories have PRIMACY compared to Euclidean time to describe and explain the overall pattern of time flows with connected observable phenomena in Euclidean spacetime.

3) Supra-Euclidean time flows projected to Euclidean time is necessary for the manifestation of certain PHYSICALLY observable phenomena, including in BIOLOGICAL nature, and such time flows can include LEAPS as measured along the ordinary time line. This is consistent with the results of the astronomical observations by Lavrentiev et al. (1990a,b, 1991, 1992) documenting non-electromagnetic and highly non-trivial effects from stars on PHYSICAL sensors from positions of the stars in the PAST (corresponding to the visual positions we observe from receiving their light), their real positions in the PRES-

ENT (in the case of the sun also documented to effect BIOLOGICAL sensors), and their positions in the FUTURE (symmetrical to their past positions, measured across the axis of their present positions).

4) Supra-Euclidean time flows projected to Euclidean time are necessary for the manifestation of certain IRREVERSIBLE phenomena in biological nature, such as branching in sea shell growth. Notice that this case is an EMERGENT irreversible phenomenon, ADDING more complex order (branching compared to not-branching growth), contrary, or rather complementary, to the well documented Kozyrev irreversible «cause» deforming the «effect» to more entropy, sought explained by inflow of additional «Time energy». This irreversible anti-entropy effect is consistent with the effect from the present, non-visible position of the sun on biological sensors (growth of microorganism colonies) as documented by Lavrentiev et al.

5) The ordinary notion of causality between physical objects and states needs DETRIVIALIZATION and COMPLEXIFICATION, including comprehension of the influence of supra-Euclidean time flows on objects and events in Euclidean spacetime, to reconcile the paradoxes rising from the ordinary notion which considers time jumps impossible.

6) «TIME TRAVEL», backward as well as forward, is not any logical absurdity or any fanciful construct, but an undeniable and quite crucial aspect of the ordinary state of affairs in Nature's dynamic architecture, as illustrated by even a quite simple biological system as branching sea shells. Hence, there is nothing surrealistic to the idea of imitating Nature's time flow by means of adequate human technology, as illustrated by the time machine experiments already executed by Chernobrov (1996, 2001).

7) Conventional notions in physics concerning the topology of overall spacetime have restricted relevance due to shortcomings in ontological rigor and sophistication, while the topology of the KLEIN-BOTTLE may offer a crucial key.

Illert argued that the basic structure of space may be somewhat similar to the structure of a complex sea shell, which — when self-intersecting — is close to the suggestion of a Klein-bottle structure. Also, a certain class of sea shell analyzed by Illert was coined «Moebius conoids» because a set of allowable spire shapes is successively

ordered as an unfolding Moebius strip (1987:fig.9; 1990b: 1613, eq.1, figs. 1 and 3), and Illert has pointed out that «Moebius-ness is a telltale sign of Klein-bottle-ishness» (Illert 2007).

Profound significance of the Klein-bottle for topology and physics, as well as for other disciplines, has been increasingly acknowledged by scientists during the last generation (cf. Rosen 1988, 1994, 1995, 1996; Morgan I, Purcell 1998, 2006; and also Brodey I and Johansen 2000, 2004, 2006).

Moebius Band magnetic monopole devices as described by Shakhparonov (I) were developed from theoretical insights in Klein-bottle projection into physical 3D space having highly non-trivial implications for energy creation, flow and density.

The fundamental tenet of the causal mechanics developed by Kozyrev can be formulated as follows: There are two types of energy in the Universe. The positive or «right» energy acts as a factor of entropy increase. The negative, or «left» energy tends to decrease the entropy, i.e. acts as a factor, which regulates the entropy increase. The «right» energy is transformed to the «left» one and this fact may be interpreted as a course of time from the past to the future. When the energy is transformed from the «left» to the «right» form, time is reversed. Kozyrev supposed (–) *that through revolving of a body together with a coordinate system along a circumference the right coordinate system is transformed to the left one at the moment, when the body reaches the point situated at the opposite side of the diameter* (Shakhparonov I:275–276).

Moebius Band technology exploits the effects of knitting these two opposite points together by a Klein-bottle projection, «gluing» the two coordinate systems in revolved superposition.

From Illert's results the success of this recent and unorthodox technology inspired by Kozyrev's work does not appear so surprising.

II. KOZYREV COMPATIBILITY WITH THE SCIENTIFIC REVOLUTION OF PHYSICS INTO HADRONIC MECHANICS

The non-triviality of time flows in branching sea shells is argued by Illert to only be a single manifestation of a highly COMMON phenomenon in nature, a communality that can be argued DIRECTLY from

the very architecture of isospace (and its isodual — cf. later) and the related physics of hadronic mechanics. Illert's conchology represents a pioneering study in the history of science, being the first specialist scientific study with highly non-trivial results, including the nature of time, consistent with — and ONLY with — the extensions by hadronic mathematics from Euclidean spacetime to isospacetime and in physics from classical and quantum mechanics end Einstein relativity into hadronic mechanics. In this way Illert's results give crucial GENERAL support to hadronic mechanics and the underlying geometry as a more advanced and relevant physics to describe and explain nature.

As Illert states (p. 103), the iso-Euclidean geometry was discovered by Ruggero Maria Santilli (1988), and has during the last 20 years been further treated in rich detail by Santilli himself and various mathematicians. Let's examine closer the way Santilli connects to Illert's conchology, and the GENERAL significance of non-trivial time categories in hadronic mechanics and its underlying hadronic mathematics.

The most extensive text expressing Santilli's connection to conchology, is Santilli's contribution to Illert and Santilli 1995: *Part II: Representation of Sea Shells via Isotopic and Genotopic Geometries* (p. 112–183).

Santilli presents an ALTERNATIVE and ADDITIONAL argument to Illert's for the impossibility of a mathematical representation of the growth of (certain classes of) sea shells in Euclidean space (p. 112–115). Santilli's argument focuses on the restrictions embedded in the basic AXIOMS of Euclidean geometry, where the Langrangian is restricted by Euclidean SCALAR PRODUCTS and Euclidean DISTANCE, while the adequate Langrangian to represent sea shell growth requires a more «**generalized** notion of distance and, therefore, a generalized GEOMETRY» (p. 115).

The next question is WHAT generalization of geometry is needed. Could this be the well-known Riemann space or Minkowski space connected to the relativity theories? Santilli states that Minkowski space and relativistic space-time is excluded because the sea shell basically is AT REST (p. 112). But could a transition from 3D Euclidean to the more general 3D Riemann space hit the mark, to represent sea shell growth in a CURVED space? Santilli argues, with reference to Illert's diagram in fig. 1, that also this possibility is excluded because of the re-

lated insufficiency of the conventional notion of TIME to describe and explain the BRANCHING phenomenon, «because the «time arrow» in the transition from the Euclidean to the Riemannian geometry remains the same» (p. 116). Santilli writes:

In fact, the Euclidean geometry and «our» conventional notion of **time** *are manifestly* unable *to provide any representation of the behaviour in the* **neighborhood of branching points (–)**. *As a matter of fact, the Euclidean notions would imply clear inconsistencies, such as the prediction of an* acausal *behaviour which is against the physical evidence of the* consistent *growth of sea shells. The above occurrence establishes beyond scientific doubt that sea shells evolve in time in a way structurally more* **general** *than our own perception of time and, in particular, in a way capable of mastering* **both** *directions of time. In fact, the behaviour of sea shells at bifurcation is one specific example of what is commonly referred to as a* **space-time machine**, *that is, the capability of moving in both space and time in a* **causal** *way* (p. 115).

Hence, the non-trivial time categories connected to branching shells, are quite crucial in the argument for describing sea shell growth in a MORE general geometry than Riemann space or Minkowski space. The iso-Euclidean geometry provides such a geometry with the adequate generality.

«The main idea of the new geometry is the **generalization** *of the fundamental Euclidean* **units** *of space and time»* (p. 117). In general, isomathematics is constructed from a DETRIVIALIZATION of the unit, based on the discovery that all earlier mathematics was implicitly restricted by the silent assumption of the number of 1 having to be the basic unit. In the words of Peter Rowlands (who has developed a far-reaching supra-mathematics — or rather: unitary supra- and omniscience — coined *nilpotent universal rewrite system):* «The number of one is already **loaded**» (Rowlands 2003). This means that applying the number of 1 as the basic unit imposes connected mathematical restrictions that are removed when the choice of unit is made RELATIVE and ARBITRARY (compared to the original unit) with a corresponding LIFTING of ALL earlier mathematics to a more complex and generalized one. Such liftings are *isotopic,* i.e. PRESERVING the axioms of the original mathematics. When lifting Euclidean geometry to a

more general iso-Euclidean geometry, this involves the ALTERATION (called *deformation)* of a mathematical object described with isounits vs. with Eulidean units. The deformation is given by the space *isotopic element* (inverse of the isounit) and is included in the isogeometry which therefore is much more extended than the Euclidean geometry. Also, Riemannian geometry manifests as just a particular case of a much broader isogeometry (cf. p. 118).

