The deductive Krein space structure of the Unified Field Theory, creative mathematical vacuum & perfect plasma, and related opportunities

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Prologues

Richard Feynman

There isn't any theory today that has $SU(3) \times SU(2) \times U(1)$

„The standard model is that the one that says that we have electrodynamics, we have weak interaction, and we have strong interaction; .. They're not put together. ... Three theories, strong interactions, weak interactions, and electromagnetic ... The theories are linked because they seem to have similar characteristics ... Where does it go together? Only if you add some stuff that we don't know. There isn't any theory today that has $SU(3) \times SU(2) \times U(1)$", (GU) p. 433.

Robert H. Sanders

The standard model is not the final theory

„Theoretical physicists are convinced that the standard model is not the final theory. There are a number of phenomena which find no explanation in the context of the standard model and must be added in an ad hoc manner. For example, the Higgs mechanism, the mysterious field which gives mass to all other particles, does not follow in any sense from the standard model. The apparent asymmetry between matter and anti-matter is not explained by the standard model. Neutrino masses do not naturally arise in the context of the standard model. There is clearly physics, a deeper theory, beyond the standard model", (SaR) p. 82.

Roger Penrose

„In order to produce an universe resembling the one in which we live, the Creator would have to aim for an absurdly tiny volume of the phase space of possible universes – about $10^{10^{123}}$ – of the entire volume, for the situation under consideration", (PeR) p. 444.

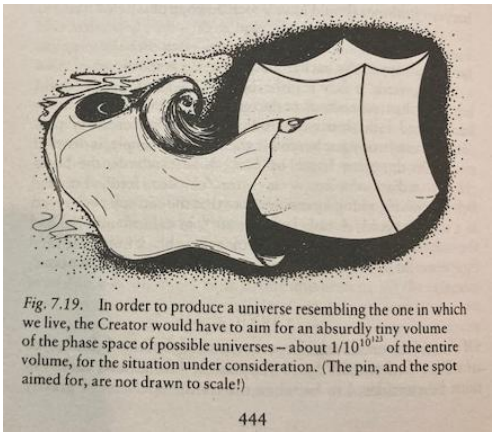

Fig. 7.19. In order to produce a universe resembling the one in which we live, the Creator would have to aim for an absurdly tiny volume of the phase space of possible universes – about $1/10^{10^{123}}$ of the entire volume, for the situation under consideration. (The pin, and the spot aimed for, are not drawn to scale!)

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A. The conceptual design elements of the UFT in a nutshell

For a detailed view on the physical and mathematical modelling framework of the proposed Unified Field Theory (UFT) we refer to (BrK0).

The UFT is governed by two types of energy, the today's mechanical energy (i.e., kinetic and potential energy) and a newly proposed *dynamic energy*. Bohm suggested a „wholeness, explicate & implicate order" principle for quantum theory (BoD). In line with this concept we consider mechanical energy as „explicate energy" and dynamic energy as „implicate energy". The „dynamic energy" is defined by the Krein space intrinsic concept of a self-adjoint potential operator accompanied by a correspondingly defined „energy" inner product on all of the Krein space, (AzT), (BoJ), (VaM). We shall deal with several types of elementary „particles" (which we call quanta or components) resp. the following related groups of dynamic and mechanical energetical systems:

- DQ1 system: 2-component Krein space based „ground state" dynamic quanta system
- DQ2 system: 2-component Krein space based „perfect plasma" dynamic quanta system
- DQ3 system: 2-component Krein space based „perfect electromagnetic" dynamic quanta system
- DQ4 system: 2-component Krein space based Dirac [2.0] mechanical x dynamic quanta system
- DF system: 1-component Hilbert space based dynamic fluid system
- MF system: 1-component Hilbert space based mechanical fluid system.

The definition of the underlying defining scheme of quanta number sequences is based on the different number theoretical properties of *odd* and *even* integers. While the cardinality of both sets is $\aleph_0$ (aleph-null), the so-called Snirel'man density of the odd integers is „1/2", while the Snirel'man density of the even integers is „zero". Colloquially spoken, the different „densities" of odd-integer based quanta number sequences and their related even-integer based „anti-quanta" number sequences (resp. their related implicate „potential") enables and governs the building process of the quanta number sequences of appropriate quanta combinations. The baseline DQ1 & DQ2 energy systems are „meta-physical", i.e., they are „a priori" given enabling the building of physical relevant mechanical quanta with intrinsic dynamic energy. All DQ systems are timeless and spaceless and are governed by an overall conservation of energy law [(*)].

The considered symmetry groups are the restricted Lorentz group associated with $SU(2)$ and the complex Lorentz group associated with $SU(2) \times SU(2)$. The (real) Lorentz group has four components, but no Lorentz transformation in one component can be connected to another in another component. The complex Lorentz group has just two connected components, (StR) pp. 11 ff. It describes the hidden symmetry of the Coulomb problem, ((RoH) S. 163.

The symmetry group of the DQ systems is the complex Lorentz group [(**)]. The concept of „symmetry break down" comes along with the change from Krein space based dynamic systems to the purely Hilbert space based DF & MF energy systems. The latter ones are accompanied by the symmetry group of the mechanical Minkowski space-time world. The compact embeddingness of all concerned Krein and Hilbert scales provides the appropriate modelling framework for the concept of a „global nonlinear stability of the Minkowski space", (ChD) [(***)].

[(*)] this addresses the „first mover" problem of Big Bang and all that (WeS); the prize to be paid are the a priori meta-physical energetical DQ systems, whereby the a priori „perfect plasma" system may become a model of the „dark matter" in the universe providing the foundation of a (bright) electromagnetic „stationary (purely dynamic energy based) luminiferous ether", (EiA5). The latter one enables the definition of mechanical energy governed 2-component $(\underline{e}, \underline{m})$ based Maxwell-Mie equations. It avoids the concept of a „displacement current", providing consistent explanations of the Landau damping, the CMBR, Ehrenfest's photophoresis discovery, which he interpreted by the existence of electric and magnetic ions, (BrJ), and a link to the Klein-Gordon-field. The concept of a „Mie pressure" (i.e., a kind of mechnical potential, (WeH1) p. 206) is in line with Lorentz's various kinds of ether pressure:

> Lorentz took „*from the ether its mechanical, and from matter its electromagnetic qualities*", (EiA5). However, the Maxwell-Lorentz equations cannot hold for the interior of the electron, (WeH1) p. 206-208. In Mie's theory „*the electric force is counterbalanced in the ether by an electric pressure*" in order to ensure that „*the negative charges compressed in an electron do not explode*", (WeH) p. 171, (WeH1) p. 208. The explicate mechanical $(\underline{e}, \underline{m})$ are accompanied by a related „Mie pressure", i.e., the „potential difference" between the underlying mechanical x dynamic quanta pairs $(\underline{e}, p)$, $(\underline{m}, e)$. This „Mie pressure" makes the concept of a „strong force" of the SMEP obsolete.

[(**)] The math. proof of the CPT invariance phenomenon, the only fundamental law of nature requiring a „time arrow", is enabled by the complex Lorentz transform (StR).

[(***)] All PDE systems are considered as variational representations in the the proposed $H_{1/2} = H_1 \otimes H_1^{\perp}$ Hilbert space Minkowski space-time continuum framework; in variational theory a nonlinear operator may be interpreted as a compact disturbance operator accompanied by the so-called Garding inequality, where the linear energy term remains to govern the related total energy functional/norm, (BrK0) p. 11, (LiP), (LiP1). The concept provides an alternative modelling framework for the characteristic GRT phenomena with regards to the SRT. Colloquially spoken, if the SRT is modelled in the H_1 Hilbert space MF system accompanied by a mechanical gravitational potential with the constant speed of light c, the specific GRT phenomena may be interpreted as „compact" disturbances in an overall $H_{1/2} = H_1 \otimes H_1^{\perp}$ DF framework, (BrK10). This modelling approach supports „Einstein's lost key", which is in line with Dicke's related theory, and Dirac's „large number hypothesis" as part of his „new basis for cosmology", (DiP2), (UnA1).

The norms of Hilbert or Krein spaces provide the modelling element for invariant quantities in conservation laws (e.g., in mechanics and electrodynamics). Within the Krein space framework there is an order-from-order mechanism between the concerned indefinite norms. The transition from the Krein space based DQ systems to the DF Hilbert space based $H_{1/2} = H_1 \otimes H_1^{\perp}$ system is accompanied by a change from an *implicate* self-adjoint dynamic potential operator concept and its related definite norm on all of the Krein space to the *explicate* self-adjoint mechanical (Laplacian) potential operator and its related definite norm on all of the H_1 Hilbert space domain. It turned out that the $H_{1/2} = H_1 \otimes H_1^{\perp}$ Hilbert space decomposition in combination with the Riesz transform provides an alternative *Schrödinger* [2.0] *(-Calderon) quantum momentum operator*, (BrK6). It may be interpreted as a compact disturbance of the explicate self-adjoint mechanical (Laplacian) potential operator.

The Krein space based quanta system scheme is based on the extended Hilbert space $H_{(\tau)}$ of the Hilbert scales H_α defined by the inner product resp. norm

$$(x, y)_{(\tau)} = \sum_1^\infty e^{-\sqrt{\lambda_i}\tau}\, x_n\, y_n, \quad \|x\|_{(\tau)}^2 = (x, x)_{(\tau)}$$

with $\lambda_n^{(\kappa_n)} := \frac{1}{2}\lambda_n \int_0^\infty tanh\left(\frac{1}{2}n\kappa_n\tau\right) e^{-\frac{1}{2}\sqrt{\lambda_n}\tau} d\tau = \sqrt{\lambda_n}\left[\frac{\sqrt{\lambda_n}}{n\kappa_n}\beta\left(\frac{\sqrt{\lambda_n}}{2n\kappa_n}\right) - 1\right]$, (BrK0) p. 15). It is linked to the energy Hilbert space $H_{1/2} = H_1 \otimes H_1^{\perp}$ by the energy equation of a vibrating string governed by the norm of $H_{(\tau)}$ in the form

$$\|x\|_{1/2}^2 = \frac{1}{2}\int_0^\infty \left[\|x'\|_{(\tau)}^2 + \|\dot{x}\|_{(\tau)}^2\right] d\tau\,.$$

Physically spoken, the extended (energy) Hilbert space $H_{1/2}$ provides an appropriate model of a *dynamic* fluid particle. The extended dynamic fluid energy Hilbert space enables global existence and uniqueness of the non-stationary, non-linear 3D Navier-Stokes initial-boundary value system, (BrK11). It is also in line with the proposed modified Schrödinger momentum operator with domain $H_1^{\perp}$ in (BrK6), (BrK8). The prize to be paid for the simplication changing from a Krein space based framework with indefinite norms to the Hilbert space based the DF system $H_{1/2}$ with definite norms is a disorder-from-order mechanism. Accordingly, the approximation MF system (the standard variational mechanical energy Hilbert sub-space H_1) of the DF system $H_{1/2}$ is governed by the thermo-statistical order-from-disorder mechanism [(**)].

[(*)] The Hilbert space $H_{(\tau)}$ contains all distributional Hilbert scales H_α and turned out to be the natural domain of the d'Alembert (wave) operator in order to ensure appropriate shift theorem in line with the elliptic and parabolic shift theorems, (BrK0) p. 25; tihs puts the spot on the Courant conjecture (spherical waves only in case of two and four variables, (CoR) p. 763.

[(**)] (ScE) p. 1-2*: „There is, essentially, only one problem in statistical thermodynamics: the distribution of a given amount of energy E over N identical systems. Or perhaps better: to determine the distribution of an assembly of N identical systems over the possible states in which this assembly can find itself, given that the energy of the assembly is a constant E. The distinguished role of the energy is, therefore, simply that it is a constant of the motion – the one that always exists, and, in general, the only one. The generalization to the case, that there are others besides (momenta, moments of momenta), is obvious; it has occasionally been contemplated, but in terrestrial, as opposed to astrophysical, thermodynamics it has hitherto not acquired any importance. "To determine the distribution" .. means in principle to make oneself familiar with any possible distribution-of-the-energy (or state-of-the-assembly), to classify them in a suitable way, i.e. in the way suiting the purpose in question and to count the numbers in the classes, as as to be able to judge of the probability of certain features or characteristics turning up in the assembly. The question that can arise in this respect are of the most varied nature, especially in relation to the fineness of classification. At one end of the scale we have the general question of finding out those features which are common to almost all possible states of the assembly so that we may safely contend that they „almost always" obtain. In this case we have well-nigh only one class – actually two, but the second one has a negligibly small content. At the other end of the scale we have such a detailed question as: volume (i.e., the number of states of the assembly) of the „class" in which one individual member is in a particular one of its states. Maxwell's law of velocity distribution is the best-known example.*

[(**)] *„The dielectric constant is a measure of the amount of electric potential energy, in the form of induced polarization that is stored in a given volume of material under the action of an electric field. It is expressed as the ratio of the dielectric permittivity of the material to that of a vacuum or dry air"*, Wikipedia; *„the permittivity constant is a constant of proportionality between electric displacement and electric field intensity in a given medium, such as a vacuum"*, Wikipedia; a consequence of the Maxwell equations (where light is considered as an electromagnetic wave and where the energy tensor of the electromagnetic Maxwell field is only known outside of the electron) is that electric and magnetic fields can propagate in empty space without any electric charges nearby; this property puts the dielectric constant and the permittivity constant into relation to the speed of light, (UnA2) p. 46; assuming that all materials contain electrically charged particles that move when exposed to heat, the amount of radiation emitted by a blackbody is desribed by Planck's law of thermal radiation, see also (RoP3). ... The two parameters of the laws of Wien and Rayleigh-Jeans became obsolete when die Planck action (auxilliary) constant h came into existence, (UnA2) p. 41; Einstein's formula for the energy of a light quanta E= h*f (f denotes the frequency of the light wave and h the Planck action constant) explains the photoeletric effect (emission of electrons when light hits a metal), (UnA2) p. 43; Dirac's observed coincidence between the size of the proton (atomic theory) and the size of the universe (cosmology), which lead him to his large number hypothesis, (DiP2); Sommerfeld's "fine structure constant" is a mathematical requirement to solve the Dirac equation to model the relativistic movement of an electron in the "interior" of the hydrogen atom. It is required to ensure two convergent power series representions of the related two mathematical "radial parts" of that equation enabling Sommerfeld's formula for the eigenvalues of the energy of an electron in a hydrogen potential, (MaW) S. 71.

The current phenomenological and conceptual structure of physics mutually dependent on each other. This resulted into regional disciplines of physics, where physics at large scale decouples from the physics at a smaller scale, i.e., theoretical physics is scale dependent and at each scale, there are different degrees of freedom and different dynamics. Correspondingly, there are physical model specific so-called „Nature constants“, which reflect the characteristic elements between theoretical model and related experimental results. The pivotal point of most of those constants is somehow related to the Maxwell equations (**). The deductive structured energy field models require an adapted concept of „Nature constants“, which describe the „borderlines“ between the purely dynamic and the mechanical worlds. Namely, this concerns the borderlines between the „perfect plasma“ Maxwell-Mie model (***) and the „perfect electromagnetic“ Maxwell-Mie model (QN: $\frac{2}{3} \leq \kappa_{\underline{e}} = \frac{4n-2}{4n-1} < 1 < \kappa_{\underline{m}} = \frac{4n}{4n-1} \leq \frac{4}{3}$) resp. the three 1-component mechanical Dirac 2.0 nucleus type quanta, the electronium, the positronium, and the neutronium (QN: $\frac{4}{3} \leq \kappa_{N^-} = \frac{8n-4}{4n-1} < \kappa_{N^+} = \frac{8n}{4n-1} < 2 < \kappa_{N^0} = \frac{5}{2}$).

Summary

The Krein space based energetical quanta systems

The construction of Krein space based energetical quanta systems is enabled by the concepts of a *potential* and a *self-adjoint potential* (or J-symmetry) *operator*.

The concept of an intra-quanta system specific dynamic energy

The Krein space framework enables the definition of quanta system specific intrinsic (*implicate) potential-difference* accompanied by related quanta system specific energy inner product, which defines the quanta system specific energy. The sequence of quanta numbers is defined by the intrinsic „potential“ difference of the considered quanta and anti-quanta pair of the system.

The concept of an inter-quanta systems dynamic energy

Between the integrated quanta energy systems there are potential-differences between the several hierarchically ordered quanta system layers represented by different defintite norms of those systems. Those different dynamic energy norms are governed by an overall conservation law of total energy across all Krein space based dynamic systems. an related minimization principle moves energies from the upper layers finally back to the ground state layer. In other words, there is a top down entropy process from the three atomic nuclei layers finally down to the ground state layer.

The Dirac 2.0 quanta system as foundation for anorganic chemistry

The integrated quanta field systems is supposed to become a quanta (conductor, semi-conductor, isolator) atomic nucleii models for anorganic chemistry.

A Hilbert space based approximation system to classical physics

The integrated Krein space based dynamic quanta systems can be approximated by the energy (Hilbert space based) $H_{1/2} = H_1 \otimes H_1^{\perp}$ system. This is basically the standard variational mechanical energy space H_1, which is compactly embedded into $H_{1/2}$, „complemented“ by a dynamic energy space $H_1^{\perp}$ (*). The energetical elements of $H_{1/2}$ are called dynamic fluid elements, because the variational 3D-NSE representation with respect to the $H_{1/2}$ inner product enjoys bounded energy inequalities, i.e. the 3D-NSE system becomes well-posed, (BrK11).

(*) This framework enables the definition of the modified Schrödinger momentum operator with domain $H_1^{\perp}$ in (BrK6), (BrK8). This operator may be interpreted as a compact disturbance of the H_1 - coercive Laplacian operator, i.e. the „energetical“ coerciveness condition can be applied:

A variational representation of an operator in the form $B = A + K$, where A is a H_α - coercive operator with a compact disturbance K fullfills a coerciveness (Garding type type inequality) condition in the form, (AzA),

$$(Bu, v) \geq c \cdot \|u\|_\alpha \|v\|_\alpha - (Ku, v) \text{ or } (Bu, v) \geq c_1 \cdot \|u\|_\alpha^2 - c_2 \cdot \|u\|_\beta^2$$

with $H_\beta \subset H_\alpha$ compactly embedded. For related arguments regarding the Boltzmann-Landau equations see (LiP), (LiP1).

B. The deductive Krein-Hilbert space based quanta energy field structure

1. Hilbert scales and Krein space intrinsic κ_n-self-adjoint potential operators

The proposed Unified Field Theory (UFT) provides an all-encompassing theory, where physical models of different physical areas are no longer decoupled and differently scaled according to their different levels of granularity. It is governed by two types of energy, the today's *mechanical energy* (kinetic and potential energy) and (in line with Planck's dynamic type of physical law, (PlM)) a newly proposed *dynamic energy*.

Heisenberg W.
The degeneracy of the ground state and *the indefinite metric in Hilbert space*

(HeW) vi: *„The mathematical formalism contains some unconventional features which formerly have rendered its understanding somewhat difficult: the indefinite metric in Hilbert space and the degeneracy of the ground state.“*

(BoJ) Preface: *„By definition, an indefinite inner product space is a real or complex vector space together wit a symmetric (in the complex case: hermitian) bilinear form prescribed on it so that the corresponding quadratic form assumes both positive and negative values. The most important special case arises when a Hilbert space is considered as an orthogonal direct sum of two subspaces, one equipped with the original inner product, and the other with -1 times the original inner product. ... The subject first appeared thirty years ago in the papers of Dirac (DiP) and Pauli (PaW).“*

The modelling framework of the UFT is based on the Hilbert-Krein space theory and the concept of a Krein space intrinsic self-adjoint (Hamiltonian) potential operators. The related proposed dynamic energy norms on all of the Krein space $H^{+}_{\kappa.(\tau)} \otimes H^{-}_{\kappa.(\tau)}$ accompanied by κ_n-quanta numbers are given by, BrK0) p. 15),

$$|||x|||^2_{(\kappa-case)} := \sum_{n=1}^{\infty} \lambda_n^{(\kappa_n)} x_n^2 \,,\, \kappa_n \neq 0$$

with

$$\lambda_n^{(\kappa_n)} := \frac{1}{2}\lambda_n \int_0^{\infty} tanh\left(\frac{1}{2}n\kappa_n\tau\right) e^{-\frac{1}{2}\sqrt{\lambda_n}\tau} d\tau = \sqrt{\lambda_n}\left[\frac{\sqrt{\lambda_n}}{n\kappa_n}\beta\left(\frac{\sqrt{\lambda_n}}{2n\kappa_n}\right) - 1\right].$$

They enable the definition of, (1) *two-component dynamic* $\otimes$ *dynamic energy systems* in the form $H_{\kappa_1} \times H_{\kappa_2}$, and (2) *one-component mechanical* $\otimes$ *dynamic energy systems* in the form $H_1 \otimes H_{\kappa}$. Finally, the one-component Krein space based system $H_1 \otimes H_{\kappa}$ can be approximated by a purely Hilbert space based system in the form $H_{1/2} = H_1 \otimes H_1^{\perp}$.