With regard to geometry, the lifting from Euclidean to iso-Euclidean space includes a lifting of the trivial space unit diagonal (1,1,1) into a nowhere singular and Hermetian, 3x3 dimensional matrix with unrestricted functional dependence on any quantity (such as time, angle, hypersurface), and a joint lifting of the Euclidean metric in the inverse amount. In its most general possible realization this is the NON-diagonal form of the dimensional matrix.

(Iso-Euclidean geometry was introduced by Santilli 1988, with its basic foundations worked out for the classical level in the two volume monograph Santilli 1991 and for the operator — i.e. particle — level in the two volume monograph Santilli 1995 (first editions 1993–1994). In depth mathematical studies of the new manifolds underlying this geometry, coined *Tsagas manifolds,* were published in Tsagas 1993. For a short introduction to isomathematics, see Santilli 2001:59–80 and 2003b.)

Santilli demonstrates mathematically that:

the quantitative representations of sea shell growths achieved by Illert are indeed a **particular** *case of the isoeuclidean geometry. In fact, an inspection of the general Langrangian* (–) *Eq.* (1.36), *p. 25* (–) *indicate the particular case in which the* 3x3*-dimensional isotopic element* (–) **reduced** *to a* **one***-dimensional scalar function* (–). *The understanding is that* **more general realizations in three dimensions are possible** (p. 118–119).

This is an important conclusion, making it likely that biological growth WAY MORE COMPLEX than sea shells also can be described and explained from iso-Euclidean geometry with LESS reductive iso-Langrangians than what was sufficient for Illert to crack the code for sea shell growth.

In iso-Euclidean geometry the universal algorithm for sea shell growth corresponds to a perfect SPHERE in isospace. Santilli proves mathematically that:

all *possible compact and noncompact quadrics in Euclidean space (including sphere, ellipsoids and paraboloids) are* **unified** *by the isoeuclidean geometry in the* **covering** *notion of* **isosphere. (–)** *In fact, the isoeuclidean geometry indicates that the shape in which a sea shell* **appears** *to us, despite its complexity, can indeed be a perfect sphere in its own isospace. In fact, the* **deformation** *of the perfect sphere into the most general possible shape in the* **conventional** *space* **(–)** *<its formula is presented> implies the* **reduction of all** *infinitely possible shapes of sea shells to only* **one** *shape, the* **perfect** *sphere in* **isospace (–)**. *The differentiation between one shape and another is then given by* **different isounits** (p. 120—121).

In fig. 3 (p. 122) Santilli shows geometrical illustrations of such differentiation from the unitary isosphere. To DISCOVER the possible reduction to a unitary isosphere, the isounit must be given the adequate («suitable») generalization of the unit (p. 123). Appendix B (p. 170–175) presents the basics for the exact procedure in such a reduction. Santilli also gives different demonstrations of the reduction, presenting the exact equations for proving that hyperbolic clocksprings of both first and second kind reduces to a perfect CIRCLE in the iso-Euclidean plane, and that *Nipponites* reduces to a perfect SPHERE in isospace (p. 156–157).

In general, isogeometry offers powerful mathematical methods for reducing different geometric forms or relations which APPEAR unconnected in 3D to a UNITARY CONNECTION in ISOSPACE by LIFTING well-known structures from 3D geometry to a CORRESPONDING higher and broader structure in isospace. An illustration can be the isotopic lifting of the Pythagorean Theorem (p. 165). In isospace all such triangles are right triangles, but right isotriangles manifest in 3D as right triangles as only a special case; in most cases a right isotriangle is DEFORMED to a triangle with CURVED sides in the projection into Euclidean space. Further, ALL possible curved sides can be reduced to a right isotriangle (with 180 degrees sum of angles) by means of adequate isounits. This also illustrates that many geometrical structures that appeared too irregular in 3D to be within reach for pre-Santilli mathematics, can be represented adequately by adequate quite simple isostructures. In general, this is a strong indication that reality holds an overall ontological architecture where the observable

multitude of 3D biological forms is ANCHORED in isospace (or above) and manifested by a projection from there by surprisingly simple algorithms.

With regard to the more general ontological point, the following remarks by Santilli are highly interesting:

In different terms, in holding a sea shell in our hands, the limited capabilities of our three Eustachian tubes give us the **impression** *that it lives in our three-dimensional Euclidean space, while in* **reality** *the sea shell lives in a structurally* **more general** *space* (p. 114).

The shapes <of sea shells> as we see them with our senses occur only when they are **projected** *in our space* (p. 123).

Consistent with this, Santilli notes that the SIZE of a sea shell measured by us is the PROJECTION from its size in isospace («the sea shell in its own space»), and this isosize can be smaller or bigger depending on the space isounit (p. 121).

However, compared with the significant implications of the lifting from space to isospace, Santilli states that «the implication of the corresponding lifting of **time** is even **more** intriguing and far reaching» (p. 121).

In this lifting, the one-dimensional Euclidean time is lifted into the still ONE-dimensional iso-Euclidean time. However, the mathematical structure in this lifting to the field of isotime admits units of isotime with an ARBITRARY quantity compared to the time unit in Euclidean space, hence including NEGATIVE quantities (p. 121).

In fact, while ordinary time has **only** *the flow forward, isotime can* **arbitrarily** *flow forward* **or** *backward depending on the* **sign** *of its unit* (p. 121).

What is the meaning of the concept «arbitrarily» here, connected to the technical meaning given by Santilli's mathematical expressions (1.20 and 1.21, p. 121)? A popular shorthand to define isonumbers is «"numbers with an **arbitrarily generalized** but **fixed** unit" from which the notion of isospace (–) are derived» (p. 127). Hence, there is a twofold relation here: Any choice of isounit is FIXED (for ALL further isomathematical considerations based on THIS isounit) and REQUIRED to construct ANY isonumber. On the other hand it is possible to choose for such a fixation ANY isounit inside the framework of the

mathematical field, and as such the isounit is characterized as arbitrary. Different from in pre-hadronic mechanics, the choice of (iso-) unit for a specific scientific purpose will have rich IMPLICATIONS for the descriptive and explaining power of the mathematical representation based on the unit. Some choices are way more ADEQUATE than others. This is not the case in ordinary physics, where the choice of unit is considered just a trivial question of standard convention, without any implications for the mathematical structure, because the unit does not play any INTEGRATIVE ROLE in pre-Santilli mathematics, but is EXCLUDED from the mathematics. (This indicates a significant change in the very relation between mathematics and physics, a relation that becomes much more INTIMATE after the invention of iso-mathematics. Quite obviously, this change has non-trivial implications for a scientifically compatible ONTOLOGY.) To pick ADEQUATE isounits, one has to understand the structural relation between isospace and Euclidean space and compare the implications of the picked isounits with observable empirical patterns. This was exactly what Illert's conchology study succeeded in doing, with astonishing empirical matching.

With regard to the question of «arbitrarily», it is also important to notice that isomathematics from its very structure does not give any preference for use of positive isounits compared to negative isounits; these are in principal and on the generalized level considered on an equal footing. Therefore, the same holds also for isospace and for isotime. Nor is there anything in the general mathematical structure of the RELATION between isospace and Euclidean space that gives any preference for use of positive isounits compared to negative isounits to reach an adequate mapping (from bottom-up reduction and top-down projection) of this relation. (This abstract mathematical indifference in itself gives support to the connected COSMOLOGY of hadronic mechanics, arguing a non-trivial co-existence of the matter universe with an ANTIMATTER universe with OPPOSITE signs, observed from our matter universe, of its physical units which implicates the NECESSITY of negative isounits — cf. later.) Because the isomathematical structure admits and opens up for existence of negative isounits as well as positive ones, it would be somewhat surprising if only positive ones were adequate for scientific descriptions and explanations of empirical patterns. And the study of Illert DEMONSTRATED the

adequacy of negative ones with regard to isotime, NECESSARY to describe the growth trajectories of bifurcating sea shells. This discovery was not only ADMITTED by the lifting to isospace, but a quite natural EXPECTATION from the very structure of isomathematics.

In the same way as it occurs for spheres and isospheres, **time and isotime coincide at the abstract level.** *In particular, our* **ordinary** *time t remains completely* **unchanged,** *because all changes occur in the* **unit** *of time* (p. 121–123).

This means that ordinary time still is INCLUDED and OVERLAPPED in the PROJECTION from isotime, and further that the conventional unit of ordinary time can be LIFTED to a corresponding isounit.

Isogeometry includes the quite revolutionary notion of *isoduality* (introduced by Santilli 1985) which implicates that isospace only can exist in co-existence with a new kind of space named *isodual isospace* which can be considered as a space that exists in complementary opposition to isospace, more like a «shadow» or a «twin». Isospace and its dual exist on an EQUAL footing in the ontology embedded in isogeometry, where the shadow of one twin is the other twin. The fixation of who is the shadow and who is not, is an arbitrary choice on the isospace level, just like it does not matter for the study of the complementarity between right and left hand what hand the description of the relation starts with. However, for the twin this equal footing may not be IMMEDIATELY obvious, because of his PRIMARY location in himself, not in his brother (the shadow space), and not in their unitary «twinness» (the upper bird eye view).