The „creative“ dynamic quanta pair resp. their appropriately define sequences of electrino and positrino quanta numbers, builds the space- and timeless *a priori* dynamic vacuum („ground state energy“) system. The combination of two electrinos res. two positrons accompanied by correspondingly defined sequences of quanta numbers build the „perfect plasma“ dynamic system and the composed quanta pair of electron & proton. In the same manner the next layer is built, the „perfect electroton-magneton“ dynamic system is built. So far, all sequences of quanta number are less than one and all quanta are governed by purely (time- and spaceless) dynamic energy. The latter „perfect electromagnetic“ system enables the building of further physical quantum types, accompanied by correspondingly defined mechanical quanta with quanta numbers > one providing three types of mechanical atomic nuclei. Those quanta energy field systems are called Dirac $^{2.0}$ systems. They are in line with three physical types of atoms, conductor, semi-conductor, and non-conductor.

Note: The „potential differences“ between quanta and anti-quanta reflected by the potential operator of the considered system may be interpreted as a kind of „Mie pressure“ of the Mie theory, ((WeH) (WeH1).

Note: In the Dirac 2.0 system the „quantum particles may have positive masses, even though the classical waves travel at the speed of light“, (this solves the „YME mass gap problem“).

Note: The commutators of two self-adjoint dynamic potential operators are accompanied by a well known result in form of an "variance inequality" enabling an uncertainty principle, (DaS) Theorem 2.1, (FoG), (NeJ).

Note: The Krein space based quanta system scheme may be approximated by a simple $H_{1/2}$ Hilbert space system. In this case the mechanical energy of the classical fluid element is complemented by a dynamical energy component $H_1^{\perp}$. The $H_{1/2} = H_1 \otimes H_1^{\perp}$ Hilbert space is the natural extension of the standard variational mechanical energy Hilbert space H_1 with inner product defined by the Dirichlet integral $(u,v)_1 := D(u,v) := (\nabla u, \nabla v)$. The Prandtl operator plays a key role in aerodynamics, as well as in fluid dynamics (especially in the context of a well-posed NSE problem and the related (pressure) Neumann problem). The considered „fluid“ quantum particle may be interpreted as a „rotating fluid“ solving the „3D nonlinear, non-stationary NSE problem“, (BrK9). It also turned out that the norm $\|x\|^2_{1/2}$ of such a dynamic 1-fluid-component is isometric to an inner product in the form $(Qx, Px)_0$, where Q, P denote Schrödinger‘s position & momentum operators, indicating an alternative Schrödinger$^{2.0}$ operator, (BrK6).

2. The symmetry group of the creative vacuum and plasma systems

The symmetry group of the two dynamic quanta pair systems, the vacuum and the plasma systems, is the complex Lorentz transformation $S^3 \times S^3 \cong SU(2) \times SU(2)$; this is the hidden symmetry group of the Coulomb problem. It is the set of all pairs of 2×2 matrices with determinant one, which are connected (!) by a multiplication law. The group S^3 (the unit quaternions of the quaternion algebra $|\boldsymbol{H}$) contains the isomorphic normal subgroups $G \coloneqq \psi(S^3 \times e)$, $G' \coloneqq \psi(e \times S^3)$ of the group $SO(4)$, where ψ denotes the surjective orthogonal mapping $\psi(a,b) : |\boldsymbol{H} \to |\boldsymbol{H}, x \to ax\bar{b}$. Accordingly, the symmetry group $G \times G'$ becomes the most appropriate candidate for the mechanical $\otimes$ dynamic quanta pair systems.

3. Related mechanical energy Hilbert sub-spaces $\boldsymbol{H_2}$, $\boldsymbol{H_1}$ of $\boldsymbol{H_{(\tau)}}$

There is a consistent bottom up hierarchy of the above Krein-Hilbert (energy) spaces starting from an *a priori* dynamic vacuum energy field (the largest field) up to the domain H_2 of the symmetric Laplace potential operator $-\Delta$. The (Sobolev) Hilbert space H_2 is the standard domain of elliptic, parabolic, and hyperbolic PDE equations; it is compactly embedded into the mechanical (variational) energy Hilbert space H_1.

The mechanical model "potential" operators of elliptic and parabolic PDE are the Laplace potential $-\Delta$ and the related heat equation operator $\partial/\partial t - \Delta$; their appropriate domains with regards to well defined convergent energy norms are the (variational) H_1 resp. the (classical) H_2 energy (Sobolev) Hilbert spaces. In the calculus of variations the Dirichlet integral defines the inner product of the standard mechanical energy Hilbert space H_1. The Hilbert space H_2 is the sub-space of the mechanical (variational) energy Hilbert space H_1; the latter one is defined by the self-adjoint Friedrichs extension of the symmetric Laplace potential operator $-\Delta$ with domain H_2.

Krein (energy) spaces are proposed as mechanical $\otimes$ dynamic energy spaces. Those are indefinite inner product vector spaces with a symmeric (in the complex case: hermitian) bilinear form prescribed on it so that the corresponding quadratic form assumes both positive and negative values, (BoJ). In our case the underlying extended Hilbert space $H_{(\tau)}$ of the Hilbert scales H_α is defined by the inner product resp. norm

$$(x,y)_{(\tau)} = \sum_1^\infty e^{-\sqrt{\lambda_i}\tau}\, x_n\, y_n, \quad \|x\|_{(\tau)}^2 = (x,x)_{(\tau)}.$$

The (τ)-norm is weaker than any α-norm, i.e., $\|x\|_{(\tau)}^2 \le c\|x\|_\alpha^2$ for any α-norm with $c = c(\alpha,\tau)$ depending only on α and τ, i.e. there is a compact embeddingness in the form $\mathrm{H}_2 \subset \mathrm{H}_1 \subset H_{1/2} = H_1 \otimes H_1^\perp \subset H_{(\tau)}$. It turned out that the mechanical model "potential" operator of hyperbolic PDE, the wave operator equipped with the domain $H_{(\tau)}$ is also well defined and that the $H_1 \otimes H_1^\perp$ decomposition enables an alternative Schrödinger$^{2.0}$ operator, (BrK6).

4. "Action" caused by potential difference and the least action principle

The mechanical and dynamical energy field model is based on a Hermitian operator expressed as the sum of two Hermitian operators, a mechanical and a dynamical operator. The domain of the "mechanical energy operator" is given by the (weak) standard energy Hilbert space H_1 with the (Dirichlet integral based) inner product $(x,y)_1 = \sum_1^\infty \lambda_n\, x_n\, y_n$ and norm $\|x\|_1^2 = \sum_1^\infty \lambda_n x_n^2$. The domain of the "dynamical energy operator" (which is given by the (κ- case specific) Krein space intrinsic self-adjoint *J*-operators, (AzT), (BoJ)) defined on all of the Hilbert space $H_{(\tau)} = H_{\kappa.(\tau)}^+ \otimes H_{\kappa.(\tau)}^-$.

The invariant quantities in the energy conservation laws are called „functionals". In the Krein space framework those functionals are the (κ- case specific) indefinite norms, which may be interpreted as "potential differences" of the considered energetical system. In order to govern the overall conservation of energy laws in Hilbert scales in a Minkowski space-time world the well defined "least action principle" may be applicable.

Note: The kinetic energy of a gravitational potential is a result of a falling potential difference.
Note: The "potential difference" in form of a membrane in running water is the acknowledge biological concept to build a cell.

5. Bohm's wholeness, implicate & explicate order in physical laws

(BoD1) p. 111: *„What we usually call „particles" are relatively stable and conserved excitations on top of this vacuum. Such particles will be registered at the large-scale level, where apparatus is sensitive only to those features of the field that will last a long time, but not to those features that fluctuate rapidly. Thus, the „vacuum" will produce no visible effects at the large-scale level, since its fields will cancel themselves out on the average, and space will be effectively „empty" for an electron in the lowest band, even though the space is full of atoms"*

(BoD1) p. 186: *„What is being suggested here is that the considerations of the difference between lens and hologram can play a significant part in the perception of a new order that is relevant for physical law.*

(BoD1) p. 188: *„There is the germ of a new notion of order here. This order is not to be understood solely in terms of a regular arrangement of objects (e.g. in rows) or as a regular arrangement of events (e.g. in a series). Rather, a total order is contained, in some implicit sense, in each region of space and time.*
Now the word „implicit" is based on the verb „to implicate". This means „to fold inward" (as multiplication means „folding many times"). So we may led to explore the notion that in some sense each region contains a total structure „enfolded" within it."

6. The implicate & explicate energetical κ-quanta scheme

The Krein space based κ-quanta scheme is defined by related appropriately defined sets of quantum numbers κ_n according to the following table. The building processes from the underlying two fundamental dynamical „vacuum quanta", the electrino and the positrino, happen randomly.

Model case	**EP**	**Anti-EP**	**QN** quantum numbers	**QN** quantum numbers	**Potential** quantum numbers
$\kappa - case$	$q \in H^{+}_{\kappa.(\tau)}$	$q^{anti} \in H^{-}_{\kappa.(\tau)}$	q_n	q_n^{anti}	$\boldsymbol{\kappa_n} := \lvert q_n - q_n^{anti} \rvert$
Vacuum particle neutrino ν	$\nu := \epsilon \otimes \pi$	$\nu = \epsilon \otimes \pi$	$n_\nu = n_\pi + n_\epsilon = \frac{1}{2}$	$n_\pi + n_\epsilon = \frac{1}{2}$	$\kappa_\nu = 0$
Vacuum particle electrino ϵ	ϵ	$\epsilon \otimes \pi \otimes \pi$	$n_\epsilon := \frac{2n-1}{4n-1}$	$\frac{6n-1}{4n-1}$	$\kappa_\epsilon = \frac{4n}{4n-1}$
Vacuum particle positrino π	π	$\pi \otimes \epsilon \otimes \epsilon$	$n_\pi := \frac{2n}{4n-1}$	$\frac{6n-2}{4n-1}$	$\kappa_\pi = \frac{4n-2}{4n-1}$
Plasma particle electron e	$e := \epsilon \otimes \epsilon$	$p := \pi \otimes \pi$	$n_e = \frac{4n-2}{4n-1}$	$n_p = \frac{4n}{4n-1}$	$\kappa_e = \frac{1}{2n-1/2}$
Plasma particle positron p	$p := \pi \otimes \pi$	$e := \epsilon \otimes \epsilon$	$n_p = \frac{4n}{4n-1}$	$n_e = \frac{4n-2}{4n-1}$	$\kappa_p = \frac{1}{2n-1/2}$
Plasma particle neutron $\underline{n}$	$\underline{n} := \nu \otimes \nu$	–	$n_{\underline{n}} = \frac{4n-1}{4n-1} = 1$	0	$\kappa_{\underline{n}} = 1$
Maxwell-Mie particle electroton $\underline{e}$	$\underline{e} := e \otimes \pi$ $\underline{e} = \epsilon \otimes \epsilon \otimes \pi$	π	$n_{\underline{e}} = \frac{6n-2}{4n-1}$	$\frac{2n}{4n-1}$	$\kappa_{\underline{e}} = \frac{4n-2}{4n-1} = \kappa_\pi$
Maxwell-Mie particle magneton $\underline{m}$	$\underline{m} := p \otimes \epsilon$ $\underline{m} = \pi \otimes \pi \otimes \epsilon$	ϵ	$n_{\underline{m}} = \frac{6n-1}{4n-1}$	$\frac{2n-1}{4n-1}$	$\kappa_{\underline{m}} = \frac{4n}{4n-1} = \kappa_\epsilon$
Atomic nucleus particle positronium N^+ (*)	$N^+ := \underline{m} \otimes \underline{m}$	electron $e = \epsilon\epsilon$	$n_{2\underline{m}} = \frac{12n-2}{4n-1}$	$n_e = \frac{4n-2}{4n-1}$	$\kappa_{N^+} = \frac{8n}{4n-1}$
Atomic nucleus particle electronium N^-	$N^- := \underline{e} \otimes \underline{e}$	positron $p = \pi\pi$	$n_{2\underline{e}} = \frac{12n-4}{4n-1}$	$n_p = \frac{4n}{4n-1}$	$\kappa_{N^-} = \frac{8n-4}{4n-1}$
Atomic nucleus particle neutronium N^0	$N^0 := \underline{e} \otimes \underline{m}$	neutrino $\nu = \epsilon\pi$	$n_{\underline{em}} = \frac{12n-3}{4n-1} = 3$	$n_\nu = \frac{1}{2}$	$\kappa_{N^0} = \frac{5}{2}$

(*) the notion is proposed in (UnA2) p. 96

Note: The quanta number sequences are related to each other in the following form $0 < \kappa_e = \kappa_p \leq \frac{2}{3} \leq \kappa_\pi = \kappa_{\underline{e}} < 1 < \kappa_\epsilon = \kappa_{\underline{m}} \leq \frac{4}{3} \leq \kappa_{N^-} < 2 < \kappa_{N^+} \leq \frac{8}{3}$ with $\kappa_e = \kappa_p \to 0 = \kappa_\nu$, $\kappa_\pi = \kappa_{\underline{e}}, \kappa_\epsilon = \kappa_{\underline{m}} \to 1 = \kappa_{\underline{n}}$, $\kappa_{N^-}, \kappa_{N^+} \to 2 = \kappa_{N^0} - n_\nu$.

The vacuum and plasma quanta (ϵ, π, ν, e, p) are all implicate dynamic entities. The proposed symmetry group of the dynamic vacuum and plasma quanta pair systems is the complex Lorentz transformation $S^3 \times S^3 \cong SU(2) \times SU(2)$.

The characteristics of *collisionless* plasma dynamics is the Landau damping phenomenon. It is a wave damping without energy dissipation by elementary particle collisions, i.e., it is about the possibility of resonance between the wave phase velocity and the velocity of individual electrons. Landau damping *„may also have application in other fields. For instance, in the kinetic treatment of galaxy formation, stars can be considered as atoms of a plasma interaction via gravitational rather than electromagnetic forces*“, (ChF) p. 245.

The electroton $\underline{e}$, the magneton $\underline{m}$, and the three Dirac [2.0] atomic nucleus quanta $N^{\pm,0}$ may be considered as (explicate) mechanical entities. „Folding inwards“ those systems lead to the underlying creative „actual entities“ (WhA). They might be also called monades [2.0] (see below).

The creative dynamic vacuum quanta pairs to build
condensed plasma quanta pairs

Dynamic quanta pair field types	Dynamic Entity
vacuum energy field	***(electrino,positrino)*** $(\boldsymbol{\epsilon}, \boldsymbol{\pi})$
plasma energy field	(electron,positron) $(e = \epsilon\epsilon, p = \pi\pi)$

(DaJ) p. 26: Davidson's creative vacuum
"*..., what looks to us as solid is actually a dance of tiny particles in a vacuum. In fact, if all the space were compressed out of our planet earth, it would end up the size of a tennis ball, or some say, even a pea. The exact final dimension is irrelevant because firstly it is not likely to happen and secondly the point is made either way. In summary, then, according to modern physics:* physical material substance is mostly nothing or vacuum."

The dynamic plasma quanta pairs as
condensed vacuum quanta pairs

Expressed colloquially, *plasma is an ionized gas consisting of approximately equal numbers of positively and negatively charged particles*."

Dynamic quanta pair field types	Dynamic Entity
vacuum energy field	(electrino,positrino) (ϵ, π)
plasma energy field	***(electron,positron)*** $(\boldsymbol{e} = \boldsymbol{\epsilon\epsilon}, \boldsymbol{p} = \boldsymbol{\pi\pi})$

The (dynamic) plasma quanta pairs may be interpreted as condensed (dynamic) vacuum quanta pairs. Those plasma quanta pairs are characterized by an identical absolute amount of „charges“ close to $1/2$, a property, which is in line with the Landau damping phenomenon. The composition of those pairs is called *neutron* accompanied by the quantum numbers one. The (purely mathematical) vacuum quanta pairs are characterized by nealy identical $\pm$ „charges“ with quanta numbers close to one; the related potential differences defines the potential operator enabling the definition of the inner product of the „ground state energy“ space.

The dynamic electromagnetic quanta pairs as
condensed vacuum and plasma quanta pairs

Dynamic quanta pair field types	**Mechanical Entity**	**Dynamic Entity**
vacuum energy field		(electrino,positrino) (ϵ, π)
plasma energy field		(electron,positron) $(e = \epsilon\epsilon, p = \pi\pi)$
electromagnetism energy field	***(electroton, magneton)*** $(\underline{\boldsymbol{e}} = \boldsymbol{\epsilon\epsilon\pi}, \underline{\boldsymbol{m}} = \boldsymbol{\pi\pi\epsilon})$	***(positrino, electrino)*** $(\boldsymbol{\pi}, \boldsymbol{\epsilon})$

The dynamic electromagnetism quanta pairs are built by appropriate compositions of plasma and vacuum quanta. The explicate x implicate forms $(\underline{e}, \pi)$ resp. $(\underline{m}, \epsilon)$ may be interpreted as "*cohesive electrical pressure*" resp. as "*cohesive magnetic pressure*" as proposed by Mie, (WeH1) p. 206. The Mie Theory overcomes current modelling challenges of the Maxwell equations concerning the electromagnetic currents. The Maxwell-Mie model is in line with Leedskalnin's claim, that magnetic and electric current is (basically) the same. It delivers an explaning of Ehrenhaft's discovery of the photophoresis phenomenon.

Note: In classical electricity theory the electric flux is a flux of charges transported by the electrons in metals. The „pressure" by which the electrons are pushed into the conductive wire is called *electric tension* or *electric potential*.

The atomic Dirac $^{2.0}$ quanta built from the
three possible combinations of the electromagnetic quanta

The challenge of the Dirac $^{1.0}$ quantum system

(FeE): *„Dirac's theory of radiation is based on a very simple idea; instead of considering an atom and the radiation field with which it interacts as two distinct systems, he treats them as a single system whose energy is the sum of three terms: one representing the energy of the atom, a second representating the electromagnetic energy of the radiation field, and a small term representing the coupling energy of the atom and the radiation field.*"

The Dirac $^{2.0}$ quanta scheme provides three atomic nuclei quanta, which are called positronium, electronium, and neutronium accompanied by correspondingly defined quanta numbers > 2. They are built by three possible combination of the two (dynamic) electromagnetic quanta, the electroton and the magneton.

Mechanical Entity	**(explicate, implicate) structure**
positronium $^{(*)}$ N^+: $2\underline{m}$	(N^+, e)
electronium N^-: $2\underline{e}$	(N^-, p)
neutronium N^0: $\underline{em}$	(N^0, ν)

$^{(*)}$ notion is proposed in (UnA2) p. 96;

Note: The 2-component electronium-positronium quanta pair system (N^-, N^+) may be interpreted as mechanical hot plasma system. It probably may provide an appropriate model as a solar building block in the sense of (RoP)), where each quanta pair (N^-, N^+) is balanced by a „neutral" 1-component composition of a two neutronium $2N^0$ mechanical quantum elements.

Note: The mechanical Dirac $^{2.0}$ (Krein space based) quanta energy field model (with indefinite metric) solves the *YME mass gap problem* of the Clay Mathematics Institute.

The $H_{1/2}$ energy Hilbert space based approximation model
of the Krein space based quanta system scheme

The Krein space based quanta system scheme can be approximated by the energy (Hilbert space based) model $H_{1/2} = H_1 \otimes H_1^{\perp}$; the standard mechanical energy Hilbert space H_1 is compactly embedded into $H_{1/2}$; $H_1^{\perp}$ is a closed sub-space of $H_{1/2}$, which may be interpreted as dynamic energy field. The dynamic quanta elements of $H_1^{\perp}$ may be interpreted as alternative field intrinsic "potential functions", alternatively to physical case specific defined potential functions like the potential function $V(r)$ in Schrödinger's harmonic quantum oscillator equation. The tool to build the orthogonal relationship between the mechanical and the dynamic (energy) worlds are the Riesz transforms (resp. the 1D-Hilbert transform).

Note: The mechanical $\otimes$ dynamic (Hilbert space based) quanta energy field model $H_{1/2} = H_1 \otimes H_1^{\perp}$ solves the *3D-NSE problem* as the non-linear energy term of the 3D non-linear, non-stationary NSE system is bounded with respect to the $H_{1/2}$ energy norm as a simple consequence of the Sobolevskii inequality (BrK11), (SoP).

Note: The pressure p of the NSE can be expressed in terms of the velocity u by the formula $p = \sum_{j,k=1}^{3} R_j R_k (u_j u_k)$, where $\boldsymbol{R} := (R_1, R_2, R_3)$ is the Riesz transform and $\boldsymbol{u} \otimes \boldsymbol{u} = (u_j u_k)$ is a $3x3$ matrix.

Note: In the calculus of variations the ("weak" mechanical energy) Hilbert sub-space H_1 of $H_{1/2} = H_1 \otimes H_1^{\perp}$ is governed by Fourier waves, while the related complementary closed ("weak" dynamic energy) sub-space $H_1^{\perp}$ of $H_{1/2}$ (which is not a Hilbert space (!)) is governed by Calderón wavelets [(*)]. Newton's indecomposable (rainbow) spectral colors are in line with the concept of Fourier waves accompanied by the H_1 domain and a discrete spectrum. Goethe's comprehensive field model and his proposed concept of an "effective cloudy" (the third force) might be consistently modelled by wavelets with the related domain, i.e. the complementary closed ("weak" dynamic energy) sub-space of $H_{1/2}$ accompanied by a continuous spectrum.

Note: The $H_{1/2} = H_1 \otimes H_1^{\perp}$ Hilbert space decomposition in combination with the Riesz transform provides an alternative *Schrödinger [2.0] (-Calderon) quantum momentum operator*, (BrK6).

Note: The Krein space based quanta system scheme is based on the extended Hilbert space $H_{(\tau)}$ of the Hilbert scales H_α defined by the inner product resp. norm

$$(x, y)_{(\tau)} = \sum_1^{\infty} e^{-\sqrt{\lambda_i}\tau}\, x_n\, y_n, \quad \|x\|_{(\tau)}^2 = (x, x)_{(\tau)}.$$

It is linked to the energy Hilbert space $H_{1/2} = H_1 \otimes H_1^{\perp}$ by the energy equation of a vibrating string governed by the norm of $H_{(\tau)}$ in the form

$$\|x\|_{1/2}^2 = \frac{1}{2}\int_0^{\infty} \left[\|x'\|_{(\tau)}^2 + \|\dot{x}\|_{(\tau)}^2\right] d\tau\,.$$

Note: The $H_{1/2}$ Hilbert space plays also a key role in the Teichmüller theory and the universal period mapping via quantum calculus accompanied by a *canonical complex structure* for $H_{1/2}$, (NaS). The degree or winding number of maps of the unit circle into itself corresponds to a related $H_{1/2}$-norm enabling the statement „one cannot her the winding number", (BoJ). The underlying crucial mathematical theorem is provided by the Theorem A.3 in (BoA).

7. The potentially three atomic nucleus types for an order-from-order creation process of first atoms

According to the deductive structure the perfect plasma system provides the physical baseline „actual entities“. Nearly all of the physical matter in the universe is in „plasma state“. The electronium-positronium quanta pair (N^-, N^+) can be interpreted as mechanical hot plasma energy system, which is counter-balanced by a „colder“ 1-component neutronium $2N^0$ mechanical energy system. This may provide an appropriate model as a solar building block in the sense of (RoP). Then, the cosmic background radiation and the Landau damping phenomenon may be interpreted as characteristics of the creation process of electromagnetic plasma „mechanical entities“ in the universe. The „colling process“ in such a solar mechanical plasma system, i.e. the conversion from (N^-, N^+) quanta pairs to $N^0 + energy$, might provide an appropriate model for the creation of the atomar elements. Looking at the special role of noble gases, the sophisticated roles of hydrogen, the Pauling model of electronegativity, and the chemical fake entity H^+ of a free proton in water solution, (VoD1) p. 31, the three types of mechanical Dirac $^{2.0}$ nuclei types may improve the current structure of the period table of elements.

The three most present chemical substances in the sun are hydrogen, oxygen, and carbon, (JeJ) p. 163. Viktor Schauberger considered the oxygen as the assistant of the sun at Earth, (BaA) p. 51, and water as the source of life. He saw water as a pulsating substance that energizes all of life, both organic and inorganic, (BaA) p. 31, and hydrogen as the “carrier” of both, carbone and oxygen [(*)]. Viktor Schauberger called the temperature +4° C the state of indifference of water, meaning that when in its highest natural condition of health, vitality and life-giving potential, water is an internal state of energetic equilibrium and in a thermally and spacially neutral condition.

Explicate hydrogen-hydroxyl bonds (i.e. destilled water) are not existing in the „mechanical vacuum“ of our solar system. So the question arises, which „action“ is required to build such a stable (non-conducter) network on Earth maintaining two separate (explicate) mechanical energy (quanta) systems? As the crucial differentiator between the Earth and the other planets in our solar system (w/o any or negligible water) is its magnetic field. Therefore, this magnetic field may enable the creation of an explicate two-component (hydrogen & hydroxyl) energy system accompanied by correspondingly implicate two-component entities. This rare characteristic of Earth may support the argument in (WaP).

Note: According the P.-M. Robitaille there are two separate mechanical energy systems within destilled water: hydroxyl (OH) and hydrogen (H), (RoP2). Assuming that there is a third nucleus type for carbone-hydrogen (C^*H) bonds this may enable higher energetical nucleus entities types for water (H_2O) and carbs, i.e. carbohydrates, e.g. in forms like $C_6H_{12}O_6 \cong (HC)_6\text{-}(OH)_6$. The correspondingly calculated sequences of quanta numbers ensure related potential differences between the underlying explicate and implicate quanta [(*)], i.e. also all biological entity types contain *ground state* or *perfect plasma* entities. Viktor Schauberger used to call this type of polarity Nature’s engine, (BaA) p. 51.

Note: Deleuze’s related concept of „(constitutive) difference“ is examplary eplained by the biological membrane; a membrane in running mineralized water is the required prerequiste to create a cell.

Note: This modelling approach puts the spot on the fuel cell concept (i.e. an electrochemical cell that converts chemical energy directly into electricity) and related different electrolytes (i.e. different substances that conduct charged ions from one electrode to the other) of fuel cells (e.g. a proton-exchange membrane based fuel cell).

[(*)] (BaA) p. 51: Schauberger used the term „carbones“ for all those elements, (the extra „e“ meaning more than just „carbon“), because of the prevalence of various sorts of carbonous matter in the multitude of living organisms ..., see also (LaS) S. 252
[(**)] (BaA) p. 34, Temperature control: Viktor Schauberger „showed how small variations in temperature are as crucial to the healthy movement of water and sap as they are to the human blood. He identified in particular the importance for water of the temperature of +4° C, referred to physically and chemically as the „anomaly point,“ when water is at densest and has the greatest vitality, health and energy content. ... In all forms of water, in trees and other living organisms, the temperature gradient (the upward and downward movement of temperature) is active. .. Each form of gradient has its special function in Nature’s great production.“
(BaA) p. 108: The creation of water: Where does water come from? No one really knows. It is one of Nature’s mysteries. ... Water is conventionally described as H_2O, having two hydrogen atoms, each carrying a positive external cahrge, and one oxygen atom carrying zwo negative external charges. It has, however, been analyzed to contain 18 different compounds and 15 separate types of ions. Both seawater and our bodies contain 84 elements in the same proportion. There is 4% salt in our blood; in the oceans it is also 4%. ... Carbon, its (water‘s) so-called inorganic counterpart, has a similar capacity that no other elements possess.
(BaB) p. 110, destilled water is a non-conductor; mineralized water is not: *„V. Schauberger called it „juvenile water“, because it has no developed character or qualities. It is hungry like a baby. .. Water is mature when it is suitably enriched with raw material, what we call „impurities“, on which other organisms depend for their energy and life*“.
(BaA) p. 131: *„Viktor Schauberger designed an experiment to demonstrate how groundwater rises during the day and recedes at night*“

8. The restricted real Lorentz group and the complex Lorentz group
(StR)

The Lorentz transformation in special relativity is a simple type of rotation in hyperbolic space.

The Lorentz group L has four components, each of which is connected in the sense that any point can be connected to any other, but no Lorentz transformation in one component can be connected to another in another component. One of this components is the restricted Lorentz group, which is the group of $2x2$ complex matrices of determinant one, $SL(2,C)$. It is isomophic to the symmetry group $SU(2) \cong SL(2,C)$, containing as elements the complex-valued rotations, which can be written as a complex-valued matrix of type

$$\begin{pmatrix} a+ib & c+id \\ -c+id & a-ib \end{pmatrix} \text{ with determinant one.}$$

It is important in describing the transformation properties of spinors. In SMEP the group $SU(2) \cong SL(2,C)$ describes the weak force interaction with 3 bosons W^+, W^-, Z.

Another group associated with the Lorentz group L is the complex Lorentz group $L(C)$, [(*)]. It has just two connected components, $L_+(C)$ and $L_-(C)$. The transformations 1 and -1, which are disconnected in L are connected in $L(C)$. In other words, the complex Lorentz transformation connects

- the two components containing the 1-transformation and space-time inversion
- the two components containing the space inversion and the time inversion.

Just as the restricted Lorentz group is associated with $SL(2,C)$, the complex Lorentz group is associated with $SL(2,C) \otimes SL(2,C) \cong SU(2) \otimes SU(2)$. There is also a two-to-one homomorphism from $SL(2,C) \times SL(2,C)$ onto $L(+,C)$.

The spin of an elementary particle is its eigen-rotation with exactly two rotation axes, one parallel and one anti-parallel axis to a magnetic field. This is the 2×2 complex number scheme, where every „normal“ rotation is contained twice. Consequently, an electron has a charge only half of the Planck's quantum of action.

[(*)] The complex Lorentz group is composed of all complex matrices satisfying

$$\Lambda^{\kappa}{}_{\mu}\Lambda_{\kappa\nu} = g_{\mu\nu} \text{ or } \Lambda^T G \Lambda = G, \qquad (1\text{-}5).$$

It has just two connected components, $L_+(C)$ and $L_-(C)$ according to the sign of det(Λ). The transformations 1 and -1, which are disconnected in L are connected in $L(C)$. In other words, the complex Lorentz transformation connects

- the two components containing the 1-transformation and space-time inversion, i.e. the pair
$$\{\det(\Lambda) = +1, \det(\Lambda^0{}_0 = +1)\}, \{\det(\Lambda) = +1, \det(\Lambda^0{}_0 = -1)\},$$
- the two components containing the space inversion and the time inversion, i.e. the pair
$$\{\det(\Lambda) = -1, \det(\Lambda^0{}_0 = +1)\}, \{\det(\Lambda) = -1, \det(\Lambda^0{}_0 = -1)\}.$$

Summary:

While two (real) Lorentz transformations need to be connected to one another by an appropriately defined continuous curve of Lorentz transformations, there are two pairs of components of the complex Lorentz transform, which are both already connected by definition.

Just as the restricted Lorentz group is associated with $SL(2,C)$, the complex Lorentz group is associated with $SL(2,C) \otimes SL(2,C)$. The latter group is the set of all pairs of $2x2$ matrices of determinants one with the multiplication law

$$\{A_1, B_1\} \cdot \{A_2, B_2\} = \{A_1A_2, B_1B_2\}.$$

Is is easy to see that only matrix pairs which yield a given $\Lambda(\mathrm{A},\mathrm{B})$ are $(\pm\mathrm{A}, \pm\mathrm{B})$. In particular,

$$\Lambda(-1,1) = \Lambda(1,-1) = -1.$$

The corresponding complex Poincare group admits complex translation but also the multiplication law

$$\{a_1, \Lambda_1\} \cdot \{a_2, \Lambda_2\} = \{a_1 + \Lambda_1 a_2, \Lambda_1\Lambda_2\}.$$

It has two components $\mathrm{P}_{\pm}(C)$, which are distinguished by $\det(\Lambda)$ and a corresponding inhomogeneous group to $SL(2,C)$.

9. Unzicker's suggestion out of the two Dirac conjectures

„The quantum effects of gravity start at the size of an atomic nucleus and not at the far smaller, unobserved Planck's length of 10^{-35} meters."

(UnA) p. 225: *"Dirac's conjecture – that the number of particles in the universe 10^{80} is related to its size (which is 10^{40}) proton radii- clashes with all established concepts .... It suggests that the quantum effects of gravity start at the size of an atomic nucleus and not at the far smaller, unobserved Planck's length of 10^{-35}) meters that this is 20 powers of ten below the nucleus' radius is the result of Dirac's hypothesis. (However, it doesn't have any fundamental meaning.)"*

Dirac's new basis for cosmology

(UnA2) p. 73: "*Dirac's first conjecture (DiP2): In the hydrogen atom, nature's simplest stable structure, the constituent proton and electron are held together by electric force. Yet their gravitational attraction, however small it may be, can also be calculated theoretically. Dirac noticed that the ratio of the two forces ... was an incredibly huge number (about 10^{39}) with almost 40 digits*."

(UnA2) p. 74: "*Dirac has discovered a second conjecture, connected to the first conjecture, which make a random coincidence extremely unlikely. After the first estimates of the total mass M(U) of the universe in the 1930s, Dirac divided M(U) by the mass of the proton m(p), thus arriving at the ball-park figure of the number of particles in the universe, 10^{78} the square of that other mysterious, but lent substance to the first obeservation. For decades, Dirac's second observation has defied all attemps at explanation. In particular, it seems to jeopardize all established cosmological models. For normally the number of particles should be proportional to the volume, i.e. the third power of the linear dimensions of the cosmos, not just to the second. All the more remarkable, however, is that Dirac's cosmology ultimately follows from Einstein's pivotal idea of a variable speed of light back in 1911, if one consequently applies Dicke's formulation of 1957*", (see also (UnA1).

Mach's principle 2.0

(UnA1) p. 156: „*To round off the value of Dirac's observation, however, one should mention that it is in complete harmony with Ernst Mach's thoughts on gravity, though Dirac apparently never dealt with Mach. ... The fact that Dirac considered the size and the mass of the universe, the two quantities that Mach also related to the origin of gravity, constitutes another piece in this fascinating puzzle.*

However, Dirac's observation goes beyond Mach's principle. Imagine that the number of particles in the universe was billion times larger, while simulataneous their mass was a billion times smaller. This would change nothing about Mach's principle (or ‚flatness') but it would alter Dirac's observation. In other words, Dirac was the first to insinuate that the size and the mass of elementary particles had a meaning, and that it is no coincidence that they are as large and heavy as they are. Who thought soothe same? You've guessed it – Albert Einstein:

> „The real laws of nature are much more restrictive than the ones we know. For instance would it not violate our known laws, if we found electrons of any size or iron of any specific weight. Nature however only realizes electrons of a particular size and iron of very specific weight."

10. Unzicker's question: Does a neutron feel the age of the universe?

(UnA2) p. 95: „*From a philosophical point of view, the half-life of the neutron of about ten minutes is a basic quantity that calls for an explanation. ... Claiming that the decay of the neutron can be deduced within the variable speed of light model would certainly be premature. In any case, however, the phenomenon of radioactivity will only be thorughly understood once the half-life of the neutron is calculated from first principles. .... However, if the mass ratio of proton/electron does depend logarithmically on the age of the universe, then it follows that at the time of the „Big Flash" the electron and proton were of equal weight. ... The hydrogen atom would then be similar to an object now called positronium, consisting of an electron and its antiparticle positron that orbit each other. .... This would imply that the orbital speed of the electron in the hydrogen atom was equal to the speed of light.... This, in turn, suggests that the hydrogen atom – at that time an orbiting electron-positron pair – could simply be seen as a rotating light wave.*

C. The dynamic fluid and the Dirac $^{2.0}$ atomic nucleus entities solving two millennium problems (NSE & YME)

1. A well posed 3D-NSE system governed by a $H_{1/2} = H_1 \otimes H_1^{\perp}$ mechanical x dynamic energy Hilbert space

"... making substantial progress from a theoretical point of view toward a mathematical theory which will unlock the secrets hidden in the Navier-Stokes equations"

where the mechanical energy of the classical fluid element is complemented by a dynamical energy enabling convergent related energy norm estimates.

Navier-Stokes Equation - Clay Mathematics Institute

"*This is the equation which governs the flow of fluids such as water and air. However, there is no proof for the most basic questions one can ask: do solutions exist, and are they unique? Why ask for a proof? Because a proof gives not only certitude, but also understanding.*

Waves follow our boat as we meander across the lake, and turbulent air currents follow our flight in a modern jet. Mathematicians and physicists believe that an explanation for and the prediction of both the breeze and the turbulence can be found through an understanding of solutions to the Navier-Stokes equations. Although these equations were written down in the 19th Century, our understanding of them remains minimal. The challenge is to make substantial progress toward a mathematical theory which will unlock the secrets hidden in the Navier-Stokes equations."

Note: The standard (variational (!)) mechanical energy Hilbert space H_1 is replaced by the (polynomial-decay) energy Hilbert space $H_{1/2} = H_1 \otimes H_1^{\perp}$. It turned out that the non-linear energy term of the 3D non-linear, non-stationary NSE system is bounded with respect to the $H_{1/2}$ energy norm as a simple consequence of the Sobolevskii inequality (BrK11), (SoP), (GiY). The tool to build the orthogonal relationship between the mechanical H_1 world and the dynamic $H_1^{\perp}$ world is the Riesz operator, (BrK11).

Note (the central energy inequality): Putting $B(u) := P(u, grad)u)$ in the NSE and assuming $Pu_0 = u_0$, the NSE initial-boundary equation is given by

$$\frac{du}{dt} + Au + Bu = Pf \ , \ u(0) = u_0.$$

Multiplying this homogeneous equation with $A^{-1/2}u$ leads to

$$(\dot{u}, u)_{-1/2} + (Au, u)_{-1/2} + (Bu, u)_{-1/2} = 0, \ (u(0), v)_{-1/2} = (u_0, v)_{-1/2} \text{ for all } \ v \in H_{-1/2};$$

the pressure p can be expressed in terms of the velocity in the term

$$(Au, v)_{-1/2} := (\nabla u, \nabla v)_{-1/2} + (\nabla p, v)_{-1/2} = (u, v)_{1/2} + (p, v)_0 \qquad \text{for all } \ v \in H_{-1/2}$$

$$(u(0), v)_{-1/2} = (u_0, v)_{-1/2} \qquad .$$

can be expressed by the formula $p = -\sum_{j,k=1}^{3} R_j R_k (u_j u_k)$ where (R_1, R_2, R_3) denotes the Riesz transform; the corresponding Neumann problem of the pressure field p may be modelled by the Prandtl operator accompanied by the domain $H_{1/2}$ enjoying appreciated properties, (LiI). This also provides additional understanding for "frictionless" boundary modelling problem of the NSE, (GaG).

For $\alpha = -1/2$ one gets from the Sobolevskii-estimates ($^{(*)}$ see also (GiY) lemma 3.2), the generalized "energy" inequality in the form

$$\frac{1}{2}\frac{d}{dt}\|u\|_{-1/2}^2 + \|u\|_{1/2}^2 \le \left|(Bu, u)_{-1/2}\right| \le \|u\|_{-1/2}\|Bu\|_{-1/2} \cong \|u\|_{-1/2}\left\|A^{-1/4}Bu\right\|_0.$$

Putting $y(t) := \|u\|_{-1/2}^2$ one gets $y'(t) \le c \cdot \|u\|_1^2 \cdot y^{1/2}(t)$, resulting into the a priori estimate

$$\|u(t)\|_{-1/2} \le \|u(0)\|_{-1/2} + \int_0^t \|u\|_1^2(s)ds \le c\{\|u_0\|_{-1/2} + \|u_0\|_0^2\},$$

which ensures global boundedness by the a priori energy estimate provided that $u_0 \in H_0$.