This is important for the understanding of TIME INVERSION connected to isotime, as something quite different from the ORDINARY notion of time reversal as a mapping of forward (positive) time into backward (negative) time in the SAME EUCLIDEAN space. In isogeometry time inversion is defined by isoduality as the novel antiautomorphic map transforming the sign for the isotime unit in isospace to the OPPOSITE sign for the isodual time unit in isodual isospace. For ALL physical units the sign of isospace transforms to the opposite sign in its isodual, and time is of course no exception. This means that ordinary positive time in our Euclidean space is reconstructed with a POSITIVE sign projected from ISO-TIME (because the arbitrary isounit by

convention has been CHOSEN and FIXATED with the sign to ensure this). However, ordinary positive times comes out with a NEGATIVE sign interpreted (as an IMAGINARY projection) from ISODUAL time. The reason for this is that the isodual unit automatically is derived with the OPPOSITE sign of the fixated isounit. Plainly mirroring this, positive time projected from isodual time, comes out with a negative sign interpreted from isotime. Since isospace and isodual space are considered on an equal footing, time flow in Euclidean space has to be regarded as a COMPOSITE result of projections from isotime and from isodual time, hence also involving NEGATIVE time (interpreted from isospace, but positive observed from isodual space). The new notion of time inversion can not be understood as an inversion from one time direction to its opposite in the same Euclidean space, because the two time directions have DIFFERENT and INDEPENDENT sources in a certain HYPERSPACE, respectively in isospace and isodual isospace.

The time flow observed in our 3D space must be understood from an UPPER framework COMBINING BOTH isotime and its isodual time. And from this upper framework we are able to understand that a combination of forward and backward time must be explained and adequately described from having their out spring or anchoring in DIFFERENT (but mirrored) (hyper-)spaces, i.e. in isotime and isodual time. Hence the coexistence of forward and backward time, and the transformation between them (conventional time reversal), can NEITHER be understood from the restricted framework of our 3D space NOR from the less restricted framework of isospace WITHOUT its isodual. Such a restriction will with NECESSITY give the APPEARANCE of a way too SHALLOW distinction between forward and backward time. And at the same time the necessity of such an illusion can be understood from the UPPER framework, and ONLY from that.

There is not any hidden CONVENTIONAL 3D space (or time) due to the existence of isodual space, but the ANCHORING of one part of 3D space (and time) in NON-CONVENTIONAL isodual space is hidden. We can only observe its manifestation in conventional space and in a way that BLURS the crucial distinction between this manifestation and the other familiar observables manifested from isospace.

This means that the multidimensionality implied in the ontology of hadronic mechanics has a specific architecture quite different from

other theories of multidimensionality in physics. The theory is highly non-trivial on the abstract levels, but highly familiar on the observable level. Some crucial quotes from Santilli 2006 in this regard: *this identity is at the foundation of the perception that antipar-ticles "appear" to exist in our space, while in reality they belong to a structurally* **different** *space* **coexisting within** *our own, thus setting the foundations of a "multidimensional universe" coexisting in the same space of our sensory perception* (Santilli 2006:94).

The above isodual equations indicate the **multidimensional** *character of nature, not in the popular sense of increasing the dimension of the basic Euclidean space, but rather in the* **hyper** *dimensional sense that* **different 3D** *spaces* **coexisting one inside the other** (**–**) *extended antiparticles do not exist in the iso-Eucledian space, but rather in their* **own isodual** *iso-Eucledian space that is physically* **distinct** *from the former... Note again that classical antiparticles move* **backward** *in time, although this time referred to the* **isotime** (Santilli 2001:166).

Another possible difficulty is to understand how we can determine that backward (vs. forward) time really is anchored in isodual time and not in isotime, since the technicalities of isotime also seem to include the possibility of a projection into Euclidean space resulting in NEGATIVE time. A further inspection will clarify that this IS possible, but it is not the SAME TYPE of backward time relevant to describe and explain sea shell growth. The condense presentation by Santilli 2001:101–3 gives the basics to sort this out.

Here Santilli states that isomathematics involves «**two different** conjugations, one for the map of the **future into the past** and the other for the map of motion **forward into the backward**» (Santilli 2006:101). Isounits are per definition always POSITIVE and definite, defined over real numbers, complex numbers and quaternions, while isodual isounits always are NEGATIVE and definite over the same field.

The combination of the two conjugations gives a classification into the four non-trivial time categories deduced from isogeometry (cf. Santilli 2001:102):

I. *ISOTIME,* with the discovery of the new category of *forward in future time*. If the isotime unit is +1, this corresponds with conven-

tional time in the Euclidean projection; if it is smaller than 1, we get the isotime unit for time flows FASTER than conventional time; and if it is bigger than 1, we get the isotime unit for time flows SLOWER than conventional time. The size of the isotime unit depends on the isotopic scalar function (expression 1.20, p. 121).

II. *INVERSE ISOTIME,* with the discovery of the new category of *backward in past time*. This implies the SAME isotime unit as I. Technically, this time category represents a multiplication of the same unit to the left (vs. right for time category I) in the so-called *isoproduct* (cf. Santilli 2001, chapters 2.9 and 3.2 for the theoretical background for this symmetry in the so-called Lie—Santilli theory).

III. *ISODUAL ISOTIME,* with the discovery of the new category *of forward in past time*. With regard to the unit, the same holds here as for I, but with the crucial difference of the unit being negative.

IV. *INVERSE ISODUAL ISOTIME,* with the discovery of the new category of *backward in future time*. With regard to the unit, the same holds here as for II, but with the crucial difference of the unit being negative. Also, the unit relation between I and II is the same as between III and IV.

From this systematic classification it becomes clear that the two non-trivial time categories involved in sea shell branching growth are I and IV, forward in future and backward in past, the first one from isotime and the second from isodual isotime. We notice the theoretical existence of category II for backward time flow, NOT anchored in isodual isotime. But this category is NOT involved in sea shell branching, because the relevant backward time for branching operates in FUTURE time (constituted by I), not in PAST time. There is no other way than the specific combination of I and IV to combine some of the four categories to yield the resulting growth trajectory of branching. Therefore, we can determine with certainty that backward time involved in sea shell branching is NOT explainable from only the notion of isotime and isospacetime, but REQUIRES the addition of isodual isotime and isodual isospacetime. Backward time flow ALONE is not enough to require this; the SPECIFIC TYPE of backward time flow represented by IV is necessary.

This specifies Illert's *Gatlin propagator* to be anchored in isoDUAL spacetime, NOT in isospacetime.

Illert writes, after having stated the formula for the iso-unit for all associative products from the relevant Langrangian in isospace:

but this exponential can equivalently be **negative***-definite thereby defining an* **isodual** *universe wherein time evolves* **backward,** *and energy is* **negative** *definite. Thus our discovery of action backward and forward through time at branchpoints, constitutes the* **first manifestation** *of* **isodual** *isogeometries ever seen in nature. The* **necessity** *for motion backward in time is precisely the geometric* **isoduality** (p. 102).

The notion of isodual spacetime is highly non-trivial, because it presupposes not only the existence of a hidden, higher order (in the sense of Bohm) of spacetime projecting our conventional space-time, but also the co-existence of a basically INVERTED and even more hidden higher order where the conventional relations of nature is upside-down (regarded from our framework), and at the same time co-MANIFESTING in our ordinary spacetime together with the not-inverted higher order. (However, it may be of interest that some related notions do exist in archaic and esoteric sources, such as the «twin king universe».)

In spite of this non-triviality isoduality is the NECESSARY COSMOLOGY embedded in hadronic mechanics. The comprehensive connections here are presented in a condense format in Santilli's book *Isodual Theory of Antimatter with Applications to Antigravity, Grand Unification and Cosmology* (2006). It is interesting to note that the invention of isodual numbers was not made inside pure mathematics, but emerged from the search for mathematical tools to describe and solve some theoretical problems in particle physics. Therefore, it may seem surprising that the discipline of biology, not physics, delivered the first empirical study offering crucial support to the notion of isoduality embedded in hadronic mechanics, and by this also to the isodual theory of ANTIMATTER and the far-reaching implications from this revolutionary theory. Illert's results gave significant credibility to isomathematics and isodual mathematics not constituting mathematical toy universes, but necessary to «hit the mark» (as Bohm used to say) of a hidden key structure in the very architecture of reality. This credibility was enhanced by many other scientific findings, shortly overviewed in Santilli 2006:228–252, chapter 3.7: *Experimental verifications and industrial applications of hadronic mechanics*.

Illert's results also inspired Santilli's discoveries of the so-called *Causal Time Machine* and the *Causal Spacetime Machine* worked out from the paradigmatic framework of the isoselfdual theory of antimatter:

In fact, the behaviour of sea shells at bifurcation is one **specific** *example of what is commonly referred to as a* **space-time machine,** *that is the capability of moving in* **both** *space and time in a* **causal** *way* (p. 115).

Also, the generalization of the unit of time has the further **direct** *consequence of implying a fully* **causal,** *theoretical prediction of the* **space-time machine** <Deutch 1991, Li 1993 and Santilli 1994a and 1994b> **(–),** *that is, the capability for an elementary particle of performing a* **closed loop** *in the forward time-like cone under a certain combination of fields due to matter* **and antimatter. (–)** *this author patterned the space-time machine* **(–)** *along the time* **behaviour of sea shells** *at bifurcation of sea shells studied by Illert* **(–)** <Santilli 1994a and 1994b>. *In fact, for all practical purposes, there is* **no technical difference** *between* **a particle** *traveling backward and then forward in time and the evolution of a* **sea shell** *at bifurcation* (p. 124).