$^{(*)}$Lemma 3.2 (GiY): For $0 \le \delta < 1/2 + n \cdot (1 - 1/p)/2$ it holds

$$\left|A^{-\delta}P(u, grad)v\right|_p \le M \cdot \left|A^{\theta}u\right|_p \cdot |A^{\rho}u|_p$$

with a constant $M := M(\delta, \theta, \rho, p)$ if $\delta + \theta + \rho \ge n/2p + 1/2$, $\theta, \rho > 0$, $\theta + \rho > 1/2$. Putting $p := 2$, $\delta := 1/4$,$\theta := \rho := 1/2$ fulfilling $\theta + \rho \ge \frac{1}{4}(n+1) = 1$ it follows

$$\left\|A^{-\delta}P(u, grad)u\right\| \le c\left\|A^{\theta}u\right\| \cdot \|A^{\rho}u\| = c\|u\|_{2\theta} \cdot \|u\|_{2\rho} = c\|u\|_1^2$$

resp.

$$\frac{1}{2}\frac{d}{dt}\|u\|_{-1/2}^2 + \|u\|_{1/2}^2 \le \left|(Bu, u)_{-1/2}\right| \le c \cdot \|u\|_{-1/2}\|u\|_1^2.$$

The Neumann problem and integral equations with (Plemelj's) double layer potentials
(BrK7), (BrK11), (LiI) p. 95 ff., PU)

Note (GaG): The NSE initial boundary value problem determines the initial pressure $p_0(x)$ by the Neumann problem

$$\Delta p_0 = f_0 - u_0 \cdot \nabla u_0 \qquad \text{in } \Omega$$

$$\frac{\partial p_0}{\partial n} = [(\Delta u_0 - u_0 \cdot \nabla)u_0 + f_0] \cdot n \quad \text{at } \partial\Omega$$

with $f_0 := \lim_{t\to 0} f(\cdot, t)$. Applying formally the div-operator to the classical NSE the pressure field must satisfy the following Neumann problem

$$\Delta p = (u \cdot \nabla)u - f \qquad \text{in } \Omega$$

$$\frac{\partial p}{\partial n} = [\Delta u - (u \cdot \nabla)u + f] \cdot n \qquad \text{at } \partial\Omega$$

where n denotes the outward unit normal to $\partial\Omega$.

As it holds that

$$[\Delta u - (u \cdot \nabla)u + f] \cdot n|\partial\Omega \to \left[\Delta u_0 - (u_{\cdot 0}\nabla)u_0 + f_0\right] \cdot n_{|\partial\Omega} \qquad \text{in } H_{-1/2}(\partial\Omega)$$

and

$$\nabla \cdot [f - u \cdot \nabla)u]_{|\partial\Omega} \to \nabla \cdot [f_0 - u_0 \cdot \nabla)u_0]_{|\partial\Omega} \qquad \text{in } H_{-1/2}(\partial\Omega)$$

the pressure p tends to p_0 in the sense that $\|\nabla(p(\cdot, t) - p_0\| \to 0$ as $t \to 0$.

From this it follows that in this framework the prescription of the pressure at the boundary walls or at the initial time independently of u, could be incompatible with and, therefore, could retender the problem ill-posed.

Note: For a closed connected surface $S \subset R^3$ in R^3 the Prandtl operator $\prod: H_r \to H_{r-1}$ is defined by the double layer potential

$$u(x) := \prod(v)(x) := \frac{1}{4\pi} \oiint_S v(y) \frac{\cos \phi_{xy}}{|x-y|^2} dS_y$$

whereby ϕ_{xy} is the angle between the vector $|x - y|$ and the normal n_y to the surface at the point y and $v(y)$ is the density of the double layer potential.

Corollary 1: For $\frac{1}{2} \le r \le 1$ the Prandtl operator $\prod: H_r \to H_{r-1}$ is bounded and the function $u(x)$

$$u(x) := \prod(v)(x) := \frac{1}{4\pi} \oiint_S v(y) \frac{\cos \phi_{xy}}{|x-y|^2} dS_y$$

is an element of $H_1(R^3 - S)$.

Corollary 2: For $\frac{1}{2} \le r < 1$ the double layer potential in the form $u = \prod(v)$ provides the unique solution of the Neumann boundary value problem

$$\Delta u = 0 \quad \text{in} \quad R^3 - S$$

$$\frac{\partial u}{\partial n} = f \quad \text{on } S\,.$$

Note: In the context of the two mechanical and dynamic energy concepts the regularity $u \in H_1(R^3 - S)$ may be interpreted as a mechanical energy field of the exterior space of a closed connected surface $S \subset R^3$; see also (BeJ) et al..

2. The Dirac $^{2.0}$ quanta dynamics model solving the YME mass gap problem

"... making progress in understanding from a theoretical point of view that the quantum particles have positive masses, even though the classical waves travel at the speed of light."

Yang-Mills & The Mass Gap - Clay Mathematics Institute

„The laws of quantum physics stand to the world of elementary particles in the way that Newton's laws of classical mechanics stand to the macroscopic world. Almost half a century ago, Yang and Mills introduced a remarkable new framework to describe elementary particles using structures that also occur in geometry. Quantum Yang-Mills theory is now the foundation of most of elementary particle theory, and its predictions have been tested at many experimental laboratories, but its mathematical foundation is still unclear. The successful use of Yang-Mills theory to describe the strong interactions of elementary particles depends on a subtle quantum mechanical property called the "mass gap": the quantum particles have positive masses, even though the classical waves travel at the speed of light. This property has been discovered by physicists from experiment and confirmed by computer simulations, but it still has not been understood from a theoretical point of view. Progress in establishing the existence of the Yang-Mills theory and a mass gap will require the introduction of fundamental new ideas both in physics and in mathematics."

The so-called *standard model* of elementary particles (SMEP) is about three de-coupled theories with similar characteristics; the underlying independent three groups of elementary particles are governed by Fourier waves, which are in a weak variational PDE equation framework accompanied by the domain H_1. Well defined „wave dynamics" specific PDE models require bounded energy norm estimates. The considered exponential-decay Hilbert space of the UFT provides an appropriate domain framework for well defined hyperbolic wave operators. Accordingly, not the simplest energy Hilbert space model $H_{1/2}$ but the Dirac $^{2.0}$ modelling layer accompanied by well defined wave operators (i.e. including the necessary appropriately defined domains (!)) makes the YME system in its current form obsolete. The Dirac $^{2.0}$ model in a $H_{(\tau)} = H^{+}_{\kappa.(\tau)} \otimes H^{-}_{\kappa.(\tau)}$ framework provides three possible one-component nuclei types with mechanical (mass) energy.

D. The deductive quanta and energy field structure and related opportunities

A. Unzicker
The Mathematical Reality

„... current ideas in physics, especially the standard models of particle physics and cosmology, offer very little help for a real understanding. ... I would like to present a mathematical alternative that could possible replace space and time. .... To achieve a satisfactory understanding of reality. Ultimately, we search for mathematical objects whose properties describe the various physical phenomena in purely mathematical terms", (UnA2) p. 3

J. Holt,
„Why does the world exist?"

Both Leibniz and Descartes, in their rationalist way, confronted the mystery of existence. Both decided that the one sure ontological foundation for a contingent world like ours was an entity that carries within itself the logical guarantee of its own existence. Such an entity, they held, could only be God", (HoP) p. 90

Related philosophical questions/attempts/quotes are

- *the search for something permanent, (RuB1) p. 63*
- Heraklitus: „*you cannot step twice into the same river; for fresh waters are ever flowing in upon you*", (RuB1) p. 63
- Plato and Aristotle agree that Heraklitus taught that „*nothing ever is, everything is becoming*" (Plato), and that „*nothing steadfastly is*" (Aristotle), (RuB1) p. 63
- Kant maintained that arithmetic and geometry are synthetic, but are likewise *a priori*. He was that thus led to formulate his problem in these terms:
  How are synthetic judgments *a priori* possible?
  The answer to this question, with its consequences, constitutes the main theme of *The Critique of Pure Reason*, (RuB1) p. 680
- *why* there is „*something*", but „*not nothing*"?
- *what* was first, „*something*" or the „*creation process of something*"?

This chapter is about the deductive quanta and energy field structure and its relation to the transcendental empirism of Deleuze („constitutive (or transcendental) difference") and Whitehead („process and reality").

1. A meta-physical „Big Bang event" or a mathematical creative ground state?

The philosophical transcendental concepts of a creator of both, „*something*" or a „*creation process of something*" is God, Brahman, idea or so.

The current physical (transcendental) concept is an *a priori* assumed (i.e. meta-physical) „Big Bang" „event". It is required as „starting signal/singularity" for the creation process of the current cosmos, which happening during the first three minutes ($t > 0$) „after" Big Bang ($t = 0$), (WeS).

R. Penrose calculated the probability to produce such an universe resembling the one in which we live; *the Creator would have to aim for an absurdly tiny volume of the phase space of possible universes resulting into the probability* $1/10^{10^{123}}$, (PeP) p. 444.

Assuming that there was first a „*creation process of something*" the deductive quanta and energy field structure provides an alternative concept to the *a priori* meta-physical „Big Bang" „event". The a priori „Big Bang-first-mover" concept is replaced by a mathematical (i.e. meta-physical) ground state (vacuum) concept accompanied by (mathematical) ground state (dynamic) energy.

This dynamic system enables creation processes of physical a priori „perfect plasma" dynamic entities. Both systems enable further higher energetical dynamic and mechanical entities; the all-encompassing energetical system is governed by a conservation of (ground state) energy law.

Ockham's principle may provide an appropriate guideline to decide about the two options, the (time dependent!) biggest black hole ever or an ontological-mathematical foundation of a contingent world with entities that carries within themselves the logical guarantee of their own existence.

2. The deductive quanta and energy field structure enabling an *a priori* creative mathematical vacuum system and an *a priori* creative physical plasma system

The overall principle of the deductive quanta and energy field structure is, that „quanta dynamics (i.e. the action of the quantum system)“ corresponds to „potential differences“ within the quanta systems.

Layer no.	Quanta system name	Energetical quanta type	Bohm‘s implicate/explicate order concept	Schrödinger's order vs. disorder scheme	Quanta numbers characteristics
0	Vacuum system	dynamic⊗dynamic (*)	implicate⊗implicate	order-from-order mathematical (a priori)	$(\epsilon, \pi) \to (\frac{1}{2}, \frac{1}{2})$
1	Perfect plasma system	dynamic⊗dynamic (*)	implicate⊗implicate	order-from-order physical (a priori)	$(e = \epsilon\epsilon, p = \pi\pi) \to (1,1)$ $(\nu = \epsilon\pi, \nu = \epsilon\pi) = (1,1)$
2	Perfect electromagnetics system	mechanical⊗dynamic (**)	explicate⊗implicate (order-from-order)	order-from-order	$(\underline{e} = \epsilon\epsilon\pi, \pi) \to (\frac{3}{2}, \frac{1}{2})$ $(\underline{m} = \pi\pi\epsilon, \epsilon) \to (\frac{3}{2}, \frac{1}{2})$
3	Dirac $^{2.0}$ systems	mechanical⊗dynamic (***)	explicate⊗implicate (order-from-order)	order-from-order	$(N^+ = 2\underline{m}, e) \to (3,1)$ $(N^- = 2\underline{e}, p) \to (3,1)$ $(N^0 = \underline{em}, \nu) \to (3,=1)$
4	Dynamic fluid system $H_{1/2}$	mechanical⊗mechanical	explicate⊗implicate (a priori space & time)	disorder-from-order complex Lorentz symmetry break down	Fourier waves → H_1 Calderón wavelets → $H_1^{\perp}$
5	Mechanical fluid system H_1	mechanical	explicate (space & time)	order-from-disorder	Thermostatistics → $H_0 = L_2$

(*) The symmetry group of the dynamic ⊗ dynamic systems is the complex Lorentz transformation $S^3 \times S^3 \cong SU(2) \times SU(2)$ which are connected (!) by a multiplication law. ($SU(2)$: the set of all pairs of 2×2 matrices with determinant one; S^3: the unit quarternions)

(**) The group S^3 (the unit quaternions of the quaternion algebra $|\boldsymbol{H}$) contains the isomorphic normal subgroups $G \coloneqq \psi(S^3 \times e)$, $G' \coloneqq \psi(e \times S^3)$ of the group $SO(4)$, where ψ denotes the surjective orthogonal mapping $\psi(a,b) : |\boldsymbol{H} \to |\boldsymbol{H}, x \to ax\bar{b}$. Accordingly, the symmetry group of the two-component electromagnetic Maxwell-Mie (mechanical ⊗ dynamic resp. dynamic ⊗ mechanical) system is $G \times G'$.

(***) The symmetry group of the three Dirac $^{2.0}$ system is S^3. This is in line with Unzicker's vision of the mathematical world and *how S^3 manifests in reality*, (UnA2).

3. The *a priori* (transcendental) creative mathematical vacuum system and the *a priori* (transcendental) creative perfect plasma system

The two dynamic vacuum quanta, the „electrino“ and the „positrino“ are modelled as element of the Hilbert space $H_{(\tau)}$ accompanied with appropriately defined quanta numbers and related Krein space intrinsic potential operator. Colloquially formulated, the definition of their related quantum numbers is based on desired different „densities“ of those quanta in the vacuum. The design principle is based on the different (Schnirelmann) densities of odd and even integers. Assuming that all of the infinite electrinos are numbered by odd integers, and all of the infinite positrinos are numbered by even integers, the „density in a vacuum“ of the electrinos is ½ (quantum numbers tend to ½), while the „density in a vacuum“ of the positrinos is 0 (quantum numbers tend to ½).

There is an positive density ½ of the electrinos in the vacuum system, i.e. there is a mathematical probability that an electrino may meet a positrino or another electrino. An electrino-positrino combination is called a neutrino (with quantum numbers identical ½). An electrino-electrino combination is called an electron (with quantum numbers tend to 1). The creation of an electron is counterbalanced by the creation of a corresponding positrino-positrino combination, called positron (also with quantum numbers tend to 1). The creation of an electron-positron pair is then counterbalanced by a neutron (with quantum numbers identical 1).

Physically speaking, the electron-positron pairs provide a perfect plasma dynamics model as the number of electrons and positrons (with opposite charges) in the vacuum show the „same“ infinite numbers of entities with cardinality $\aleph$; those are counterbalanced within the vacuum system by the same number of neutrons. This (vacuum and plasma entities) creation processes are.

Note: The creative mathematical vacuum and plasma reality is accompanied by the symmetry of the complex Lorentz group, i.e. it is independent from space and time, (UnA2) p. 3.

4. The two characteristic phenomena of the creative vacuum and perfect plasma systems

The cosmic background radiation and the Landau damping phenomena may be interpreted as the characteristic phenomena of the electromagnetic quanta creation process from the vacuum and perfect plasma dynamic quanta systems.

The electromagnetic system is in line with the Ehrenhaft photophoresis phenomenon.

5. The key differentiator between the Dirac $^{1.0}$ and Dirac $^{2.0}$ systems

The Dirac $^{1.0}$ system is *„a single system whose energy is the sum of three terms: one representing the energy of the atom, a second representating the electromagnetic energy of the radiation field, and a small term representing the coupling energy of the atom and the radiation field*“, (FeE). The Stern-Gerlach experiment showed that there is a magnetic property of the observed „electron“, which is not reflected by the „Schrödinger“ energy term. The conclusion out it lead to the „hypothesis of an electron spin“ accompanied by an additionally assumed angular momentum energy term of an electron. Later the Lamb shift phenomenon was observed, which falsified the Dirac model. Assuming that the bounded electron has two complementary kinetical energies, a spin-orbit momentum and a spin-angular momentum Sommerfeld derived an adapted (approximating) energy formula, which, at the end, required the purely mathematical existence of the so-called fine structure constant.

Note: The solution of the Schrödinger equation in three dimensions lead to the concept of principle quantum numbers (i.e. main shells) and minor quantum numbers (i.e. lower shells accompanied by sharp, principle, diffuse, and fundamental spectral lines). This physical modelling concept is „just“ a consequence of a mathematical assumption to solve the Schrödinger equation in form of a convergent power series representation. This requires the physical modelling assumption that there is a decomposition of the total energy of the considered atomic system into two parts, a linear mechanical momentum and a complementary angular mechanical momentum. The solution of the proposed Schrödinger $^{2.0}$ operator is accompanied by a decomposition of the total energy system into an explicate mechanical momentum part and a nucleus type specific implicate dynamic energy part.

Note: Sommerfeld's fine structure constant is „just“ mathematically required to ensure convergent power series representations of the considered Dirac $^{1.0}$ model.

Note: The Dirac $^{2.0}$ systems neither requires the *hypothesis of an electron spin* nor the existence of the fine structure constant.

Note: The three 1-component nucleus types of the proposed quanta scheme are the (integrated explicate and implicate) energy systems are the positronium $(N^+, e) = (2\underline{m}, e)$, the electronium $(N^-, p) = (2\underline{e}, p)$, and the neutronium $(N^0, \nu) = (\underline{em}, \nu)$. They allow to build six different types of nuclei combinations.

Note (The Mie theory): „*The aim of the trilogy on matter theory in (MiG), (MiG1), (MiG2) was to develop a unified theory able to account for the existence and properties of electrons (as well as atoms or molecules), explain recent observations of atomic spectra, and yield field equations for gravitation*“, (SmC).

Note (The Mie theory and a global nonlinear stability of the Minkowski space): „*Mie aimed to derive electromagnetism, gravitation, and aspects of the emerging quantum theory from a single variational principle and a well-chosen Lagrangian. Mie's main innovation was to consider nonlinear field equations to allow for stable particle-like solutions (now called solitons), and he clarified the use of variational principles in the context of special relativity*“, (SmC). This is in line with Klainerman's proof of a „global nonlinear stability of the Minkowski space, (ChD).

Note (The Mie theory): „*Part of Mie's project was to develop a relativistic theory of gravitation as a consequence of his generalized electromagnetic theory, and our second goal is to briefly assess this work, which reflects the conceptual resources available for developing a new account of gravitation by analogy with electro-magnetism. .... Mie characterized electromagnetic theory as "aether physics." Mie emphasized the appeal of reducing physics to a simple set of equations governing the state of the aether and its dynamical evolution, and conceiving of elementary particles as stable "knots" in the aether rather than independent entities*“, (SmC).

Note (The Mie theory): „*Die Grundannahme meiner Theorie ist,* daß auch im Innern der Elektronen elektrische und magnetische Felder auftreten. *Die Elektronen und demnach überhaupt die kleinsten Teilchen der Materie sind nach dieser Auffassung also mit dem Weltäther nicht wesensverschieden, sie sind nicht, wie man sich das vielleicht vor zwanzig Jahren dachte, Fremdkörper im Äther, sondern* sie sind nur Stellen, wo der Äther einen ganz besonderen Zustand angenommen hat, den wir durch das Wort elektrischte Ladung bezeichnen. ....

Man wird vielleicht denken, daß man mit der eben formulierten Grundannahme wenig anfangen könne. Sie führt aber immerhin zu einer allgemeinen Form für die Grundgleichungen der Ätherphysik, wenn man noch zwei weitere Annahmen hinzunimmt. Die erste ist, daß das Relativitätsprinzip allgemeine Gültigkeit haben soll*, die zweite,* daß die bisher bekannten Zustände des Äthers, nämlich elektrisches Feld, magnetisches Feld, elektrische Ladung, Ladungsstrom, vollständig ausreichen, um alle Erscheinungen in der materiellen Welt zu beschreiben“, (MiG).

6. Revolutionary hypotheses to link to anorganic atoms/ions, water, hydrogen bonding, the origin of atmospheric oxygen and self-replicating baseline living matter entities

Some puzzle pieces to link to anorganic chemistry

Note: The three 1-component nucleus types of the proposed quanta scheme are the (integrated explicate and implicate) energy systems are the positronium $(N^+, e) = (2\underline{m}, e)$, the electronium $(N^-, p) = (2\underline{e}, p)$, and the neutronium $(N^0, \nu) = (\underline{em}, \nu)$.

Note: The α-radiation consists of α particles, i.e. ${}^4_2H$ nuclei. The first characterization of a neutron (with mass number 1 and order number 0) was given by J. Chadwick in the form

$$ {}^9_4Be + {}^4_2H \rightarrow {}^{12}_6C + {}^1_0n. $$

An α-decay is only possible for nuclei with mass numbers > 208 and order numbers > 82. Two examples of α-decays are given by

$$ {}^{210}_{84}Po \rightarrow {}^{206}_{82}Pb + {}^4_2H, \quad {}^{228}_{90}Th \rightarrow [{}^{224}_{88}Ra]^* + {}^4_2H. $$

Note: The γ-radiation triggers no change of mass and order numbers. It is accompanied by a line spectrum occuring when electrons change between the several energy layers of the electron shell. Two examples of γ-decays are given by

$$ \left[{}^{125}_{52}Te\right]^* \rightarrow {}^{125}_{52}Te + \gamma, \quad [{}^{224}_{88}Ra]^* \rightarrow {}^{224}_{88}Ra + \gamma. $$

Note: The $\beta^- \cong {}^0_{-1}e$-decay is an electron emission process. The ${}^0_{-1}e$ contains no nucleon. In the current model there is no electron in the nucleus, however, a neutron can change into a proton when it emits an electron (the proton with the nucleus is denoted by ${}^1_1p$; the free proton is denoted by ${}^1_1He$. If a β^- particle is emitted the number of neutrons in the nucleus is reduced by 1 and the number of protons is increased by 1, i.e. the total number of nucleons keeps unchanged, and the ratio between neutron and protons decreases.

Note: An $\beta^+ \cong {}^0_1e$-decay is an electron capturing process resp. a positron emission process (also the ${}^0_1e$ contains no nucleon). It only happens in case of instable nuclei with a small neutron/proton ratio, which do not occur in nature. The emission of a positron changes a proton into a neutron., i.e. the number of neutrons in the nucleus increases by 1 and the number of protons decreases by 1.

Note (Artificially created β^+-decay and *neutrinos*): Additionally a nuclide with a large number of protons accompanied by an appropriate ratio of neutrons and protons can also emit positrons. This process is accompanied by the radiation energy of a neutrino and x-ray.

Some puzzle pieces to link to bio-chemistry

Note: The radioactive nuclide ${}^{14}_6C$ permanently arises in the atmosphere from cosmic neutron radiation and nitrogen (and Wilson's „cloud chamber" observation) are modelled by

$$ {}^{14}_7N + {}^1_0n \rightarrow {}^{14}_6C + {}^1_1H, \quad ({}^{14}_7N + {}^4_2He \rightarrow {}^{17}_8O + {}^1_1H) $$

while the ${}^{14}_6C$ will be oxidized in the atmosphere to CO_2 and vanishes by β^- decay according to

$$ {}^{14}_6C \rightarrow {}^{14}_7N + {}^0_{-1}e\,. $$

Note: For an appropriate design of biochemical energetical „actual entity" systems for „living entities" (*), we note

(1) ... that in a "living organism" there is a permanent source of required energy driving a metabolic cycle, while releasing a lower level of energy. This is about an energetical self-producing, self-organizing, dissipative non-equilibrium system. A dissipative non-equilibrium system means that there is an energetical system with a permanent potential difference, which never (until the "death" of the "living organism") gets to the energetical ground state of the affected atoms

(2) ... that the Krein space based modelling framework of the proposed UFT provides the concept of an "implicate" potential energy operator enabling the definition of a "dynamic energy" quanta scheme. We note that such a framework also provides the concepts of angular and dissipative (maximal pair) operators accompanied by appropriate sub-spaces of the considered Hilbert space, (AzT), (BoJ)

(3) ... Robitaille's work on water, hydrogen bonding, and the microwave background, (RoP2), see also below

(4) ... Davankov's hypothesis in the evolution of matter to life, (DaV2), see also below.

(*) The term actual entity has been borrowed from Whitehead's philosophy of process and reality, (PfM) S. 82, (WhA1).

The integrated quanta field systems provide the physical (conductor, semi-conductor, isolator) atomic nucleii foundation for anorganic chemistry. An alignment with the *transcendental empirism* of Deleuze and Whitehead or the *molecular vitalisms* as proposed by Kirschner et al. (KiM) needs to include organic chemistry.

Linking the energetical systems of the proposed dynamic quanta scheme with anorganic atoms/ions and properly defined organic molecules and composed biochemical „entities“ of Nature necessarily require an appropriate definition of „life“, its essential prerequisites (i.e. water and oxygen), and appropriate (bio-) chemical compositions of living matter, (CaJ), (DaV2), (SoK).

In (RoP) forty lines of evidence are presented that the solar body is comprised of, and surrounded by, condensed matter, which is basically liquid hydrogen.

In (DaV2) it is pointed out that „*free atmospheric oxygen mainly stems from photolysis of water molecules by cosmic irradiation, and that this is not necessarily bound to living organisms on the planet*“. At the same time in (RoP2) it is shown that „*the presence of hydroxyl* $(O - H)$ *and hydrogen* $(H \cdots OH_2)$ *bonds within water indicate that it can simultaneously maintain two separate energy systems*“. It is proposed to make the fake entities ^{+}H, ^{-}OH (in the sense of (VoD1) p. 31) to actual entities (in the sense of Deleuze/ Whitehead, (PfM) S. 82 ff. The oxidative phosphorylation (OxPhos) process, the final stage of cellular respiration to produce ATP, also requires the combinations $OH + CO \rightarrow COOH$, and $H + COOH \rightarrow H_2 + CO_2$, where the CO_2 plays also a key role with regards to breathing. We also note that ribose may be interpreted as the bonds of five carbon-hydrogen (CH) and five hydroxyl (OH) energy systems.

Note: The carbon has an outstanding property: it is a four-valent atom allowing double bonds, i.e., it is the most appreciated chemical element by nature to build complex chain formations, while at the same time avoiding a complete break down of such chains in case of their destruction. Most of the organisms consist of about 70% of water. The rest consists of only a few chemical elements, i.e., C, N, O, H, Ca, P, K, S, Cl, Na, Mg, (VoD) p. 4.

In a "living organism" there is a permanent source of required energy driving a metabolic cycle, while releasing a lower level of energy. Physically speaking, this is an energetical self-producing, self-organizing, dissipative non-equilibrium system. A dissipative non-equilibrium system means that there is an energetical system with a permanent potential difference until the "death" of the "living organism" system.

Note: The characteristics of all living organisms on Earth are underlying chain formations of only left-handed amino acids. The building of those chain formations is enabled by the concept of a "membrane". It is a tool to achieve a concentration change of amino acid chain formations from one side of the membrane to the other side enabled by a "potential difference". This tool is understood as the basic concept of a metabolic cycle. The left-handed amino acids are a specific characteristic of the Earth; this "left-handed" property is common with the neutrino spin. Some bacteria can transform hydrogen sulfur and carbon dioxid into sulfur and water.

We note that the Krein space based modelling framework of the proposed UFT provide the concept of a system specific „implicate“ potential energy operator enabling the definition of a „dynamic energy quanta“ scheme. Additionally, such a framework provides the concepts of angular and dissipative (maximal pair) operators defined on sub-spaces of the considered overall energy Hilbert space, (AzT), (BoJ).

Note: In (DaV2), (SoK) it is pointed out that homochiral living matter entities enabling a dissipative self-replication biochemical energy process. The biochemical counterpart of „potential difference“ concept is provided by the membrane of a cell where the homochiral living matter „acts as a chiral catalyst for its own production“. This reaction is called „asymmetric autocatalyst“, (SoK).

The mitochondria is making about 88 to 90% of the ATP, the energy currency in the cell. In neurons and heart and skeletal muscle, too. The basic energy process that allow a cell to maintain its bioenergetic potential would be oxidative phosphorylation. Essentially the Warburg Effect in one sentence is damaged mitochondrial respiration and there's compensatory fermentation, (RoJ) p. 54.

The „cancer“ (dysfunctional cell) related hypothesis is, (RoJ) p. 14:

1. Cancer arises from damage to cellular respiration
2. Energy through fermentation gradually compensates for insufficient respiration
3. Cancer cells continue to ferment lactate in the presence of oxygen (Warburg effect)
4. Enhanced fermentation is the signature metabolic malady of all cancer cells (as the cells are fermenting not only lactic acid, but also amino acids and particularly glutamine).

a. Liquid metallic hydrogen as a solar building block (RoP)

*(RoP): **Abstract**: Our Sun has confronted humanity with overwhelming evidence that it is comprised of condensed matter. Dismissing this reality, the standard solar models continue to be anchored on the gaseous plasma. In large measure, the endurance of these theories can be attributed to 1) the mathematical elegance of the for the gaseous state, 2) the apparent success of the mass-luminosity relationship, and 3) the long-lasting influence of leading proponents of these models. Unfortunately, no direct physical finding supports the notion that the solar body is gaseous. Without exception, all observations are most easily explained by recognizing that the Sun is primarily comprised of condensed matter. However, when a physical characteristic points to condensed matter, a postori arguments are invoked to account for the behavior using the gaseous state. In isolation, many of these treatments appear plausible. As a result, the gaseous models continue to be accepted. There seems to be an overarching belief in solar science that the problems with the gaseous models are few and inconsequential. In reality, they are numerous and, while often subtle, they are sometimes daunting. The gaseous equations of state have introduced far more dilemmas than they have solved. Many of the conclusions derived from these approaches are likely to have led solar physics down unproductive avenues, as deductions have been accepted which bear little or no relationship to the actual nature of the Sun. It could be argued that, for more than 100 years, the gaseous models have prevented mankind from making real progress relative to understanding the Sun and the universe. Hence, the Sun is now placed on trial. Forty lines of evidence will be presented that the solar body is comprised of, and surrounded by, condensed matter. These 'proofs' can be divided into seven broad categories: 1) Planckian, 2) spectroscopic, 3) structural, 4) dynamic, 5) helioseismic, 6) elemental, and 7) earthly. Collectively, these lines of evidence provide a systematic challenge to the gaseous models of the Sun and expose the many hurdles faced by modern approaches. Observational astronomy and laboratory physics have remained unable to properly justify claims that the solar body must be gaseous. At the same time, clear signs of condensed matter interspersed with gaseous plasma in the chromosphere and corona have been regrettably dismissed. As such, it is hoped that this exposition will serve as an invitation to consider condensed matter, especially metallic hydrogen, when pondering the phase of the Sun.*

b. Blackbody radiation, the loss of universality, and the carbon particle (RoP1), (RoP3)

(RoP1): Abstract: Through the reevaluation of Kirchhoff's law (Robitaille P. M. L. IEEE Trans. Plasma Sci., 2003, v. 31(6), 1263–1267), Planck's blackbody equation (Planck M. Ann. der Physik, 1901, v. 4, 553–356) loses its universal significance and becomes restricted to perfect absorbers. Consequently, the proper application of Planck's radiation law involves the study of solid opaque objects, typically made from graphite, soot, and carbon black. The extension of this equation to other materials may yield apparent temperatures, which do not have any physical meaning relative to the usual temperature scales. Real temperatures are exclusively obtained from objects which are known solids, or which are enclosed within, or in equilibrium with, a perfect absorber. For this reason, the currently accepted temperature of the microwave background must be viewed as an apparent temperature. Rectifying this situation, while respecting real temperatures, involves a reexamination of Boltzman's constant. In so doing, the latter is deprived of its universal nature and, in fact, acts as a temperature dependent variable. In its revised form, Planck's equation becomes temperature insensitive near 300 K, when applied to the microwave background.

(RoP3): ...graphite and carbon black continue to play a central role in the construction of blackbody cavities. The advent of universality is reviewed through the writings of Pierre Prévost, Pierre Louis Dulong, Alexis Thérèse Petit, Jean Baptiste Joseph Fourier, Siméon Denis Poisson, Frédérick Hervé de la Provostaye, Paul Quentin Desain, Balfour Stewart, Gustav Robert Kirchhoff, and Max Karl Ernst Ludwig Planck. These writings illustrate that blackbody radiation, as experimentally produced in cavities and as discussed theoretically, has remained dependent on thermal equilibrium with at least the smallest carbon particle.

c. Water, hydrogen bonding, and the microwave background (RoP2)

(RoP2): Abstract: In this work, the properties of the water are briefly revisited. Though liquid water has a fleeting structure, it displays an astonishingly stable network of hydrogen bonds. Thus, even as a liquid, water possesses a local lattice with short range order. The presence of hydroxyl ($O-H$) and hydrogen ($H \cdots OH_2$) bonds within water, indicate that it can simultaneously maintain two separate energy systems. These can be viewed as two very different temperatures. The analysis presented uses results from vibrational spectroscopy, extracting the force constant for the hydrogen bonded dimer. By idealizing this species as a simple diatomic structure, it is shown that hydrogen bonds within water should be able to produce thermal spectra in the far infrared and microwave regions of the electromagnetic spectrum. This simple analysis reveals that the oceans have a physical mechanism at their disposal, which is capable of generating the microwave background.

d. Free origin of atmospheric oxygen from photolysis of water molecules by cosmic irradiation (DaV), (DaV1), (DuA)

(DaV)*:* Critical review on the origin of atmospheric oxygen: Where is organic matter?

Abstract: *In a short note of 1998 Davankov questioned the generally accepted notion that the unique features of the planet Earth, namely, the presence of life and atmospheric oxygen are inseparably bonded as a case and effect. Indeed, photosynthesis in terrestrial and aquatic phototrophs simultaneously produces oxygen and carbohydrates in almost equal amounts. Since the degradation of organic matter through burning or rotting also consumes an equivalent amount of oxygen, the total masses of oxygen and organic material must always remain comparable. This correlation for Earth appears to be drastically distorted in favor of oxygen, thus disproving the still widespread delusion of biogenic origin of atmospheric oxygen. Instead, by analyzing more recent data on the balance between oxygen and organics we arrive at the conclusion that radiolysis of water vapors with the preferential dissipation of hydrogen to space, most probably, was the major source of the free and oxidation-spent oxygen. The present review tries to illuminate the most important uncertainties that still remain to be clarified before an interdisciplinary and scientifically-balanced picture on the evolution of Earth gets settled.*

(DaV1)*:* The Riddle of Atmospheric Oxygen: Photosynthesis or Photolysis?

Abstract: *The stoichiometry of the photosynthetic reaction requires that the quantities of the end products (organic biomaterial and free oxygen) be equal. However, the correct balance of the amounts of oxygen and organic matter that could have been produced by green plants on the land and in the ocean since the emergence of unique oxygenic photosynthetic systems (no more than 2.7 billion years ago) is virtually impossible, since the vast majority of oxygen was lost in oxidizing the initially reducing matter of the planet, and the bulk of organic carbon is scattered in sedimentary rocks. In recent decades, convincing information has been obtained in favor of the large-scale photolysis of water molecules in the upper atmosphere with the scattering of light hydrogen into space and the retention of heavier oxygen by gravity. This process has been operating continuously since the formation of the Earth. It is accompanied by huge losses of water and the oxidation of salts of ferrous iron and sulfide sulfur in the oceans and methane in the atmosphere. The main stages of the evolution of the atmosphere and surface layers of the Earth ' s crust are analyzed for the first time in this work by considering the parallel processes of photosynthesis and photolysis. Large-scale photolysis of water also provides consistent explanations for the main stages in the evolution of the nearest planets of our Solar System.*

e. Homochiral living matter entities and an asymmetric dissipative autocatalysis energy process (CaJ), (DaV2), (SoK)

(DaV2)*:* Chance and Necessarity in the Evolution of Matter to Life: A Comprehensive Hypothesis

Abstract: *Specialists in several branches of life sciences are trying to solve, piece by piece, the immensely complex puzzle of the origin of life. Some parts of the puzzle seem to appear with a rather high degree of clarity, while others remain totally obscure. We cannot be sure that life emerged only on our Earth, but we believe that the presence of large amounts of water in its liquid state is absolutely essential for the emergence and evolution of living matter. We can also assume that the latter exploits everywhere the same light elements, mainly C, H, O, N, S, and P, and somehow manipulates the same simple monomeric and polymeric organic compounds, such as alpha-amino acids, carbohydrates, nucleic bases, and surface-active carboxylic acids. The author contributes to the field by stating that all fundamental particles of our matter are "homochiral" and predominantly produce in an absolute asymmetric synthesis amino acids of L-configuration and carbohydrates of D-series. Another important point is that free atmospheric oxygen mainly stems from the photolysis of water molecules by cosmic irradiation and is not necessarily bound to living organisms on the planet.*

1. *What is Life?*
2. *Water – Essential Prerequisite of Life*
3. *Chemical composition of Living Matter*
4. *Prebiotic Organic Chemistry on Earth*
5. *Origin of Biological Homochirality*
6. *Life and Oxygen in the Atmosphere*
7. *Concluding Remarks*

- *When considering life on our Earth as a logical result of a long and complicated evolution process of the matter accumulated by the planet, rather than a unique divine phenomenon in the Universe, it is advisable to try formulating basic regularities of the evolution and incidents on its pathway, according to our current knowledge and imagination. Let us present these ideas in a short summary.*
- *Because of the invariant chirality of weak interactions, all primary particles compose a homochiral pool of building elements for the construction of atoms and molecules. In contrast, all leptons (photons and muons) exist as a racemic form of energy quanta.*
- *Plasma reactors resulting from the super-high-velocity collisions of cosmic bodies generate mixtures of organic compounds, whose amount and composition are determined by the occasional content of the plasma torch-involved material.*

- *All organic compounds synthesized in a plasma torch acquire preferred configurations that correspond to the invariant chirality of fundamental weak interactions; the forms dominating everywhere are L-amino acids and D-carbohydrates.*
- *The mechanisms further enhancing the extent of homochirality in the complex mixture of organic compounds remain unclear.*
- *The presence of large amounts of water in its liquid state on any planet is the essential prerequisite for life to emerge, since water is the only unique natural solvent compatible with both polar organic compounds and mineral electrolytes.*
- *Any living matter must be based on the abundant light elements C, H, O, N, S, and P, for the reason that they are able to interact with each other and form chains; many other elements are also needed, though in small numbers.*
- *Life most likely emerged in a small aqueous pool that received, from time to time, additional portions of the globally produced from and distributed in the ocean; the pool frequently evaporated, which resulted in concentrating the primordial soup and enhancing contacts of the compounds with solid minerals.*
- *The organic compounds most useful and available in numerous variants are alphaamino acids, nucleic bases, carbohydrates, and, carbonic acids, since they are prone to form polymeric chains or large associates. The selection of particular compounds and polymers for composing the first self-reproducing scaffolded protocell is a matter of pure chance and remains a complete black box of early evolution.*
- *Water vapors are constantly subjected to photolysis by cosmic irradiation, followed by hydrogen escaping to space and oxygen largely retained within the planet; under certain conditions, oxygen may form, an oxygenating the atmosphere, but this is not a clear indication of the existence of living organisms on the planet.*

f. The Warburg effect and cancer as a mitochondrial metabolism disease (RoJ), (SeT), (SeT1)

(RoJ) p. 54: Essentially the Warburg Effect in one sentence is damaged mitochondrial respiration and there's compensatory fermentation. So the basic energy processes that allow a cell to maintain its bioenergetic potential would be oxidative phosphorylation. The mitochondria is making about 88 to 90% of the ATP, the energy currency in the cell. In neurons and heart and skeletal muscle, too. ... The nucleus has very robust DNA repair mechanism. The mitochondria does not have as robust DNA repair mechanisms. So if a cell is bombarded with things like radiation or carcinogenic agents, the capacity for the mitochondria to repair itself is not as high, is not as robust as the nucleus's ability to repair DNA.

(RoJ) p. 14:

1. *Cancer arises from damage to cellular respiration*
2. *Energy through fermentation gradually compensates for insufficient respiration*
3. *Cancer cells continue to ferment lactate in the presence of oxygen (Warburg effect)*
4. *Enhanced fermentation is the signature metabolic malady of all cancer cells (as the cells are fermenting not only lactic acid, but also amino acids and particularly glutamine).*

(SeT) p. 15: Much of the confusion surrounding the origin of cancer arises from the absence of an unifying theory that can integrate the diverse observations on the nature of the disease.

(RoJ) p. 19: What's happening with cancer cells is: they are shifting their energy away from respiration to a fermentation metabolism, using available fermentable fuel.

(NiM): A number of cytosolic electrons just take the "emergency exit" from the cell by lactate secretion to maintain the cytosolic redox balance.

(SeT) p. 47/48/49: Homeostasis is the tendency of biological systems to maintain relatively stable conditions in their internal environments. Each cell and each organ contributes to the overall homeostasis of the organism. ... Metabolic homeostasis within cells is dependent to a large extent on the energy supply to the membrane pumps.

(SeT) p. 51/52: Besides OxPhos (oxidative phosphorylation), approximately 11% (4/36 total ATP molecules) of the total cellular energy is produced through substrate-level phosphorylation. Substrate-level phosphorylation involves the transfer of a free phosphate to ATP from a metabolic substrate to form ATP. Two major metabolic pathways can produce ATP through substrate-level phosphorylation in mammalian cells and tissues.