In isoselfdual states, which are BOUND STATES of matter and antimatter (for example particles and antiparticles), the theory of hadronic mechanics shows the potential for moving forward and backward in Euclidean time without violating the principle of causality, because the time arrows of the matter field (with gravitation) and the antimatter field (with antigravitation) are opposite of each other (in a combined description). This is NOT possible for matter or antimatter states alone, only the «amphibian» nature of the bound state makes it possible to move between and inside both fields.

The simplest form of time travel is given by the bound state switching from being immersed in the matter field into being immersed in the antimatter field and thereafter switching back to immersion in the matter field. This defines the *causal time machine,* which is a THEORETICAL concept, consistent with hadronic mechanics, not with necessity implying a TECHNOLOGICAL machine. Different from most theories of time travel in physics, ridden with paradoxes and inconsistencies, this theoretical machine achieves a closed loop between the two opposing spacetimes at the CLASSICAL level, which was only possible

with the invention of new mathematical domains covered by isogeometry and isodual geometry and with the accompanying addition of a complementary antimatter universe in physics.

If we add motion in space to the motion in time, we proceed from the causal time machine to the *causal spacetime machine*. Here the motion in space is not Newtonian propulsion, based on action and reaction, but ISOGEOMETRIC propulsion, covering distances via local DEFORMATIONS of Euclidean geometry WITHOUT use of action and reaction. The general equation for such geometric propulsion (Santilli 2006:282, equation 4.3.7), implies JOINT existence of space and time mutations, by the way inversely proportional to each other. (For an introduction to antigravity and the theories of causal time machines and causal spacetime machines from hadronic mechanics, see Santilli 1999b and Santilli 2006, 4.3: 273–288. For a broader treatment, see Santilli Ib.)

In general, theoretical difficulties with combining the notion of causality with time travel, sometimes leading to absurdist claims of time travel transcending the causality principle, is due to scientific and philosophical confusion concerning the conceptual and categorical logic of the causality nexus, and due to primitive and inadequate ontologies FRAMING and ANCHORING this logic. Supported by supra-Euclidean isogeometry hadronic mechanics has been able to work out ontology for physics and biology sufficiently differentiated and coherent to stay clear of many such difficulties stemming from more Flatland type problem formulations. If there are only one or just a few roads on your map, it is not possible to understand that the territory can have much traffic without collisions.

From the scientific development of the theoretical concepts of causal time and spacetime machines, presupposing the general development of hadronic mechanics, the question of TECHNOLOGICAL constructions of such machines, and their empirical existence, can be approached in a sober and pragmatic scientific way. Much due to ignorance of relevant advanced physics, there is still much basic confusion in the scientific field popularly termed «UFO phenomena» — a notion with many connotations carrying emotional load and memetic noise. However, it is a matter of fact that already in 1995 Santilli wrote an article to clarify the issue from the FOREFRONT of physics. A quote from the abstract:

these advances (–) *permit the initiation of rigorous, quantitative, mathematical, theoretical, or experimental studies of the phenomena, such as:*

– *New theoretical models on the elimination of inertia* (a prerequisite to do sharp turns) *which are computerizable, by therefore permitting a visual verification,* <this was *a sine qua non* for Illert's computer modelling of sea shell growth from isostructures>;

– *Novel geometries for the socalled «space-time machines» which have now reached a maturity suitable for the initiation of systematic experimental verifications;*

– *New experimental measures which can establish the past presence of an alien vessel in a given landing site beyond any scientific doubt; and others*. (Santilli Ia).

Consistent with the potensated transdisciplinary relevance the new advances in mathematics related to hadronic mechanics do not only include isomathematics and isodual mathematics, but also huge new mathematical fields capable for description and analysis of way more complex systems of nature than most structures in the conventional scientific object of physics. These fields are coined *geno-mathematics and hyperstructural mathematics,* each also with corresponding isodual mathematics. Compared to isomathematics with its isodual, both these fields have crucial ADDITIONAL relevance for the understanding of TIME in biology, as well as in the universe as a whole.

In general isofields are included in genofields, and genofields are included in hyperfields, consistent with increasing degree of complexity in the respective mathematics and with the accompanying successive broadening of related mathematical axioms. It follows from this chain of inclusion that isogeometry is included in genogeometry which is included in hypergeometry. From pragmatic scientific economy of thought, the adequate approach to analyze a complex phenomenon of nature, such as sea shell growth, is to climb this hierarchical ladder in steps: first, analyze as much as possible from isogeometry; second, add as much as possible of the remaining from genogeometry; third, complete the analysis — if still necessary — from hypergeometry (cf. p. 128).

Genogeometry (also called «genoeuclidean geometry») is constructed via genotopies which do NOT (different from isogeometry) preserve the conventional geometrical axioms, but admit such axioms as only a

particular case of more generalized axioms. While isogeometry geometrize REVERSIBLE time evolutions, this is only a special case of the more general genogeometry which geometrize IRREVERSIBLE time evolutions. (Technically this difference is due to the difference between a hermitean and non-hermitean basic unit.) Therefore, genogeometry is required for a FULL treatment of non-conservative systems of nature, such as sea shell growth. Isogeometry delivers the possibility of the four non-trivial time categories (and can also be MADE to represent irreversible processes via the ADDITION of a certain explicit time dependence), but in genogeometry these four time categories fall organically and quite immediately out of the axioms as four classes of possible time directions, all being with necessity IRREVERSIBLE. In geometry the four categories are coined *forward time genounit* (I), *backward time genounit* (II), *isodual forward time genounit* (III) and *isodual backward genounit* (IV) (cf. p. 124–127). In general, genogeometry is adequate to study biological systems because such systems are that complex that they are characterized by INTRINSIC IRREVERSIBILITY.

Hypergeometry (as introduced by Santilli from hyperstructural mathematics, not to be confused with for example the hypermathematics of Charles Muses) was developed from generalizing genogeometry by means of hypernumbers which can be defined by a popular shorthand as numbers with a FAMILY of generalized units. In hyperstructures quantities can acquire a finite or infinite family of values, with the capability of representing even more complex biological structures than sea shell growth (cf. p. 127–128). (For a monograph on such hypergeometry, see Vougiouklis 1993. For an introduction to the whole field of iso-, geno- and hypermathematics and their applications in physics, chemistry and technology, see Santilli 2001, 2002, 2003a,b, 2006.)

Different from pre-Santilli hyperstructures, Santilli's hypermathematics is general and broad enough to be able to verify the following five specified conditions required for "the achievement of a representation of the complexity of biological systems via the *most general possible mathematics*":

(1) is structurally **irreversible (–)**;

(2) can represent **deformations;**

(3) is **invariant** under time evolution;

(4) is **multi-dimensional;** and, **last but not least;**

(5) is **compatible** with our sensory **perception.**

(Santilli 2006: 226).

With regard to time, this extension of mathematics also implies that the four listed non-trivial time categories emerging BEFORE the addition of geno- and hypergeometry do not exhaust ALL non-trivial time categories:

we have **four additional genotimes,** *in which the time genounit can assume* **complex or quaternionic** *values, and* **four further hypertimes,** *in which the time hyperunit is given by an ordered set of generally complex or quaternionic values* (Santilli 2001:103).

Technically, the second map conjugation, connected to isoduality, requires a NONHERMETIAN genounit which as a one-dimensional scalar is a COMPLEX function. Janussis (1990) worked out a notion of genotime with a certain COMPLEX quantity as genounit (p. 126). Santilli comments Janussis' notion as the «simplest and most effective realization» of genotime, and adds:

Janussis' <1990> notion of complex time is a quantitative mathematical representation of the notion of **absolute time in ancient Greek philosophy.** *This illustrates (–) that there may exist a very large difference between our* **perception** *of the evolution of sea shells in time, and that actually* **occurring** *in the reality* (p. 127).

This indicates, probably surprising for some, that the non-trivial time categories discovered from the modern science of hadronic mechanics is not so unfamiliar when moving (forward) back to the ontology of some ANCIENT thinking.

For an even fuller understanding of sea shell growth, Santilli claims (Santilli 2001:103) that also HYPERgeometry and HYPER-TIME must be applied. His argument here has far-reaching ontological and philosophical implications, so we quote it at some length:

We recalled in Chapter 1, Fig. 1.6 <from Illert's study>*, that the correct representation of the* growth in time *of sea shells requires the* **doubling** *of the three Euclidean coordinates.*

The necessity of hypermathematics is due to the fact that, via our three Eustachian tubes, we **perceive** *the growth of sea shells as occurring in a* **conventional** three-dimensional space. *The* **only** *known* **reconciliation** *of the three-dimensionality of our sensory perception with the doubling of the references axis is that permit-*

ted by **hypermathematics,** *thanks to its* **abstract** *identity with the conventional mathematics.*

More particularly, the hypereuclidean space **coincides** *with the conventional Euclidean spaced at the abstract level. Therefore, our sensory perception of a 3x 2 dimensional hyper-representation of sea shells growth is fully three-dimensional for our sensory perception. In other words, the representation space of Fig. 1.6 is* **not six dimensional.** *It is instead* **three-dimensional multivalued** (Santilli 2001:98).