(SeT) p. 73: Warburg considered oxidative phosphorylation (OxPhos) injury or insufficiency to be the origin of cancer. OxPhos is the final stage of cellular respiration involving multiple coupled redox reactions where the energy contained in carbon-hydrogen bonds of food molecules is captured and conserved in the terminal phosphoanhydride bond of ATP. The process specifically involves the following: (i) the flow of electrons through a chain of membrane-bound carriers, (ii) the coupling of the downhill electron flow to an uphill transport of protons across a proton-impermeable membrane, thus conserving the free energy of fuel of oxidation as a transmembrane electrochemical potential, and (iii) the synthesis of ATP from ADP+Pi throught a membrane-bound enzymatic complex linked to the transmembrane flow of the protons down their concentration gradient.

7. The Krein space based „potential difference“ concept in alignment with the transcendental empirism of Deleuze and Whitehead

The integrated quanta field systems provide the physical (conductor, semi-conductor, isolator) atomic nucleii foundation for anorganic chemistry. An alignment with the *transcendental empirism* of Deleuze and Whitehead or, with the *molecular vitalisms* as proposed by Kirschner et al. (KiM), needs to include organic chemistry.

Kant was successful in providing a common concept of understanding for rationalism or empiricism. From the introduction of his “the Critique of Pure Reason“, sections V. and VI. we quote

> *„V. In all Theoretical Sciences of Reason, Synthetical Judgements „a priori“ are contained as Principles*
>
> 1. *Mathematical judgements are always synthetical …*
> 2. *The science of natural philosophy (physics) contains in itself synthetical judgements a priori, as principles. I shall adduce two propositions. For instance, the proposition, „In all changes of the material world, the quantity of matter remains unchanged“; or, that „In all communication of motion, action and reaction must always be equal“. In both of these, not only is the necessity, and therefore their origin a priori clear, but also that they are synthetical propositions. …*
> 3. *As to metaphysics, even if we look upon it merely as an attempted science, yet, from the nature of human reason, an indispensable one, we find that it must contain synthetical propositions a priori. …*
>
> *VI: The Universal Problem of Pure Reason*
>
> *„The proper problem of pure reason, then, is contained in the question: „How are synthetical judgements a priori possible?““*

The prerequisite of Kant’s transcendental philospophy is the concept of an a priori required space and time framework in order to enable the human mind (the subject) to order „objects“ and „events“ (the objects) in space and time. Colloquially speaking, the object is first related to the subject, the time is first related to the movement; in this sense Kant is in line with Newton. Time becomes an independent variable governing processes and

> „*The indefinite existence becomes determinable only in the form of time*“, (PfM) S. 140.

The a priori creative vacuum and plasma systems are independent from space and time providing synthetical jugdements. The crucial concept to govern the deducive structure of dynamic quanta systems is „potential difference“, the reprequisite to enable the creation of „actual entities“. This is in line with Whitehead’s and Deleuze’s „process & reality“ resp. „difference & repetition“ based transcendental empirism philosophy. the conceptual differentiator to Kant’s transcendental philosophy is that:

„*the being of a res vera is constituted by its „becoming*“

or, with respect to the deductive structure in the light of the convictions of Leibniz & Descartes:

> *„there is a* mathematical *(a priori) foundation of the* physical *world structure in form of* the deductive structure of energetical quanta *that carry within itself the logical guarantee of its own existence“*
>
> Whitehead A. N.
> Process & reality

(1) It belongs to the nature of a „being“ that it is a potential for everything „becoming“.
this may be interpreted as the counterpart of the UFT principle, that each “action” is caused by the potential difference within implicate⊗implicate or explicate⊗implicate quanta systems

*(2) the concept of „*actual entities“, those processes create new entities, (PfM) S. 82 ff.
they may be interpreted as a kind of Leibniz *monades* [2.0]

Deleuze G.
Difference and Repetition

The concept of constitutive (or transcendental) difference, i.e. the condition enabling difference, where every physical or vital individuation requires the existence of a meta-stable state, the state of disparation and the difference between physical and vital individuation: while the physical individuation (constituted and existing at the boundary of a body) is content with a single received information, the living (which is growing from the inner and the outer of the body) receives more information and singularities.

Driesch H.
Geschichte des Vitalismus
Die materialistisch-darwinistische Zeitströmung

„Vier Grundumstände haben den Charakter alles Denkens über Natur, und nicht nur über sie, in der zweiten Hälfte des neunzehnten Jahrhunderts bestimmt:

Zum ersten eine materialistische Metaphysik, wie sie als ganz allgemeiner Gegensatz gegen die idealistische Identitätsphilosophie erwachsen war.

Zum anderen der Darwinismus, jene Anweisung, wie man durch Steinwürfe Häuser typischen Stiles baut.

Drittens die Entdeckung des Satzes von der Erhaltung der Energie durch Robert Mayer; ein Satz, der trotz seiner Inhaltsarmut die Naturwissenschaften in wahre Verzückung versetzt hat.

Viertens und letztens und ganz besonders für Biologisches in Betracht kommend, die Entdeckung und planmäßige Erforschung der feinen Dtrukturen der Lebewesen mit Hilfe der verbesserten optischen Werkzeuge.
...
Die materialistische Metaphysik lehrte, daß alles Wirkliche Bewegung sei, daß es Qualitäten höherer Art nur als Schein gäbe.
Der Darwinismus behauptete zu zeigen, wie zweckmäßig Konstruiertes durch absolute Zufälligkeiten entstehen könne. ....
Am Energiesatz erkannte man nicht, daß es nur der Kausalsatz in quantitiativer Fassung sein.
Die Entdeckung der feinen Strukturen aber spielte den Forschern einen ebensolchen Streich, wie ihnen früher das Fehlen ihrer Kenntnis gespielt hatte: War früher sehr vieles für die unmittelbare Wirkung eines letzten Lebensgesetzes erklärt worden, da man eben nicht wußte, daß noch sehr viele maschinenartige Mannigfaltigkeiten da seien, die doch zunächst einmal für Erklärungsversuche hätten herangezogen werden müssen, so glaubte man jetzt, da man einiges auf Grund der erkannten feinen Strukturen etwas wirklich verstand, es müsse alles auf Grund derselben verständlich sein: damit aber waren bereitwillig einer dogmatischen Maschinentheorie die Tore geöffnet“, (DrH) S. 132 ff.

Driesch H.
The history & theory of vitalism

Four circumstances fundamentally determined the character of all thought about nature, and indeed on many other problems, in the second half of the nineteenth century.

First of all, the rise of materialistic Metaphysic in express opposition to the idealistic identity-philosophy.

Then Darvinism, which explained how by throwing stones one could build houses of a typical style.

Thirdly, the discovery of the law of the Conservation of Energy by Robert Mayer – a proposition which in spite of the poverty of its content enraptured all the natural sciences.

Lastly, and particular importance in reference to Biology, the discovery and systematic investigation of the delicate structures of living beings with the help of improved optical instruments“, (DrH1) pp. 137-138.

Heidegger M.

„*Beweisen läßt sich im Bereich des Denkens nichts, aber weisen manches*“, (WiR) S. 10

„*Wir kommen nie zu den Gedanken, sie kommen zu uns*“, (WiR) S. 46

Weyl H.
Organic and inorganic matter

„*One of the profoundest enigmas of nature is the contrast of dead and living matter. … The gap between organic and inorganic matter has been bridged to a certain extent by the discovery of virusses. … A virus is clearly something like a naked gene*“, (WeH) p. 276.

Note: There is the similarity to Schrödinger’s conception regarding consciousness (situation potential) & subconscious (learning by repetition; suitable reaction again & again) (ScE1) p. 96, see also (ScE2) p.45 and (NaT) p. 115.

Note: The physical order-from-order mechanisms and the related molecular biological order-from-order mechanisms may support Nagel’s „*dual aspect theory*“; it is based on the assumption that „*a physical organism by itself can’t have a mind, as there is no way of constituting subjectivity out of two hundred pounds of subatomic particles*“, (NaT2) p. 29.

Note: Heidegger’s „*being and time*“ was never completed (3rd missing chapter) and his later new concept of „*ontological difference*“ became just a first step into the direction of Deleuze’s „*difference (in itself) and repetition (for itself), that are logically and meta-physically prior to any concept of identity*“ (Wikipedia).

Note: For a hollistic view on the relationship of the concepts of „virus“ and „organism & cellular“ we refer to (MaA), (StR1). Seeing scientific theory not as proceeding linearly from an objective, unbiased accumulation of all available data, but rather as paradigm-driven we refer to (KuT).

8. Related stackholder views

Stakeholder list

Bohm D.; Camus A.; Carroll J. D.; Capra F.; Chen F. F.; Courant R.; Dee's Story; Davidson J.; Deleuze G.; Deligne P. et. al.; Dirac P. A. M.; Ehrenhaft F.; Einstein A.; Feynman R.; Heidegger M.; Heisenberg W.; Kant I.; Leedskalnin E.; Nagel Th.; Robitaille P.-M.; Rovelli C.; Russel B.; Schauberger V.; Schrödinger E.; Seyfried T. N.; Soai K.; Weinberg S.; Weyl H.; Whitehead A. N.; Wong M. L. et al.

Bohm D.
Wholeness and the Implicate Order

„It is important to emphasize, however, that mathematics and physics are not being regarded here as separate but mutually related structures (so that, for example, one could be said to apply mathematics to physics as paint is applied to wood). Rather, it is being suggested that mathematics and physics are to be considered as aspects of a single undivided whole", (BoD1) p. 199

Camus A.
The Myth Of Sisyphus

„The gods had condemned Sisyphus to ceaselessly rolling a rock to the top of a mountain, whence the stone would fall back of its own weight. They had thought with some reason that there is no more dreadful punishment than futile and hopeless labor.

If one believes Homer, Sisyphus was the wisest and most prudent of mortals. According to another tradition, however, he was disposed to practice the profession of highwayman. I see no contradiction in this. Opinions differ as to the reasons why he became the futile laborer of the underworld. To begin with, he is accused of a certain levity in regard to the gods. He stole their secrets. Egina, the daughter of Asopus, was carried off by Jupiter. The father was shocked by that disappearance and complained to Sisyphus. He, who knew of the abduction, offered to tell about it on condition that Asopus would give water to the citadel of Corinth. To the celestial thunderbolts he preferred the benediction of water. He was punished for this in the underworld. Homer tells us also that Sisyphus had put Death in chains. Pluto could not endure the sight of his deserted, silent empire. He dispatched the god of war, who liberated Death from the hands of her conqueror.

It is said also that Sisyphus, being near to death, rashly wanted to test his wife's love. He ordered her to cast his unburied body into the middle of the public square. Sisyphus woke up in the underworld. And there, annoyed by an obedience so contrary to human love, he obtained from Pluto permission to return to earth in order to chastise his wife. But when he had seen again the face of this world, enjoyed water and sun, warm stones and the sea, he no longer wanted to go back to the infernal darkness. Recalls, signs of anger, warnings were of no avail. Many years more he lived facing the curve of the gulf, the sparkling sea, and the smiles of earth. A decree of the gods was necessary. Mercury came and seized the impudent man by the collar and, snatching him from his joys, led him forcibly back to the underworld, where his rock was ready for him.

You have already grasped that Sisyphus is the absurd hero. He is, as much through his passions as through his torture. His scorn of the gods, his hatred of death, and his passion for life won him that unspeakable penalty in which the whole being is exerted toward accomplishing nothing. This is the price that must be paid for the passions of this earth. Nothing is told us about Sisyphus in the underworld. Myths are made for the imagination to breathe life into them. As for this myth, one sees merely the whole effort of a body straining to raise the huge stone, to roll it and push it up a slope a hundred times over; one sees the face screwed up, the cheek tight against the stone, the shoulder bracing the claycovered mass, the foot wedging it, the fresh start with arms outstretched, the wholly human security of two earth-clotted hands. At the very end of his long effort measured by skyless space and time without depth, the purpose is achieved. Then Sisyphus watches the stone rush down in a few moments toward that lower world whence he will have to push it up again toward the summit. He goes back down to the plain.

It is during that return, that pause, that Sisyphus interests me. A face that toils so close to stones is already stone itself! I see that man going back down with a heavy yet measured step toward the torment of which he will never know the end. That hour like a breathing-space which returns as surely as his suffering, that is the hour of consciousness. At each of those moments when he leaves the heights and gradually sinks toward the lairs of the gods, he is superior to his fate. He is stronger than his rock.

If this myth is tragic, that is because its hero is conscious. Where would his torture be, indeed, if at every step the hope of succeeding upheld him? The workman of today works every day in his life at the same tasks, and this fate is no less absurd. But it is tragic only at the rare moments when it becomes conscious. Sisyphus, proletarian of the gods, powerless and rebellious, knows the whole extent of his wretched condition: it is what he thinks of during his descent. The lucidity that was to constitute his torture at the same time crowns his victory. There is no fate that cannot be surmounted by scorn.

If the descent is thus sometimes performed in sorrow, it can also take place in joy. This word is not too much. Again I fancy Sisyphus returning toward his rock, and the sorrow was in the beginning. When the images of earth cling too tightly to memory, when the call of happiness becomes too insistent, it happens that melancholy rises in man's heart: this is the rock's victory, this is the rock itself. The boundless grief is too heavy to bear. These are our nights of Gethsemane. But crushing truths perish from being acknowledged. Thus, Oedipus at the outset obeys fate without knowing it. But from the moment he knows, his tragedy begins. Yet at the same moment, blind and desperate, he realizes that the only bond linking him to the world is the cool hand of a girl. Then a tremendous remark rings out: "Despite so many ordeals, my advanced age and the nobility of my soul make me conclude that all is well." Sophocles' Oedipus, like Dostoevsky's Kirilov, thus gives the recipe for the absurd victory. Ancient wisdom confirms modern heroism.

One does not discover the absurd without being tempted to write a manual of happiness. "What! by such narrow ways—?" There is but one world, however. Happiness and the absurd are two sons of the same earth. They are inseparable. It would be a mistake to say that happiness necessarily springs from the absurd discovery. It happens as well that the feeling of the absurd springs from happiness. "I conclude that all is well," says Oedipus, and that remark is sacred. It echoes in the wild and limited universe of man. It teaches that all is not, has not been, exhausted. It drives out of this world a god who had come into it with dissatisfaction and a preference for futile sufferings. It makes of fate a human matter, which must be settled among men.

All Sisyphus' silent joy is contained therein. His fate belongs to him. His rock is his thing. Likewise, the absurd man, when he contemplates his torment, silences all the idols. In the universe suddenly restored to its silence, the myriad wondering little voices of the earth rise up. Unconscious, secret calls, invitations from all the faces, they are the necessary reverse and price of victory. There is no sun without shadow, and it is essential to know the night. The absurd man says yes and his effort will henceforth be unceasing. If there is a personal fate, there is no higher destiny, or at least there is but one which he concludes is inevitable and despicable. For the rest, he knows himself to be the master of his days. At that subtle moment when man glances backward over his life, Sisyphus returning toward his rock, in that slight pivoting he contemplates that series of unrelated actions which becomes his fate, created by him, combined under his memory's eye and soon sealed by his death. Thus, convinced of the wholly human origin of all that is human, a blind man eager to see who knows that the night has no end, he is still on the go. The rock is still rolling.

I leave Sisyphus at the foot of the mountain! One always finds one's burden again. But Sisyphus teaches the higher fidelity that negates the gods and raises rocks. He too concludes that all is well. This universe henceforth without a master seems to him neither sterile nor futile. Each atom of that stone, each mineral flake of that night-filled mountain, in itself forms a world. The struggle itself toward the heights is enough to fill a man's heart. One must imagine Sisyphus happy", (CaA) p. 115

Carroll J. D.
A new defintion of life

(CaJ2): ABSTRACT: Chirality is often glossed over in theoretical or experimental discussions concerning the origin of life, but the ubiquity of homochiral building blocks in known biological systems demands explanation. Information theory can provide a quantitative framework for understanding the role of chirality in biology. Here I show how conclusions derived from information theory, in particular the concept of equivocation, can explain not only why chiral building blocks are necessary in living systems but also why a homochiral set of building blocks is necessary. These results lead to a new definition of life, and to the conclusion that the simplest form of life exists in the form of self-amplifying, autocatalytic reactions such as the Soai reaction.

Capra F.
The Tao of Physics
The dynamic universe

„The central aim of Eastern mysticism is to experience all phenomena in the world as manifestations of the same ultimate reality. This reality is seen as the essence of the universe, underlying and unifying the multitude of things and events we observe. The Hindus call it Brahman, the Buddhists Dharmakaya (the Body of Being), or Tathata (Suchness), and the Taoists Tao; each affirming that it transcends our intellectual concepts and defies further description. This ultimate essence, however, cannot be separated from its multiple manifestations. It is central to its very nature to manifest itself in myriad forms which come into being and disintegrate, transforming themselves into one another without end. In its phenomenal aspect, the cosmic One is thus intrinsically dynamic, and the apprehension of its dynamic nature is basic to all schools of Eastern mysticism", (CaF1)

Chen F. F.
Plasma physics

Microwave radiation pressure to plasma
Ponderomotive force

(ChF) p. 305, 307: „Light waves exert radiation pressure which is usually very weak and hard to detect. ... When high-powered microwaves or laser beams are used to heat or confine plasmas the radiation pressure can reach several hundred thousand atmospheres! When applied to plasma, this force is coupled to the particles in a somewhat subtle way and is called the ponderomotive force. Many nonlinear phenomena have a simple explanation in terms of the ponderomotive force.“

Courant R.
Empirical evidence and mathematical existence

(HiS) p. 148: „Empirical evidence can never establish mathematical existence – nor can the mathematician's demand for existence be dismissed by the physicist as useless rigor. Only a mathematical existence proof can ensure that the mathematical description of a physical phenomenon is meaningful.“

Davidson J.
Das Geheimnis des Vakuums

„Obwohl die Energiedichte dieser Vakuum-Oszillationen immens hoch ist, entstehen grundlegende Schwierigkeiten, wenn man versucht, diese Form der Energie in brauchbare Arbeit umzuwandeln. Es ist jedoch vorstellbar, daß die in den Quantenfluktuationen des Vakuums enthaltene Energie eine gewisse Form von interaktiven „Raumpartikeln“ hervorbringt, die eine geordnete, dynamische Vakuumstruktur erzeugen, welche sowohl elektromagnetische als auch gravitative Aspekte enthalten und außerdem wesentlich mit der Entstehung, dem Erhalt und der Gestaltung von biologischen Lebensformen verknüpft sind“, (DaJ1) p. 17

Dee's Story

(DeK) p. 3: „Consider the Big Bang Theory. A mass the size of our Universe appeared out of nowhere. Even though it was the biggest black hole ever, it then exploded. Our universe is a real thing but the Big Bang Theory is a fairy tale.“

Deleuze G.
Differenz und Wiederholung

„Deleuze will in einem Werk die konstitutive Differenz untersuchen: diese Differenz ist die Entstehungsbedingung quasi im Hintergrund. ... Man kann dies auch transzendentale Differenz (d.h. die Bedingung der Ermöglichung von Differenz) nennen. ... für jede Individuation (nach Simondon und Deleuze) braucht es immer eine transzendentale Differenz bzw. Disparation. .. „Eine jedwede Individuation erfordert die Existenz eines metastabilen Zustandes, eines Zustandes der Disparation. ... Der Unterschied zwischen einer physikalischen und einer vitalen Individuation ist nach Simondon folgender: Der wachsende Kristall bekommt ein einziges Mal die eine Information und fängt dann an zu wachsen. Ein Lebewesen reagiert wiederholt auf verschiedenste Informationen auf verschiedenen Ebenen. Deleuze in seiner Simondon-Rezension: „Insbesondere sind die Differenzen zwischen der physikalischen und der vitalen Individuation Gegenstand tiefgreifender Ausführungen. Der Bereich der inneren Resonanz erscheint in beiden Fällen als verschieden; das physische Individum begnügt sich damit, ein einziges Mal eine Information zu erhalten, und wiederholt eine anfängliche Singularität, während das Lebendige nacheinander mehrere Informationen erhält und mehrere Singularitäten verbucht; und vor allem entsteht und hält sich die physische Individuation an der Grenze des Körpers, z.B. des Kristalls, während der Lebendige von innen und von außen aus wächst, da der gesamte Inhalt seines inneren Raums „topologisch“ in Kontakt zum Inhalt des äußeren Raums steht“, (PfM) S. 100.

„Transzendentaler Empirismus: „In Wirklichkeit wird der Empirismus transzendental und die Ästhetik eine apodiktische Disziplin, wenn wir im Sinnlichen direkt das erfassen, was nur empfunden werden kann, das Sein selbst des Sinnlichen: die Differenz, die Differenz im Potential, die Intensitätsdifferenz als Ratio des qualitativ Verschiedenen,“ (PfM) S. 174

Deleuze G.
The Fold: Leibniz and the Baroque

„The Baroque refers not to an essence but rather to an operative function, to a trait. It endlessly produces folds. It does not invent things: there are all kinds of folds coming from the East, Greek, Roman, Romanesque, Gothic, Classical folds. ... Yet the Baroque trait twists and turns its folds, pushing them to infinity, fold over fold, one upon the other. The Baroque fold unfurls all the way to infinity. First, the Baroque differentiates its

folds in two ways, by moving along two infinities, as if infinity were composed of two stages or floors: the pleats of matter, and the folds in the soul. Below, matter is amassed according to a first type of fold, and then organized according to a second type, to the extent its part constitutes organs that are 'differently folded and more or less developed.' Above, the soul sings of the glory of God in as much as it follows its own folds, but without succeeding in entirely developing them, since 'this communication stretches out indefinitely.' A labyrinth is said, etymologically, to be multiple because it contains many folds. The multiple is not only what has many parts but also what is folded in many ways. A labyrinth corresponds exactly to each level: the continuous labyrinth in matter and its parts, the labyrinth of freedom in the soul and its predicates. If Descartes did not know how to get through the labyrinth, it was because he sought its secret of continuity in rectilinear tracks, and the secret of liberty in a rectitude of the soul. He knew the inclension of the soul as little as he did the curvature of matter. A 'cryptographer' is needed, someone who can at once account for nature and decipher the soul, who can peer into the crannies of matter and read into the folds of the soul", (DeG2) p. 3

Deleuze G.
networked monades, actual entitities

„Die Monaden (von Leibniz) sind (zwar) alle miteinander kompossibel und jede Monade drückt gewissermaßen die ganze Welt aus. Aber sie sind nicht wirklich untereinander vernetzt. Die Monaden sind fensterlos. .. Die actual entities (von Whitehead) sind dagegen wirklich miteinander vernetzt. Ja gerade durch die Vernetzung entstehen neue actual entities. .... Die vielen actual entities werden in einem neuen actual entity eins und so werden diese um ein actual entity vermehrt. Es entstehen und vergehen also ständig neue actual entities", (PfM) S. 82

Deleuze G.
Notions like „inequality, asymmetry, divergence, incompossibilty, disparity"

„.. und natürlich haben wir gleich eine intuitive, vage Vorstellung von Begriffen wie „Ungleichung", „Asymmetrie", „Divergenz", Inkompossibility", „Disparität". ...Nun wird mit diesen Überlegungen nochmal deutlicher, warum die Membran bzw. die Haut so entscheidend für die Philosophie von Simondon und Deleuze ist. Die Membran schafft ein Innen-Außen-Verhältnis, eine ganz besondere Divergenz zwischen Innen und Außen: Die Membran ermöglicht, dass im Innern Fließgleichgewichte und immer gleiche Kreisläufe stattfinden können, die einerseits durch die Schutzfunktion der Membran Stoffe von außen nach innen, die die chemischen Prozesse im Innern brauchen, und Stoffe von innen nach außen, die zuviel oder schädlich sind. Aber das Außen ist auch unberechenbar. Es kann immer wieder hilfreiche Stoffe anbieten. Es kann aber auch Gifte bringen usw. Die Membran koordiniert diese problematische, immer neu herausfordernde Beziehung zwischen Innen und Außen!

Zwischen dem inneren Milieu und der Umgebung schafft die Membran eine kontrollierte Kommunikation bzw. Interaktion. Das Milieu in der Zelle und die Umwelt sind inkompassibel: Ohne Membran könnten die komplexen Fließgleichgewichte nicht aufrechterhalten bleiben. Das Leben der Zelle, bestehend aus hochkomplexen Fließgleichgewichten, wäre zusammengebrochen. Es braucht die Membran, die Asymmetrie und kontrolierte Kommunikation zwischen Innen und Außen schafft." (PfM) S. 106

Deligne P. et al.
Quantum fields and strings
A course for mathematicians

„the behavior of a physical system depends on a scale (of energies, distances, momenta, etc.) at which the behavior is studied. Very generally speaking, the method of renormalization group is a method designed how to describe how the dynamics of some system changes when we change the scale (distance, energies) at which we probe it,. ... Physics is scale dependent (requiring only a mathematical metric space framework, which has no geometric structure at all), and at each scale, there are different degrees of freedom and different dynamics, i.e. physics at a large scale decouples from the physics at a smaller scale. ... In classical mechanics there are three scales of distance, time, and mass. In non-relativistic quantum theory there are two scales: the mass can be expressed through «time» and «distance» using the Planck constant) and classical relativity («time» can be expressed via «distance» using the speed of light). In relativistic quantum theory there is only the scale of distance (or equivalently – the scale of (its inverse) momenta)," (DeP) p. 551

Dirac P. A. M.
A new basis for cosmology

„The modern study of cosmology is dominated by Hubble's observations of a shift to the red in the spectra of the spiral nebulae—the farthest parts of the universe—indicating that they are receding from us with velocities proportional to their distances from us. These observations show us, in the first place, that all the matter in a particular part of space has the same velocity (to a certain degree of accuracy) and suggest a model of the universe in which there is a natural velocity for the matter at any point, varying continuously

from one point to a neighbouring point. Referred to a four-dimensional space-time picture, this natural velocity provides us with a preferred time-axis at each point, namely, the time-axis with respect to which the matter in the neighbourhood of the point is at rest. By measuring along this preferred time-axis we get an absolute measure of time, called the epoch. .... Such ideas of a preferred time-axis and absolute time depart very much from the principles of both special and general relativity and lead one to expect that relativity will play only a subsidiary role in the subject of cosmology. This first point of view, which differs markedly from that of the early workers in this field, has been much emphasized recently by Milne," (DiP2)

Ehrenhaft F.
Photophoresis

(EhF): „Particles of matter irradiated by light between electrodes behave as if they carry positive or negative electric charges. Therefore we can say that through the action of the light uncharged particles obtain unipolar charges, either negative or positive."

It is unlikely, that all those movement phenomena in light with or without the action of a field can be explained with the helf of today's hypothesis; we may be forced to reach for something new [(*)].

[(*)] *Acta Physicia Austriaca, Band 4, 1950 and Band 5, 1951*

(EhF) p. 243: „In order to explain the phenomena of photophoresis one conclusion is drawn from the movement of illuminated particles in the homogeneous electric and magnetic fields. The light induces electric and magnetic charges (poles) upon the particles if they are illuminated by concentrated light preponderantly shorter wave lengths. .... For the magnetic charges this conclusion is new, but is justified because of the complete analogy of this phenomenon with the electric phenomenon."

(EhF1): „.... light beams must have electric stationary components in the direction of the wave front normal, and that consequently there must be stationary electric potential differences between different points along the beam; and that there must be also a stationary magnetic field in the beam of light with potential differences. Hence, the light beam must have a magnetizing effect, and the charge of a magnet should be changed by light."

Einstein A.
Zur Methodik der theoretischen Physik

"Nach unserer bisherigen Erfahrung sind wir nämlich zum Vertrauen berechtigt, daß die Natur die Realisierung des mathematisch denkbar Einfachsten ist. Durch rein mathematische Konstruktion vermögen wir nach meiner Überzeugung diejenigen Begriffe und diejenige gesetzliche Verknüpfung zwischen ihnen zu finden, die den Schlüssel für das Verstehen der Naturerscheinungen liefern. Die brauchbaren mathematischen Begriffe können durch Erfahrung wohl nahegelegt, aber keinesfalls aus ihr abgeleitet werden. Erfahrung bleibt natürlich das einzige Kriterium der Brauchbarkeit einer mathematischen Konstruktion für die Physik. Das eigentlich schöpferische Prinzip liegt aber in der Mathematik. In einem gewissen Sinn halte ich es also für wahr, daß dem reinen Denken das Erfassen des Wirklichen möglich sei, wie es die Alten geträumt haben", (EiA) S.130

Einstein A.
Cosmic religion

Religion and Science
„Everything that the human race has done and thought is concerned with the satisfaction of felt needs and the assuagement of pain. One has to keep this constantly in mind if one wishes to understand spiritual movements and their development. Feeling and desire are the motive forces behind all human endeavour and human creation, in however exalted a guise the latter may present itself to us. Now what are the feelings and needs that have led men to religious thought and belief in the widest sense of the words? A little consideration will suffice to show us that the most varying emotions preside over the birth of religious thought and experience. With primitive man it is above all fear that evokes religious notions--fear of hunger, wild beasts, sickness, death. Since at this stage of existence understanding of causal connexions is usually poorly developed, the human mind creates for itself more or less analogous beings on whose wills and actions these fearful happenings depend. One's object now is to secure the favour of these beings by carrying out actions and offering sacrifices which, according to the tradition handed down from generation to generation, propitiate them or make them well disposed towards a mortal. I am speaking now of the religion of fear. This, though not created, is in an important degree stabilized by the formation of a special priestly caste which sets up as a mediator between the people and the beings they fear, and erects a hegemony on this basis. In many cases the leader or ruler whose position depends on other factors, or a privileged class, combines priestly functions with its secular authority in order to make the latter more secure; or the political rulers and the priestly caste make common cause in their own interests.

The social feelings are another source of the crystallization of religion. Fathers and mothers and the leaders of larger human communities are mortal and fallible. The desire for guidance, love, and support prompts men to form the social or moral conception of God. This is the God of Providence who protects, disposes, rewards,

and punishes, the God who, according to the width of the believer's outlook, loves and cherishes the life of the tribe or of the human race, or even life as such, the comforter in sorrow and unsatisfied longing, who preserves the souls of the dead. This is the social or moral conception of God.

The Jewish scriptures admirably illustrate the development from the religion of fear to moral religion, which is continued in the New Testament. The religions of all civilized peoples, especially the peoples of the Orient, are primarily moral religions. The development from a religion of fear to moral religion is a great step in a nation's life. That primitive religions are based entirely on fear and the religions of civilized peoples purely on morality is a prejudice against which we must be on our guard. The truth is that they are all intermediate types, with this reservation, that on the higher levels of social life the religion of morality predominates.

Common to all these types is the anthropomorphic character of their conception of God. Only individuals of exceptional endowments and exceptionally high-minded communities, as a general rule, get in any real sense beyond this level. But there is a third state of religious experience which belongs to all of them, even though it is rarely found in a pure form, and which I will call cosmic religious feeling. It is very difficult to explain this feeling to anyone who is entirely without it, especially as there is no anthropomorphic conception of God corresponding to it", (EiA1) p. 19

Feynman R.

„When a historian of particle physics pressed him (R. Feynman) on the question of unification, he resited.
„Your career spans the period of the construction of the standard model," the interviewer said.
„'The standard model'" Feynman repeated dubiously.
"$SU(3) \times SU(2) \times U(1)$. From renormalization (*), to quantum electrodynamics to now?"
„The standard model, standard model," Feynman said. „The standard model ---- is that the one that says that we have electrodynamics, we have weak interaction, and we have strong interaction? Okay, Yes."
The interviewer said, „That was quite an achievement, putting them together."
„They're not put together."
„Linked together in a single theoretical package?"
„No."
The interviewer was having trouble getting his question onto the table.
„What do you call $SU(3) \times SU(2) \times U(1)$?"
„Three theories," Feynman said. „Strong interactions, weak interactions, and electromagnetic ... The theories are linked because they seem to have similar characteristics ... Where does it go together? Only if you add some stuff that we don't know. There isn't any theory today that has $SU(3) \times SU(2) \times U(1)$ --- whatever the hell it is --- that we know is right, that has experimental check ... Now, these guys are all trying to put all this together. They're trying to. But they haven't. Okay?", (GU) p. 433

„Somebody makes up a theory: The proton is unstable. They make a calculation and find that there would be no protons in the universe any more! So they fiddle around with their numbers, putting higher mass into the new particle, and after much effort they predict that the proton will decay at a rate slightly less than the last measured rate the proton has shown not to decay at. When a new experiment comes along and measures the proton more carefully, the theories adjust themselves to squeeze out from the pressure", (UnA) p. 162
„Diejenigen, die die Mathematik nicht verstehen, werden kaum zu den tiefen Schönheiten der Natur vordringen können. Die Physiker können sich keiner anderen Sprache bedienen und wenn man mehr über die Natur lernen will, muß man die Sprache verstehen lernen, die sie spricht", (SpK) S. 3

Feynman R.
The character of physical laws

(FeR1) p. 13: "There is a rhythm and a pattern between the phenomena of nature which is not apparent to the eye, but only to the eye of analysis; and it is these rhythms and patterns which we call Physical Laws."

(FeR1) p. 36: "The strange thing about physics is that for the fundamental laws we still need mathematics."

(FeR1) p. 39: "There is no model of the theory of gravitation today, other than the mathematical form. ... „Every one of our laws is a purely mathematical statement in rather complex and abstruse mathematics."
(FeR1) p. 54: "The best law, as at present understood, is really a combination of the two in which we use minimum principles plus local laws."

(FeR1) P. 57: "This shows again that mathematics is a deep way of expressing nature, and any attempt to express nature in philosophical principles, or in seat-of-the-pants mechanical feelings, is not an efficient way."

(FeR1) p. 58: "To summarize, I would use the words of Jeans, who said that „the Great Architect seems to be a mathematician". To those who do not know mathematics it is difficult to get across a real feeling as to the beauty, the deepest beauty, of nature. ....If you want to learn about nature, to appreciate nature, it is neccessary to understand the language that she speaks in. She offers her information only in one form; we are not so unhumble as to demand that she change before we pay any attention."

(FeR1) p. 173: "What is it about nature that lets this happen, that it is possible to guess from one part what the rest is going to do? That si an unscientific question: I do not know how to answer it, and therefore I am going to give an unscientific answer. I think it is because nature has a simpicity and therefore a great beauty."

(FeR1) p. 66: "Charge is the source of a field; in other words, electricity is related to charge. Thus the particular quantity which is conserved here has two other aspects which are not connected with the conservation directly, but are interesting anyway. One is that it comes in units, and the other that it is the source of the field."
(FeR1) p. 149: "First of all there is matter – and, remarkably enough, all matter is the same."

(FeR1) p. 155: "If we put all this principles together, we discover that there are too many. They are inconsistent with each other. It seems that if we take quantum mechanics, plus relativity, plus the proposition that everything has to be local, plus a number of tacit assumptions, we get inconsistency, because we get infinity for various things when calculate them, and if we get infinity how can we ever say that this agrees with nature?"

(FeR1) p. 163: "Any schemes – such as „think of symmetric laws", or „put the information in mathematical form", or „guess equations" – are known to everybody now, and they are all tried all the time. When you are stuck, the answer cannot be one of these, because you will have tried these right away. There must be another way next time. Each time we get into this log-jam of too much trouble, too much problems, it is because the methods that we are using are just like the ones we have used before. The next scheme, the new discovery, is going to be made in a complete different way. So history does not help us much."

Heidegger M.
The Age of the World Picture

„In metaphysics reflection is accomplished concerning the essence of what is and a decision takes place regarding the essence of truth. Metaphysics grounds an age, in that through a specific interpretation of what is and through a specific comprehension of truth it gives to that age the basis upon which it is essentially formed. This basis holds complete dominion over all the phenomena that distinguish the age. Conversely, in order that there may be an adequate reflection upon these phenomena themselves, the metaphysical basis for them must let itself be apprehended in them. Reflection is the courage to make the truth of our own presuppositions and the realm of our own goals into the things that most deserve to be called in question," (HeM) p.70

„Modern physics is called mathematical because, in a remarkable way, it makes use of a quite specific mathematics. But it can proceed mathematically in this way only because, in a deeper sense, it is already itself mathematical," (HeM) p.72

Heisenberg W.
The degeneracy of the ground state

„The mathematical formalism contains some unconventional features which formerly have rendered its understanding somewhat difficult: the indefinite metric in Hilbert space and the degeneracy of the ground state. But in recent years the indefinite metric has been studied in connexion with the Bleuler-Gupta version of quantum electrodynamics and with the Lee-model, the degeneracy of the ground state plays an important part in modern solid state physics", (HeW) vi

„In fact the number of protons in the world seems to be very different from the number of neutrons, the number of electrons is very different from the number of neutrinos. Even the matter and antimatter should be distributed in the universe with equal average density – many galaxies might be consist of matter, equally many of antimatter – and if total isospin should be small in this way, the big asymmetry would remain, since in matter the total isospin would point in one direction, in antimatter in the opposite direction. Hence there would be a macroscopic deviation from symmetry in isospace.

An asymmetry of the ground state and therefore a degeneracy of this state is a well-known phenomenon in many systems discussed in conventional quantum mechanics. Ferromagnetism, superfluidity, superconductivity, crystal structure are obvious examples. In such cases two important new phenomena appear ....: The degeneracy of the ground state enforces the existence of bosons of rest mass zero, as has been pointed out in a mathematical form by Goldstone (the Goldstone theorem). Some property of the ground state can be attached to the particles thereby changing normal particles into strange particles", (HeW) p. 90

Kant I.
Metaphysische Anfangsgründe der Naturwissenschaften

„Reine Vernunfterkenntnis aus bloßen Begriffen heißt reine Philosophie, oder Metaphysik; dagegen wird, die, welche nur auf der Konstruktion der Begriffe, vermittelst Darstellung des Gegenstandes in einer Anschauung a priori, ihr Erkenntnis gründet, Mathematik genannt.
....
Ich behaupte aber, daß in jeder besonderen Naturlehre nur so viel eigentliche Wissenschaft angetroffen werden könne, als darin Mathematik anzutreffen ist. Denn nach dem Vorgehenden erfordert eigentliche Wissenschaft, vornehmlich der Natur, einen reinen Teil, der dem empirischen zum Grunde liegt, und der auf Erkenntnis der Naturdinge a priori beruht. Nun heißt etwas a priori erkennen es aus seiner bloßen Möglichkeit erkennen. Die Möglichkeit bestimmter Naturdinge kann aber nicht aus ihren bloßen Begriffen erkannt werden; denn aus diesen kann zwar die Möglichkeit des Gedankens (daß er sich selbst nicht widerspreche), aber nicht des Objekts, als Naturdinges erkannt werden, welches außer dem Gedanken (als existierend) gegeben werden kann. ... aber eine reine Naturlehre über bestimmte (Körperlehre und Seelenlehre) Naturdinge ist nur vermittelst der Mathematik möglich, ... so wird Naturlehre nur so viel eigentliche Wissenschaft enthalten, als Mathematik in ihr angewandt werden kann", (Kal) S. 6/7

Kant I.
The Critique of Teleological Judgement
Objective Purposiveness

(Kal) § 62: On Merely Formal, as Distinguished from Material, Objective Purposiveness

(Kal) § 63: On Relative as Distinguished from the Inner, Purposiveness of Nature
„Only in one case does experience lead our power of judgment to the concept of a purposiveness that is both objective and material purposiveness, i.e., to the concept of a purpose of nature-namely, when we have to judge a relation of cause to effect which is such that we can see it as law-governed only if we regard the cause's action as based on the idea of the effect, with this idea as the underlying condition under which the cause itself can produce that effect. We can do this in two ways: we may regard the effect either as directly the product of art, or as only the material that other possible natural beings employ in their art; in other words, we may regard the effect either as a purpose, or as a means that other causes employ purposively. The second purposiveness is called either usefulness (for human beings) or benefit (for any other creature), and this second purposiveness is merely relative, whereas the first is an intrinsic purposiveness of the natural being."

Leedskalnin E.
Magnetic current is the same as electric current

(LeE) p. 31: A magnetic current is the same as an electric current, those are two currents, which are made up of individual North Pole particles and South Pole particles. One current runs against one another with high velocity in a whirling helical form.

In order to let a current flow, it must must be necessarily run against the other current.