The mathematics needed for the description of sea shells growth in time is hypermathematics. Consequently, the **sole** *applicable notion of time is* **hypertime with a double multivalued structure in their four different realizations** (Santilli 2001:103).

S. Johansen (2007a) presents some analysis and discussion of Santilli's theory of hypergeometry and hypertime, with some further qualification and slight modification, as well as a theoretic extension of this theory from hadronic biology onto MENTAL SPACE (including dream space) to work out some relevant basics to initiate HADRONIC PSYCHOLOGY.

Today the total scientific body of hadronic mechanics appears as an extraordinary coherent and quite extensive scientific library, indicated by a bibliography from year 2005 listing 731 entries of main publications in the field (IBR Ic). The rise and maturing of hadronic mechanics happened in tandem with the development of hadronic mathematics initated in 1967, branching out to pioneering hadronic biology (Illert, Trell) from the mid-1990's, and quite massively to hadronic chemistry with related new technology from 1998 (Santilli 1998a, 1998b, 1999a, 2001, 2002, 2004), and recently also with some germination into philosophy (Johansen 2006) and the humanities (Johansen 2007a). Hadronic mechanics shows all the classic properties of a scientific revolution analyzed by Thomas Kuhn. Quite anomalous for such revolutions during the history of science, zero of the advances by hadronic science had, to this author's knowledge, been tried disputed by ANY antagonistic publication in scientific journals for the preceding 40 years, until a quite remarkable recent event. (*International Journal of Hydrogen Energy* published in its June 2007 issue a three pages curious critique of an article by Santilli published in an earlier issue. The critique claimed somewhat absurdistic

the 1998 discovery of and explanation of the new chemical species of «magnecules» from hadronic chemistry to be «pseudo-scientific», while at the same time revealing a wrong understanding of the very concept of the species, as well as lack of elementary knowledge about hadronic chemistry. In a later issue the journal published two anti-critiques of Calo's article, one by the physicist Kadeisvili and one — with much chemical detail — by the chemist Cloonan.

It is obvious from our presentation above that the rise of hadronic mechanics, highly confirmed by experiments, discoveries and new technology, amplifies the mentioned relevance and support to key notions in Kozyrev's theory given from Illert's conchology study. Therefore, such support is given both from highly advanced and mature mathematical physics as well as from an outstanding empirical specialist study, both independent of the Kozyrev tradition of Russian science. With regard to Kozyrev compatibility and support, it may be useful to emphasize a few further points:

Hadronic mechanics has lifted physics to a level able to include descriptions and explanations of IRREVERSIBLE processes of nature, obviously crucial for progresses in chemistry and even more in biology, and hence established a unitary theoretical umbrella for physics and other sciences. Quantum mechanics was restricted by the basic symmetry, and according reversibility, in its underpinning mathematical axioms. The expansion of mathematics by the axioms constituting genomathematics has removed this restriction, in the most general way mathematically possible, degrading reversibility to just a special case being most relevant for simple systems. At the same time this lifting and expansion does not imply a uni-directive time arrow for the OVERALL irreversible system, due to the addition of new and non-trivial categories of time and time flows revealed by genomechanics as implied in irreversible systems. This reconciles the paradox of quantum mechanics on one hand appearing as restricted by not having much to offer to explain more complex and irreversible systems, while at the same time at first glance as more advanced by allowing reversal of the time arrow. The trick is to understand irreversibility as the MORE general and broader category and comprehend reversibility as a secondary and subordinate category from there. This is in line with Kozyrev's position comprehending time reversibility from basic time irreversibility.

Korotaev et al., noticing the contradiction between time reversibility of conventional theory of physics and irreversibility of the real world, have acknowledged this resemblance between the two revolutionary theories: «Hadronic mechanics answers to this challenge. Somewhat the similar answer had been suggested by N.A. Kozyrev in the framework of causal mechanics». (Korotaev et al. 2006:680, by the way an article achieving remarkably accurate (simulated) predictions of solar and geomagnetic activities from a quite simple «pragmatic forecasting algorithm». This impressing as well as important result illustrates the specific fertility of a Kozyrev-informed approach to explain MACROscopic nonlocality effects, as well as the general necessity of working from physics theory sufficiently advanced to have a basic irreversible structure to explain complex and non-trivial phenomena.)

Further, different from quantum mechanics hadronic mechanics by the means of isomathematics was able to describe EXTENDED objects, BOTH on the classical level and the operator level, hence leaving behind quantum mechanics' restrictive assumption of point-particles that proved impotent to calculate the strong interaction, due to the difficulties with the non-linearities between the assumed point-like baryon quarks. Also, isomathematics could describe DEFORMATIONS of extended objects at both classical and operator level, and this even more so for genomathematics to describe IRREVERSIBEL deformations. In its physical interpretation this corresponded to recognition of iso- and genospaces being for real and crucial to understand such deformations. This is in accordance with Kozyrev's notion of time and energy exchanges with an «unknown World».

Finally, hadronic mechanics, equipped with isodual mathematics, made possible recognition of ANTIMATTER as existing on an equal footing with matter, due to Euclidean space being constituted from a combination of matter and antimatter universe in an overall nilbalance between positive and negative mass, energy and time. This is in accordance with key notions in the Kozyrev school. Of special interest is the isoselfdual bound states of hadronic mechanics made up by combinations of matter and anti-matter, as also claimed by some Kozyrev scientists. According to hadronic mechanics such bound states opens the possibility for causal time machines as well as causal space time machines. The last machine also moves in space, by isogeometric pro-

pulsion, covering distances via local deformations of Euclidean geometry without use of action and reaction. This implies a joint and inversely proportional existence of space and time mutations. (Santilli 2006:282, eq. 4.3.7 presents the general equation for such geometric propulsion.) This is in accordance with the possibility argued by Kozyrev (Ib: *The Way to Space* 1969) for developing antigravitational space technology with connected time deformations to progress from bulky rocket technology. With regard to biology it may be of interest to note that Santilli states that such a quasi-ordinary phenomenon as the upwards flow of sap in trees requires a non-Newtonian geometric propulsion «caused via the alteration of the local geometry without any external applied force» (Santilli 2006: 228).

Hadronic mechanics and genomathematics seem to provide most mathematical and physical tools required for the further development of more theoretically rigorous Kozyrev-inspired science. Therefore, it is more worthwhile to clarify compatibility and promote synergy between Kozyrev and hadronic mechanics, rather than to work out the details of compatibility between Kozyrev theory on one hand and the century old theories of quantum mechanics and Einstein relativity. These theories are far from the most advanced in nowadays mathematical physics, and clinging to objectively surpassed theories because most physicists still do due to ignorance or paradigmatic blockings, will not enhance scientific progress, but reduce it. All theories of physics have a restricted time span of superiority, as noted by both Kozyrev and Santilli.

III. KOZYREV COMPATIBILITY WITH RELATED ONGOING PARADIGMATIC ADVANCES IN PHYSICS AND BEYOND, CLUSTERING INTO SUPERIOR NATURAL SCIENCE

Hadronic mechanics is not the only paradigmatic shift advanced and potent enough to facilitate huge progress in science and technology in the global scientific ecology of today. Johansen (2007b) traces and highlights five such grand theories: Hadronic mechanics and chemistry (initiated by Santilli), universal nilpotent rewrite system (Peter Rowlands 2007, I), Global Scaling Theory (Hartmut Muller I), causal mechanics (Kozyrev Ia,b) and topological geometrodynamics (Matti Pitkanen I). Apart from Kozyrev all these theories have blossomed from

significant advances in sophisticated mathematical physics. The article argues these five theories to be the most advanced, judged from six criteria, with special emphasis on the criterion of inducing technological breakthroughs not possible from standard physics. These five theories are argued to be highly compatible with each others, with potential for further compatibility and mutual synergy effects. Together the five theories constitute a quite solid assembly of superior natural science compared to the century old standard physics with related theories and restrictions in technology. However, due to severe restrictions on optimal flow of scientific memes inside the global science ecology, this *de facto* clustering into superior natural science from remarkable scientific revolutions, is not much known or acknowledged.

Both Muller and Pitkanen have explicitly stated the significance of Kozyrev's work for their own advances. From his theory Muller (2001, 2004a, b, c) was able to develop new technology which in 2001 experiments succeeded in INSTANT transfer of energy and information applying gravitational standing waves, hence confirming Kozyrev's theory of such instant transfer being possible. Pitkanen's theory has not resulted in new technology, but is by far the most advanced, extensive and detailed scientific theory offering explanations of a plethora of phenomena considered paranormal by earlier physics. Rowlands theory is highly relevant due to its extraordinary level of abstraction and broadness, its connection to wave genetics and quantum holography, and its fundamental acknowledgement of nil-balance (as well as nil-potency) in the cosmos as a whole. (For further discussion of compatibility between Kozyrev science and the theories established by Rowlands, Muller and Pitkanen, we refer to the article itself.)

Considering the analysis in the referred article, it seems obvious that Kozyrev-inspired science by looking into the three mentioned theories will recognize significant scientific backing being already around from more or less independent sources, as well as receive crucial ideas to propel further progress. Also, the paradigm as well as the results achieved by the Kozyrev school seem to have crucial ideas and knowledge to offer the four other grand theories, especially with regard to advance the scientific understanding of non-trivial properties and flows of time and energy. Further catalyzing of the tendency of clustering into superior science needs some conscious efforts from involved scientists

in mentioned theories, as well as bridging activities by middle men. Increasing cooperation and coherency will also offer better protection against anti-scientific obstruction and destruction from the surpassed scientific paradigm still dominating the global science ecology by possession and execution of power means.

IV. COMPATIBILITY WITH CAUSALITY AND TIME AS ANALYZED IN DIFFERENTIAL PHILOSOPHICAL INFORMATICS

The book *Outline of Differential Epistemology* (Johansen 1991) presents a universal differential ontology (including epistemology) from a systematic, abstract and quite rigorous philosophical unfoldment of what is enfolded in the very category of INFORMATION comprehended in its most abstract and elementary sense as Bateson's «difference that makes a difference» (with some qualifying modification). This unfoldment shows that a description of a dynamic system always implies, usually as not explicitly stated or even conscious categories, a differentiation between a PHYSICAL dimension and an ALGORITHMIC dimension. In the physical dimension (comprehended as the unity of classical 3+1D) something leads to something somewhere in 3D space in a PROCESS, i.e. during duration of conventional TIME. In the algorithmic dimension some information leads to some other information in a TRANSFIGURATION, WITHOUT duration of convential time. Informational transfiguration has zero extension in the physical dimension, and physical process has zero extension in the algorithmic dimension. However, transfiguration and process are with necessity linked in a movement of diagonal gait, where the output from one is received as the input of the other. Process is completely determined from the output of an informative transfiguration, and must be comprehended as an automatic «differential movement». This is for the process comprehended at the most micrological level implied in the description. All broader spans of the dynamic systems consist of PLURAL directed sets of alternating processes and transfigurations, that can be assembled at higher levels of systemic description.

Further, a description of a dynamic system also implies a third TRANSALGORITHMIC dimension with meta-algorithms, meta-

meta-algorithms etc. The relation between meta-algorithmic and algorithmic transfiguration is analogous to the relation between algorithmic transfiguration and physical process. An implication of this is that algorithmic transfiguration has zero duration of time (and space) in the framework relating it to its physical process, while it MUST HAVE duration of time (and space), of the second order, in the framework relating it to meta-algorithmic transfiguration where it is to be comprehended as physical process itself. Therefore, there is no description or understanding without time, but what is to be considered as time vs. algorithm is RELATIVE to the level of system description, and the timeless algorithm always holds the upper hand. In COMBINED descriptions of PLURAL pairs of algorithmic transfiguration and physical process, with the pairs being of different transalgorithmic order, the time unit at an upper physical order can be compared to the time unit at a lower physical order and hence constitute a meaningful concept of TIME VELOCITY. The time unit being identical for different physical orders, appear as only a special case. Hence, this is consistent with the differences between the time unit in Euclidean spacetime vs. in iso- or genospacetimes. Hadronic geometry's description of projective deformation from genotime to Euclidean time can be interpreted as the relation between two such physical orders with the interlaying transalgorithmic order giving the deformation modes and quantitites. Also, transalgorithmic transfigurations include the possibility of CHANGES in the ratio between an upper and a lower time unit, which means changes in time velocity, a notion only meaningful measured by the unit of ANOTHER time unit, corresponding to the physical process and the spacetime from another transalgorithmic order. Then the last time unit has to be comprehended as absolute and constant in THIS combined system description, which does not mean that the same has to be the case in ANOTHER combined system description.

This work establishes the abstract, universal and elementary category of causality as with necessity implied in the abstract category of information, CONSTITUTING the input-difference and the output-difference as its necessary relata or «poles». The ordinary notion of «implication» in formal logic is the set of three pairs of truth values in two ordered expressions different from the pair of (true, false). Such a notion of causality is not sufficiently profound, because it assumes

the «cause» and the «effect» to be ALREADY separated. Therefore it also leads to classes of logical expressions contra-intuitively being deduced as true. Johansen's work establishes the category of causality as a rigorous back-reflection on what *de facto* has to be operative in the «atom» of thought as such, which is more in line with the notion of «strict implication» in modal logic, but with the difference that Johansen causality is developed with rigor from the already established differential ontology it has to be anchored in, since this ontology unfolds from information as such.

This implies that any notion of non-causal relations reflects flaws in the thinking or a notion of causality that is too shallow to precisely back-reflect and make coherently explicit what is implied in the heart of the information or thought atom. With regard to notions claiming the possibility of opposing causality to chance, such shortcomings with necessity lead to corresponding shortcomings in scientific results and their ontological interpretation, as in the case of the Copenhagen branch of quantum physics (Johansen 1991:191–205; Bohm 1987, 1993).

This does not imply that research in the Kozyrev school arguing different degrees of probability in the relation between «cause» and «effect» does not hit any significant mark (cf. Korotaev et al. 2006:681–685). On one hand Johansen has clarified that such a probability claim does not make sense for causality in the most abstract, universal and elementary sense. On the other hand it may make very good sense for certain classes of SPECIFIED relations, conventionally CONSIDERED to be «causal» in the strict and absolute sense, both in standard physics as well as in folk psychology, proving by closer theoretical or experimental investigation NOT to be accurate and to HIDE crucial associated relations important for scientific comprehension. More specifically, said notion is meaningful only when presupposing PHYSICAL causality, which is a causality type far from being the most abstract, universal and elementary (Johansen 1991:178–180), when inspecting relations between PHYSICAL OBJECTS (in the broad sense) inside this framework. To qualify the discussion we will name these objects not as «cause» and «effect» as in the Kozyrev tradition, but as «causeobject» and «effectobject».

To adequately frame the exploration and place its results, the whole causality nexus must be unfolded systematically and precisely from differ-

ential ontology as its anchoring. This is done in Johansen (1991:124–225) where a typology of eleven basic TYPES of causality is DEDUCED FROM the universal, abstract and elementary category of causality, shown to constitute the necessary and sufficient types existing in Nature and its description. Ten significant secondary types of causality are then treated as elaborations from the basic types (Johansen 1991:181–218).

The result of the deduction of the basic causality types, moving in specified succession, is indicated by Fig. 2.

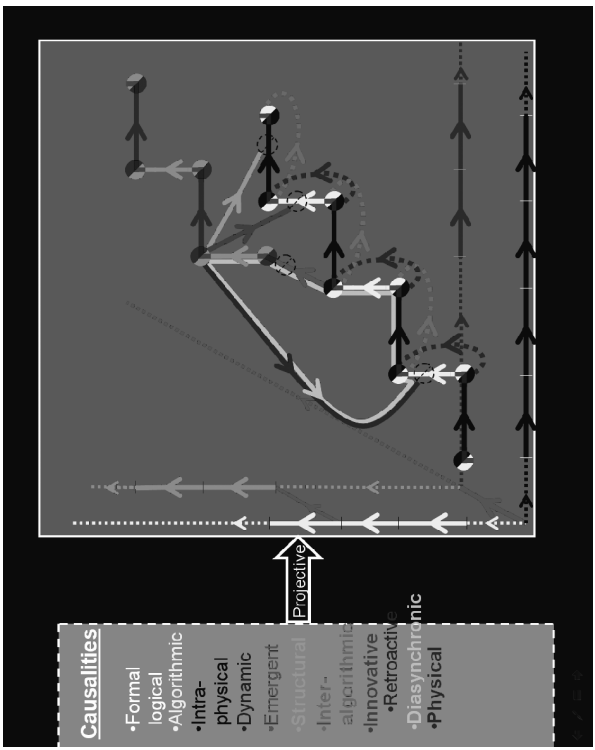

Fig. 2. Illustration of the causality nexus anchored in the three dimensions physical (black; 3+1D compressed as 1D time), algorithmic (yellow) and transalgorithmic (red). Description of first order alternates between process (black) and transfiguration (yellow), second order between blue and orange. Higher orders activate from emergence (red) and unfolds as structural change in process (light blue) or innovative change in transfiguration (dark green), with the possibility of the last being retroactive (purple). Whatever degree of order the illustrated conglomerate of causality types and arrows constitute the nexus of the whole information in the cosmos

Formal logical

This category is universal for all thinkable information, i.e. for ANY information flow in ANY described information matrix, i.e. in the imagination of a pure and free-standing logical universe. Formal logical causality is deduced in its precise form from specified classification logic between the thinkable classes and elements from ontology differentiated vertically. All other causality types are subtypes and «clothes» of this abstract one, which is what qualify them as causality types. They unfold from specified additions of different SIMILES, NECESSARY in any dynamic system description, explicitly stated or not.

Algorithmic

This is the causal relation from an input-value to an output-value inside the algorithm.

Intra-physical

This is the causal relation from start point to end point of a process.

Dynamic

This is the causal relation with the two sub-classes:

a) from end point of a process to start point in an algorithm;

b) from end point of an algorithm to start point in a process.

Projective

This is the causal relation from the meta-subject to the thought object as a whole, the potential inner classifications and causal relations being actualized in this projection (including formal logical causality). (In fig. 2 the arrow of projective causality derives the whole indigo field with its nexus, from the corresponding nexus generated in the green field denoting a segment INSIDE the thinking meta-subject that makes the description. The frame of the green field is marked with broken white lines to distinguish its ontological status from the nexus projected into the indigo field.)

Structural

This is the meta-algorithmic causality relation directing the process-output from an algorithm to the process-input for another algorithm and hence positioning all algorithms in a structure.

Inter-algorithmic

This is the causal relation from an algorithmic output to the algorithmic input for another algorithm, hence ignoring the intermediary physical process by a projection to the vertical algorithmic axis.

Emergent

This is the causal relation from an algorithm to a meta-algorithm.

Innovative

This is the causal relation from a meta-algorithm to a first order algorithm. An important sub-type of innovative causality is the **retroactive** causal relation from a meta-algorithm to a first order algorithm earlier connected to the meta-algorithm by emergent causality.

Diasynchronic

This is the causal relation made up by a CIRCUIT of algorithmic, physical, intraphysical, dynamic, projective, emergent, structural, and retroactive innovative causality.

Physical

This is the physical relation from a process output to the process input of the next process, hence ignoring all intermediary algorithmic and transalgorithmic transfigurations by a projection from the vertical axis or the depth axis to the horizontal axis.

It follows from this illustration of the causality nexus that the conventional notion of physical causality is far from constituting the most fundamental causality type. It is also far from trivial, due to its condensation of many involved causality paths through lots of shortcuts and similes.

Kozyrev experiments have provided rich documentation of cases with deviation from a one-to-one relation between (changes in) a conventionally considered causeobject and a considered effectobject in our Euclidean spacetime. The sources for such deviations can be interpreted as being of three different classes:

1) deviation due to the degree of RESOLUTION of the physical description. Any description of physical cause- or effectobjects must be specified at a certain LEVEL of physical description, considered adequate for the purpose of description. Only in the extreme case will this be the highest possible description of Euclidean spacetime (mat-

ter vs. antimatter) or the lowest possible (at the Planck length). In principle, the degree of deviation can change by decreasing the degree of resolution to more macro cause- and effectobjects or increasing the resolution to more micro cause- and effectobjects. If such level-transportation decreases the degree of deviation, this difference can explain the corresponding deviation discovered at the original level of description and resolution;

2) deviation due to the physical description ignoring INNOVATIVE causality influencing the relation between physical cause- and effectobjects, strictly linked to certain values of physical constraints involved in the relations of physical causality. This innovative causality corresponds to the notions of «Kozyrev force» or «Time energy», and requires a COMBINED description of physical process, algorithmic transfiguration, and the meta-algorithmic transfiguration emitting innovative causality. Observed from the meta-algorithmic order, the algorithmic transfiguration then is to be described as (second order) physical process including Time, just as (first order) physical process including time is described from the related algorithmic (first) order. From this one can describe the relation between Time, time and causeobject-effectobject in a compressed description of the two levels of physical process;

3) deviation due to profound ONTOLOGICAL NECESSITY. Kozyrev argues the NECESSITY of deviation due to the causeobject being distinguished from the effectobject by an intermediary gap in time and space, whatever microscopic, and hence a spacetime VECTOR existing as an intermediary between the two objects. This is consistent with a basic point in universal nilpotent rewrite theory of Rowlands stating that there always is a certain DEVIATION between the action force from something (ultimately the fermion) and the reaction force from something else. If something else is considered less than everything else, the reaction force will have to be correspondingly less than the action force. A glass put on a table meets MOSTLY the reaction force from the table, but with necessity there is an ADDITIONAL reaction involved, whatever small, from everything else than the glass and the table, and it is only for the totality of Spacetime that we have nilbalance. Also, if ALL the reaction force is directed into the effectbject, this seems to imply that the interaction between the causeobject and the

effectobject creates a BOUND STATE of the two (as of particle and anti-particle) DELETING the deviation. Then the two objects do not exist as objects anymore (only as aspects of the same object), and there will emerge a deviance on a new level: between the action force of the bound state object and the somewhat smaller reaction force of an effectobject it acts on. Therefore, there will always exist a certain deviation between change in causeobject and change in effectobject, and if the deviation is deleted this is equivalent with deleting the objects as distinguished physical objects with the result that the physical cause-effect relation is not around anymore. This means that physical causality between two physical objects ALWAYS is a SIMILE in the sense of ASSUMING a one-to-one relation in spite of this never being the whole and complete truth. Such an assumption is very useful for many purposes when the deviation is small or not relevant for the targeted aspect of the relation. Also, such an approximate assumption is NECESSARY because suspending it would mean skipping physical causality as such and making physical description and explanation impossible. (To step from physical causality to physical probability is not any final or principal solution because this only transports the deviation issue to a lower level of physical description, and because the very category of probability is a certain configuration of causality types.) On the other hand, for OTHER, and often more subtle and interesting purposes, this deviation has to be HIGHLIGHTED, as in the Kozyrev tradition. However, also in this case the deviation issue will show up again on an upper level of description. This is the condition for human understanding from the very architecture of the causality nexus of reality. This condition can not be annihilated, but may serve through the awareness of reflection as a tool of thought for more advanced scientific navigation and exploration.

On this background experiments showing deviations between causeobject and effectobject can be interpreted as more or less combinations of the three sources pointed out. The recognition of more than one source may also show useful to explain differences in deviation between similar cause- and effectobjects from different experimental set-ups at different times.

Kozyrev Postulates II and III in the highly informed, clarifying and constructive (including critical) presentation by Shikhobalov (Ic:3) of the fundamentals of Kozyrev causal mechanics, claiming an inter-

mediary distance between causeobject and causeeffect in space and time, respectively, can receive confirmation from increasing the resolution of physical process and transforming segments of considered intraphysical causality between causeobject and causeeffect to physical causality supplemented by intermediary algorithmic and dynamic causality. The postulates claim that it is always possible to insert such an algorithm, so that NOT inserting it reduces the description to an approximation. However, such approximations will always be necessary to a certain extent as well as adequate for the task of description. When intraphysical causality is transformed to algorithmic, the relevant physical properties of the causeobject and the causeeffect only count as physical outputs and inputs, respectively, received and emitted through dynamic causality as ALGORITHMIC inputs and outputs, respectively. In the algorithm they are not physical objects anymore but summed up and distilled as pure information, the information corresponding to the algorithmic SEMANTICS linking it to properties of physical objects on the input and output side. The set of differences constituting this algorithmic inputs and outputs has zero extension in time, and at the same time they are LINKED to preceding and proceeding differences, respectively, ONLY comprehensible as properties of physical objects WITH EXTENSION in physical time.

This means that Postulates II and III imply a recognition of the necessity of leaping from a (quasi-)pure physical description to a description also including and focusing the intermediary algorithm, and by this way adequately extend the ontology of physics into better self-referential coherence, in line with Rowlands' general statement: «Physics is metaphysics, has always been metaphysics, and will always be». The challenge is of course to develop and apply the ADEQUATE metaphysics with the necessary systematic differentiations and relations.

Kozyrev Postulate IV (Shikhobalov Ic:5), claiming «course» of time as a fundamental constant is extremely interesting because this represents a notion of this kind of intermediary algorithm as having a UNIVERSAL form, specifying difference in causeobject making a difference in effectobject in the physical dimension as variants (given by the two parameters space and time difference between the two objects) of a universal algorithm, not discovered before, in some analogy to what Illert discovered with regard to sea shell growth. The Weber–Fechner

relation is found to empirically constitute an approximate information law specifying the quantitative relation between physical output and algorithmic input as logarithmic, in differential philosophical informatics being argued as a result of «traceless classification» (Johansen 1991:25–35). The Kozyrev course constant of time seems as a related discovery, with its universality being connected to physical relations between objects mostly being that simple that their informative classifications are traceless, not reflexive. (With regard to the concepts of traceless and reflexive classification and their relation to information processing, see Johansen 1991:36–58.)

Kozyrev Postulate I (Shikhobalov Ic:3) states that (second order) Time distinguishes causeobject from causeeffect with a directionality (which can be revealed by the probability method developed by Korotaev; cf. for example 2006:681–685). From differential philosophical informatics this is to be interpreted as STRUCTURAL causality from SECOND transalgorithmic order, which translates in a combined description to a specified algorithm from second order physical spacetime onto first order physical spacetime. Hence, the causality type involved in Postulate I is not the same as the causality types involved in Postulates II, III and IV, and the interrelations between the different causality arrows and time categories encompassed by the four Postulates all together, must be worked out in combined descriptions including more than only first order algorithms.

This may indicate that it also will show possible as well as clarifying to interpret Kozyrev Postulates V and VI (Shikhobalov Ic: 5–10) in the framework of the sketched ontological causality nexus, which may illuminate scientific results compatible with the Postulates as well as potentially fertilize further research based on the Postulates.

If all points and paths in the 3D illustration of the causality nexus are imagined as activated, this constitutes the totality of relations imaginable in the free-standing universe of logic. This universe of logic exists as a part of the cosmic whole, but only as a PART. Far from all of the points and paths of the causality nexus is REALIZED in the cosmos APART from its segment constituted by the universe of logic. From the architecture of the causality nexus it follows that the cosmos changes by ACTIVATION of POTENTIALLY already existing points and paths, with the changes being more far-reaching with activations from increas-

ing transalgorithmic order. (Connected to fig. 2 the potential-for-actualization nexus may be imagined as broken path lines, distinguished from unbroken lines denoting the segment of the nexus being actualized at a certain time.) This is consistent with the results from the ontological mapping and investigation by Bohm (1997). In general this gives some credit to the Aristotle paradigm of potentiality/actuality. Also, it offers a general reconciliation of the paradox consisting in complexity science highlighting the key connection between «emergent relations» and increasing order/complexity, while other scientists and philosophers like Bohm have highlighted top-down causation and the «formative cause» for information. The reconciliation appears from acknowledging emergent causality as inputs triggering activation of the potential causality points and paths already existing on higher/deeper ontological order, and where what appear as emergent causality in a combined description appear as mere intraphysical causality between two algorithms in the description from the higher order.

The 3D illustration of the complexity nexus does not specify the paths and points corresponding to anti-homomorphic universes, at the lowest transalgorithmic order considered as antimatter universe(s) with time arrows manifesting as negative observed from the coordinate system of the matter universe. For such a completion we may consider the 3D nexus as inscribed in a CUBE anchored in one corner points as its origin, to complement it with its asymmetric anti-cube anchored in the corner point in 3D diagonal opposition to the first origin, and to consider the 3D superposition of the two asymmetric coordinate systems as the whole complexity nexus. In this way the overall Cube can be imagined as nil-balanced across the inner midpoint or Origin of the Cube. One possibility to account for bound states of matter and antimatter, or of positive and negative time, is to imagine such states as being located in an inner cube around the Origin, for example by transporting the two origins of the two cubes to opposite corner points of the INNER cube.

The Origin may further be considered as the singularity in the neck of the Klein-bottle, with the cube and the anti-cube manifesting in tandem through this point in some analogy to the implied Klein-bottle dynamically manifesting as the two alternating aspects of the Necker cube. In this sense the Origin could be said to not only constitute nil-balance but also nil-potency.

There is also the possibility to consider the sign of the time unit to alternate in tandem with increasing transalgorithmic order for each of the two cubes. If so, the structure of Cube would be somewhat similar to two 3D chess boards in mutual superposition as when combining the view of the board from one player and the view from his opponent on the diagonally opposing corner point, and with the inner cube acting as a glass structure.

Further research is necessary to work out the architecture of an adequate superimposed model with required detail, including the role of holographic projections, probably in some synergy between philosophical informatics, mathematical physics and sophisticated interpretation of crucial experiments and facts. However, to reach a more complete comprehension of the co-existence and co-influence of negative time arrows, it is NECESSARY to establish a superposition of the causality nexus and its asymmetric nexus. Then the points and pathways of negative time in the superimposed causality nexus can be tracked down directly from the comprehension of the causality nexus ALREADY worked out.

It seems quite obvious that not all points and paths of the causality nexus as imagined in the universe of logic exist as POTENTIAL points and paths possible to activate from emergent causality, OUTSIDE the segment of cosmos constituted by the universe of logic. This poses the question of HOW the architecture of this potential-for-real causality nexus is and how it is generated by constraints and direction.

The causality nexus is universally valid for any description and explanation of any phenomenon. However, far from the WHOLE potential-for-real causality nexus is mapped or unfolded by a specific description, and a specific description does not always have a good match to the targeted segment of this nexus which it ATTEMPTS to reveal by the amount of bits applied in the description. Adequate descriptions are not accidental constructions but matching RE-constructions which «hit the mark» (Bohm) in a «snap of recognition» (Rowlands). Thus, the whole potential-for-real causality nexus has a PRECISE architecture, more or less recognized in the description generated from it.

The question then arises if it is possible to tell something more qualified and universal about the GENERATION of this reality architecture.

From universal key properties of the category BORDER as unfolded from differential philosophical informatics (Johansen 1991:66–73) it has been deduced by Johansen (2006) that the FIBONACCI ALGORITHM is the abstract, universal and elementary algorithm of Nature, all other algorithms manifesting as mere epi-phenomena of this as «organic» results of the Fibonacci algorithm's unfoldment into complexification. This provides the basic bridge between the qualitative and quantitative aspects of Nature. If this deduction is correct, it implies that the whole potential-for-real complexity nexus is to be comprehended as a gigantic cosmic Fibonacci nexus with the differentiations between different layers and orders in the 3D nexus, as well as their interlinkings, generated from FIBONACCI SELF-REFERENCE on and of the Fibonacci-algorithm itself into hyperstructures in stead of mere progressing as the linear Fibonacci series. Some closer examination of the Fibonacci «reality atom» itself may therefore be fruitful also for the general understanding of the Time complex.

An imagined timeline divided into the three time categories past, now and future, covering their respective and successive intervals of the timeline, is only thinkable INSIDE another and ontologically UPPER now, which we therefore term «supra-now» or «Now». Therefore, the past, now and future are manifested aspects from and by the Now, and the Time complex must have a vertical architecture with an upper category manifesting into three lower ones. (More complex Time structures are then easily constructed or reconstructed by operators making different groups and movements between these four categories.)

Let's relate the Fibonacci algorithm to this elementary «atom» for time differentiation and complexification. Just for illustration we take the Fibonacci number «3» picking the preceding Fibonacci number «2» and creating the proceeding and new Fibonacci number «5» from adding «2» to «3». This procedure constitutes a TIME relation: The subject starts at a certain time point (and space point) with the «object» 3. Then the subject moves from present to future by stepping back to the position in its PAST with «2». Then the subject moves ACROSS its past now to its next now with «2» and steps forward to its next future now at the position of «3» + «2»=«5». This whole operation is ANTICIPATED in a present Now before it is REALIZED in the next future Now which is DISCONTINUOUS to the Now of anticipation. In the anticipation of

the first Now the past «2» has to be RECALLED as a conjugation to NEGATIVE time. In the realization this negative time is conjugated to POSITIVE time. Also, after the realization to the Now at «5», there is a discontinuous jump to the Now at «5» ANTICIPATING the next operation picking «3» from the base of «5» and adding them into «8».

Without working out the further details of this, it ought to be sufficient to indicate that the reality atom of the Fibonacci algorithm provides a vertical differentiation of time (and therefore also the vertical split between algorithmic and physical, or between relational and substantial time) with a corresponding horizontal differentiation of three time categories at the lower level, just as in the elementary and universal time atom of Now/(now, past, future). Therefore, already the Fibonacci algorithm provides a differentiation in positive and negative time, and qualifies this differentiation in a certain alternating and successive procedure, involving conjugation, superimposition and discontinuous jumps from one Now/(now, past, future) to next Now/(now, past, future). Hence, a detrivialization and concise comprehension of the Fibonacci algorithm may reveal some of the most profound mysteries of the Time complex.

It seems significant that the Fibonacci algorithm holds a paradoxical unity regarding the absolute and relative properties of time. One step in the Fibonacci series is always relationally identical to the preceding step (as well as the proceeding step). Also, INSIDE the framework of one whole Fibonacci step, i.e. from the observation post of the Fibonacci subject, the length of the step backward is identical to the length of the step forward because this length all the time IS the basic unit of the Fibonacci «walk». On the other hand, these relations are never (quantitatively) identical when observed in the COMBINED framework covering both whole Fibonacci steps, or when observing the backward and forward step of each from an OUTSIDE observation post. With regard to time it might be that this is related to Time influence from the specified past position of a star being mirrored also in its symmetrical future position, but with a weaker quantity. Korotaev (1996:13), following Kozyrev (1980b), gives a tempting explanation of this striking triplet phenomenon from a quite simple argument applying Minkowski geometry as its framework for interpretation. However, it may be that this also is consistent with interpreting the macro-phenomenon as fractally generated from a fundamental Fibonacci structure. It might be fruitful to check by experiment if

EARLIER past positions of stars, as well as positions FURTHER away in the future, would relate, in positioning on the sky or magnitude of influence, to the positions and influences discovered from the specified past and future positions by precise Fibonacci series.

The significance of the past star positions corresponding to the distance measured by the velocity of light, might be directly connected to light visible for our vision being the medium CONSTITUTING physical objects by the visual criterion. Topological geometrodynamics has presented a theory of coherent topological light rays manifesting at different scales corresponding to specified fractal multiples of the Planck length, with the ordinary visual light constituting just one of many such wavelengths in the hierarchy. If this is the case, it seems likely that experiments will reveal non-trivial time influences similar to those observed from stars, also from coherent topological light rays with wavelengths systematically different from visual light and at spacetime spots not overlapping with space-time positions of separated heavenly objects visible for our sensory apparatus.

The work and legacy from Kozyrev is compatible with crucial scientific advances already made by superior natural science, and has to a significant extent fueled such advances, inside the Kozyrev tradition as well as outside. In the years to come Kozyrev will keep on inspiring scientific imagination as well as careful investigations in different areas and disciplines. Hopefully, some mysteries of the World will become more or less solved from this, while at the same time new mysteries will be created as a vital force regenerating the spirit of true scientific exploration unfolding from the marriage between heavenly inebriation and earthly sobriety.

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