Leibniz G. W.
Neue Abhandlungen über den menschlichen Verstand

Buch 1: von den angeborenen Vorstellungen	*I – III*
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Nagel Th.
Mind & Cosmos
Antireductionism and the Natural Order

„We and other creatures with mental lives are organisms, and our mental capacities apparently depend on our physical constitution. So what explains the existence of organisms like us must also explain the existence of mind. ... If evolutionary biology is a physical theory – as it is generally taken to be – then it cannot account for the appearance of consciousness and of other phenomena that are not physically reducible. So if mind is a product of biological evolution – if organisms with mental life are not miraculous anomalies but integral part of nature – then biology cannot be a purely physical science. The possibility opens up of pervasive conception of the natural order very different from materialism – one that makes mind central, rather than a side effect of physical law," (NaT) p. 14

Nagel Th.
The View from Nowhere

II Mind, 1. Physical Objectivity
„The natural place to begin is with our own position in the world. One of the strongest philosophical motives is the desire for a comprehensive picture of objective reality, since it is easy to assume that that is all there really is. But the very idea of objective reality guarantees that such a picture will not comprehend everything; we ourselves are the first obstacles to such an ambition,“ (NaT2) p. 17

Robitaille P.-M.
Fourty lines of evidence for condensed matter
The Sun on trial, Liquid metallic hydrogen as a solar building block

(RoP): „Our Sun has confronted humanity with overwhelming evidence that it is comprised of condensed matter. Dismissing this reality, the standard solar models continue to be anchored on the gaseous plasma. In large measure, the endurance of these theories can be attributed to 1) the mathematical elegance of the equations for the gaseous state, 2) the apparent success of the mass-luminosity relationship, and 3) the long-lasting influence of leading proponents of these models. Unfortunately, no direct physical finding supports the notion that the solar body is gaseous. Without exception, all observations are most easily explained by recognizing that the Sun is primarily comprised of condensed matter. However, when a physical characteristic points to condensed matter, a postori arguments are invoked to account for the behavior using the gaseous state. In isolation, many of these treatments appear plausible. As a result, the gaseous models continue to be accepted. There seems to be an overarching belief in solar science that the problems with the gaseous models are few and inconsequential. In reality, they are numerous and, while often subtle, they are sometimes daunting. The gaseous equations of state have introduced far more dilemmas than they have solved. Many of the conclusions derived from these approaches are likely to have led solar physics down unproductive avenues, as deductions have been accepted which bear little or no relationship to the actual nature of the Sun. It could be argued that, for more than 100 years, the gaseous models have prevented mankind from making real progress relative to understanding the Sun and the universe. Hence, the Sun is now placed on trial. Forty lines of evidence will be presented that the solar body is comprised of, and surrounded by, condensed matter. These 'proofs' can be divided into seven broad categories: 1) Planckian, 2) spectroscopic, 3) structural, 4) dynamic, 5) helioseismic, 6) elemental, and 7) earthly. Collectively, these lines of evidence provide a systematic challenge to the gaseous models of the Sun and expose the many hurdles faced by modern approaches. Observational astronomy and laboratory physics have remained unable to properly justify claims that the solar body must be gaseous. At the same time, clear signs of condensed matter interspersed with gaseous plasma in the chromosphere and corona have been regrettably dismissed. As such, it is hoped that this exposition will serve as an invitation to consider condensed matter, especially metallic hydrogen, when pondering the phase of the Sun.“

Blackbody radiation and the loss of universality,
Implications for Planck's formulation and Boltzmann's constant

(RoP1): „Through the reevaluation of Kirchhoff's law (Robitaille P. M. L. IEEE Trans. Plasma Sci., 2003, v. 31(6), 1263–1267), Planck's blackbody equation (Planck M. Ann. der Physik, 1901, v. 4, 553–356) loses its universal significance and becomes restricted to perfect absorbers. Consequently, the proper application of Planck's radiation law involves the study of solid opaque objects, typically made from graphite, soot, and carbon black. The extension of this equation to other materials may yield apparent temperatures, which do not have any physical meaning relative to the usual temperature scales. Real temperatures are exclusively obtained from objects which are known solids, or which are enclosed within, or in equilibrium with, a perfect absorber. For this reason, the currently accepted temperature of the microwave background must be viewed as an apparent temperature. Rectifying this situation, while respecting real temperatures, involves a reexamination of Boltzman's constant. In so doing, the latter is deprived of its universal nature and, in fact, acts as a temperature dependent variable. In its revised form, Planck's equation becomes temperature insensitive near 300 K, when applied to the microwave background.“

Water, Hydrogen Bonding, and the Microwave Background

(RoP2): „In this work, the properties of the water are briefly revisited. Though liquid water has a fleeting structure, it displays an astonishingly stable network of hydrogen bonds. Thus, even as a liquid, water possesses a local lattice with short range order. The presence of hydroxyl ($O-H$) and hydrogen ($H\cdots OH_2$) bonds within water, indicate that it can simultaneously maintain two separate energy systems. These can be viewed as two very different temperatures. The analysis presented uses results from vibrational spectroscopy, extracting the force constant for the hydrogen bonded dimer. By idealizing this species as a simple diatomic structure, it is shown that hydrogen bonds within water should be able to produce thermal spectra in the far infrared and microwave regions of the electromagnetic spectrum. This simple analysis reveals that the oceans have a physical mechanism at their disposal, which is capable of generating the microwave background.“

Rovelli C.
The thermal time hypothesis

The thermal time hypothesis: In Nature, there is no preferred physical time variable t. There are no equilibrium states preferred a priori. Rather, all variables are equivalent: we can find the system in an arbitrary state ; if the system is in a state, then a preferred variable is singled out by the state of the system. This variable is what we call time. .... In other words, it is the statistical state that determines which variable is physical time, and not any a priori hypothetical „flow" that drives the system to a preferred statistical state", (RoC) p. 143

Russel B.

„"Substance", in a word, is a metaphysical mistake, due to transference to the world-structure of the structure of sentences composed of a subject and a predicate", (RuB1) p. 212

„*Space and time are not concepts; they are forms of „*intuition", (RuB1) p. 681

„All a priori knowledge deals exclusively with the relations of universals", (RuB2) p. 88

Schrödinger E.
Differentials and practice by repetition

„To my mind the key is to be found in the following well-known facts. Any succession of events in which we take part with sensations, perceptions and possibly with actions gradually drops out of the domain of consciousness when the same string of events repeats itself in the same way very often. But it immediately shot up into the conscious region, if at such a repetition either the occasion or the environmental conditions met with on its pursuit differ from what they were on all the previous incidences. Even so, at first anyhow, only those modifications or „differentials" intrude into the conscious sphere that distinguish the new incidence from previous ones and thereby usually can for „new considerations", (ScE1) p. 96

Schauberger V.

(LaS) S. 230: Deshalb nannte Chardin es auch das Universum auf der Bahn der Einrollung. .... Viktor Schauberger sah also einen engen Zusammenhang zwischen der Bewegung der Planeten, der Atome und der materiellen Zwischenstufen (Moleküle, Wasser, Wellen, Wind (vor allem Wirbelstürme), Wolken, Blut und Pflanzensäfte usw.) Er benütze für die Planetenbewegung auch den schwierigen Begriff „zykloide Raumkurvenbewegung". ... Nach Schauberger spiralen sie um die Sonne. Er begründete dies damit, daß alles, was sich im Kreise dreht, nicht von Fleck kommt. Statt „zykloide Raumkurvenbewegung" sagte er auch „planetare Bewegung". Also dreht sich auch die Erde in dieser Weise. Die „planetare Bewegung" der Erde hat auch Einfluß auf die Massenbewegung, sagte Schauberger. Das Wasser, Blut, Pflanzensäfte, Winde und Meereswellen, Gase, Rauchschwaden, etc. werden in dieser Weise bewegt.

Univ. Prof. Felix Ehrenhaft, Vorstand des ersten Physikalischen Institutes der Universität Wien, machte mit seinen Mitarbeitern die Entdeckung, daß kleinste freischwebende Materieteilchen in einem konzentrierten Lichtstrahl sich auf Schraubenbahnen bewegen. Teils in der Fortpflanzung des Lichts, teils in der entgegengesetzten Richtung. Dieser Versuch wird Photophorese genannt.

(LaS) S. 233: „Der Wirbel sorgt für Ordnung. Schauberger nannte diesen Vorgang auch „Atomumwandlung statt Atomzertrümmerung". Bei der Atomzertrümmerung werden Zerfallsprozesse eingeleitet. Uranatome werden gespalten, wodurch Energie frei wird. Uran ist bereits ein hochwertiges Element, das durch den Kernspaltungsvorgang in ein minderwertiges, hochgiftiges Abfallprodukt verwandelt wird. Aus Ordnung wird Chaos.

Beim Verfahren der natürlichen Atomumwandlung nach Schauberger werden Atome nicht gespalten, sondern durch die saugende, verdichtende Implosionskraft auf ein höheres Ordnungsnivau gebracht. Die ursprüngliche Atomstruktur wird aufgelöst und neu gruppiert, eingespeicherte Energie wird frei. Ein Trennen und Wiedervereinen auf höherer (qualitativer) Ebene. Aus Chaos wird Ordnung."

(LaS) S. 244: „Nach Schauberger ist Wachstum das Ergebnis eines Druckausgleiches zweier bipolarer (gegengeschlechtlicher) feinstofflicher Energien, die sich gegensinnig kreuzen (vermählen, vereinen), woraus ein Drittes entsteht. Diese feinstofflichen Energien sind für unser menschliches Auge unsichtbar. ... Erst das Produkt aus der Kreuzung dieser feinstofflichen Energien, die Auswirkung, das sogenannte „Dritte", das „Grobstoffliche" (summa summarum unsere gesamte materielle Welt) ist für uns sichtbar und greifbar."

(LaS) S. 250: „Ein bißchen Lichteinfluß, ein bißchen Lichtabschluß, ein bißchen Wärme, ein bißchen Kälte rhythmisch geordnet genügt, um das edelste Wasser, das durch Mutatoren fließt, hochwertig aufzuladen (zu ionisieren)."

Schrödinger E.
Science and humanism

Form, not substance, the fundamental concept
„The situation is rather disconcerting. You will ask: What are these particles then, if they are not individuals? And you may point to another kind of gradual transition, namely that between an ultimate particle and a palpable body in our environment, to which we do attribue individual sameness. A number of particles constitute an atom. Several atoms compose a molecule. Molecules there are of various sizes, small ones and big ones, but without there being any limit beyond which we call it a big molecule. In fact there is no upper limit to the size of a molecule, it may contain hundreds of thousands of atoms. It may be a virus or a gene, visible under the microscope. Finally we may observe that any palpable object in our environment is composed of molecules, which are composed of ultimate particles … and if the latter lack individuality, how does, say, my wrist-watch come by individuality? Where is the limit? How does individuality arise at all in objects composed of non-individuals?“, (ScE3) p. 122

„The new idea is that what is permanent in these ultimate particles or small aggregates is their shape and organization. The habit of everyday language deceives us and seems to require, whenever we hear the word „shape“ or „form“ pronounced, that it must be the shape or form of something, that a material substratum is required to take on a shape. Scientifically this habit goes back to Aristotle, his causa materialis and causa formalis. But when you come to the ultimate particles constituting matter, there seems to be no point in thinking of them again consisting of some material. They are, as it were, pure shape, nothing but shape; what turns up again and again in successive observations is this shape, not an individual speck of material“, (ScE3) p. 125

Seyfried T. N.
Cancer as a mitochondrial metabolic Disease

(SeT1): Abstract*: Cancer is widely considered a genetic disease involving nuclear mutations in oncogenes and tumor suppressor genes. This view persists despite the numerous inconsistencies associated with the somatic mutation theory. In contrast to the somatic mutation theory, emerging evidence suggests that cancer is a mitochondrial metabolic disease, according to the original theory of Otto Warburg. The findings are reviewed from nuclear cytoplasm transfer experiments that relate to the origin of cancer. The evidence from these experiments is difficult to reconcile with the somatic mutation theory, but is consistent with the notion that cancer is primarily a mitochondrial metabolic disease.*

(SeT) p. 15: *„A major impediment in the effort to defeat cancer has been due, in large part, to the confusion surrounding the origin of the disease. „Make no mistake about it, the origin of cancer is far from settled.“ Contradictions and paradoxes continue to plague the field (1-5). Much confusion surrounding the origin of cancer arises from the absence of a unifying theory that can integrate the diverse observations on the nature of the disease. Without a clear idea on cancer origins it becomes difficult to formulate a clear strategy for effective management and prevention. The failure to clearly define the origin of cancer is responsible in large part for the failure to significantly reduce the death rate from the disease.“*

(SeT) p. 18: THE ONCOGENIC PARADOX: *„Although very specific processes underlie malignant transformation, a large number of unspecific influences can initiate the disease including radiation, chemicals, viruses, and inflammation. Indeed, it appears that prolonged exposure to almost any provocative agent in the environment can potentially cause cancer (26, 27). That a very specific process could be initiated in very unspecific ways was considered „*the oncogenic paradox*“ by Albert Szent-Gyorgyi, a leading cancer researcher of his day (27, 28).* Oncogenesis *is the term used to describe the biological process leading to tumor formation. John Cairns also struggled with this paradox in his essay on* The Origins of Human Cancers *(29). The oncogenic paradox persists today as an unresolved issue in cancer research (26, 30). I will show how respiratory insufficiency is the origin of the oncogenic paradox.“*

(SeT) p. 22: THE WARBURG THEORY: *„In addition to the six recognized hallmarks of cancer, aerobic fermentation or the Warburg effect is also a robust metabolic hallmark of most tumors whether they are solid or blood born (42-47). Aerobic fermentation involves elevated glucose uptake with latic acid production in the presence of oxygen. Elevated glucose uptake and latic acid production is a defining chracteristic of most tumors and is the basis for tumor imaging using labeled glucose analogs (48-50). Labeled glucose analogs have become an important diagnostic tool for cancer detection and management using positron emission tomography (PET). The radiolabeled glucose collects in the tumor tissue because nearly all tumors depend heavily on glucose for survival. Consequently, it is easy to detect many tumor types based on their requirement for glucose as shown in Figure 2.4“*

(SeT) p. 24: *Warburg initially proposed that aerobic glucose fermentation (aerobic glycolysis) was an epiphenomenon of a more fundamental problem in cancer cell physiology, that is, impaired or damaged respiration (54, 56).“*

(SeT) p. 26: REASSESSMENT: *„While there is now renewed interest in the energy metabolism of cancer cells, it is widely assumed that the Warburg effect and the metabolic defects expressed in cancer cells arise primarily from genomic mutability selected during tumor progression (24, 53, 74-77). In other words, the abnormal energy metabolism in cancer arises as a secondary consequence of defects in oncogenes and*

tumor-suppressor genes (78). Emerging evidence, however, questions the genetic origin of cancer and suggests that cancer is primarily a metabolic disease as Warburg originally decribed.

It is interesting in this regards that James Watson, who co-discovered DNA as a genetic material with Francis Crick in 1953, recently suggested that more attention be paid to the metabolism of cancer (79). Watson also believes that the direction of cancer research in the United States is largely offtrack and misdirected at the highest levels. The absence of major clinical breakthroughs in the cancer war over the last 40 years and the death statistics presented in Table 1.1 support Watson's contention.

My goal is to reengage the discussion of tumor cell origin and to provide evidence supporting a general hypothesis that genomic mutability and essentially all hallmarks of cancer including the Warburg effect can be linked to impaired respiration and energy metabolism. I will review evidence showing that respiratory insufficiency precedes and underlies the genome instability that accompanies tumor development. Once established, genome instability contributes to further respiratory impairment, genome mutability, and tumor progression.

I content that most of the gene defects in natural cancers arise as downstream effects of damaged mitochondrial function. My hypothesis is based on evidence that nuclear genome integrity is largely dependent on the cell having sufficient mitochondrial respiration, and that cells require regulated energy homeostasis to maintain their differentiated state. While Warburg recognized the centrality of impaired respiration in the origin of cancer, his research did not expain how impaired mitochondrial function was connected to what are now recognized as the hallmarks of cancer. Moreover, he did not clearly describe how cancer cells appear to respire normally, but have defective mitochondrial respiration (53). I will review evidence making these linkages and expand Warburg's ideas on how impaired energy metabolism can be exploited for tumor prevention and management. My former student, Laura Shelton, and I recently published an overview of the key issues (24). However, it was not possible in this brief review to present the detailed evidence supporting the central hypothesis of cancer as a disease of impaired respiration. The following chapters present more detailed evidence in support of the main hypothesis."

(SeT) p. 47/48/49: "Homeostasis is the tendency of biological systems to maintain relatively stable conditions in their internal environments. Each cell and each organ contributes to the overall homeostasis of the organism. ... Metabolic homeostasis within cells is dependent to a large extent on the energy supply to the membrane pumps. ...Most cell functions are linked either directly or indirectly to the plasma membrane potential and to the Na(+)/K(+)/Ca(2+) gradients. Ready availability of ATP to the pumps maintains these ionic gradients. Global cellular dysfunction and ultimately organ and systems failure will arise if energy flow to the pumps is distrupted. There are several sources of ATP synthesis that can be used to maintain membrane potentials. The mitochondria produce most of the energy in the normal mammalian cells. The general structure of a mitochontrion with associated functions is shown in Figure 4.2. Other images of mitochondrial are presented in Chapter 7. In cells with functional mitochontria, ATP is derived mostly from oxidative phosporylation (OxPhos) where approximately 89% of the cellular energy is produced (about 32/36 total ATP molecules during the complete oxidation of glucose) (Fig. 4.3). This value can differ among different cells depending on which shuttle systems are used in the transport of cytoplasmic reducing equivalents (NADH (reduced form)) from the cytoplasm to mitochondria. These shuttles include the malate-aspertate shuttle, the glycerol-phosphate shuttle, and the malate-cirtrate shuttle. These shuttles are operational in tumor cells, but their activity can differ among the different types of tumor cells (12-19). Under OsPhos, ATP synthesis in normal cells is coupled to electron flow across the inner mitochondial membrane through a chemiosmotic molecular mechanism (Fig. 4.4) (29)."

(SeT) p. 51/52: "Besides OxPhos (oxidative phosphorylation), approximately 11% (4/36 total ATP molecules) of the total cellular energy is produced through substrate-level phosphorylation. Substrate-level phosphorylation involves the transfer of a free phosphate to ATP from a metabolic substrate to form ATP. Two major metabolic pathways can produce ATP through substrate-level phosphorylation in mammalian cells and tissues. The first involves the "pay off" part of the Embden-Myerhoff glycolytic pathway in the cytosol where phophate groups are transferred from organic molecules, 1,3-bisphosphoglycerate and phosphoenolpyruvate (PEP), to ADP with formation of ATP. The second pathway involes the succinyl-synthetase reaction of the tricarboxylic acid (TCA) (Fig. 4.6)."

(SeT) p. 73: "Warburg considered oxidative phosphorylation (OxPhos) injury or insufficiency to be the origin of cancer. OxPhos is the final stage of cellular respiration involving multiple coupled redox reactions where the energy contained in carbon-hydrogen bonds of food molecules is captured and conserved in the terminal phosphoanhydride bond of ATP. The process specifically involves the following: (i) the flow of electrons through a chain of membrane-bound carriers, (ii) the coupling of the downhill electron flow to an uphill transport of protons across a proton-impermeable membrane, thus conserving the free energy of fuel of oxidation as a transmembrane electrochemical potential, and (iii) the synthesis of ATP from ADP+Pi throught a membrane-bound enzymatic complex linked to the transmembrane flow of the protons down their concentration gradient."

Soai K.
The Soai reaction and its implications with the
life's characteristic features of self-replication and homochirality

(SoK) ABSTRACT: Asymmetric autocatalysis is a reaction in which chiral product acts as a chiral catalyst for its own production. The process is a self-replication of chiral molecules with amplification of enantiomeric excess (ee). In the Soai reaction, (S)-pyrimidyl alkanol with extremely low ee acts as asymmetric autocatalyst in the enantioselective addition of diisopropylzinc to pyrimidine-5-carbaldehyde to afford more of the (S)-pyrimidyl alkanol of the same structure with significantly enhanced greater than 99.5% ee. The Soai reaction is capable of absolute asymmetric synthesis. Thus, the reaction between achiral diisopropylzinc and pyrimidine-5-carbaldehyde without the intervention of any chiral factor affords enantioenriched pyrimidyl alkanol with stochastic distribution. The proposed origins of homochirality such as quartz and circularly polarized light are correlated to highly enantioenriched compound by using the Soai reaction. The implications of the Soai reaction is described in the selected life's characteristic features of selfreplication and homochirality.
(SoK) 1.1*: „Characteristic features of life (selected) and those of asymmetric autocatalysis: self-replication and homochirality*

Among the characteristic features of life, the most typical one would be its ability of self-replication, a feature that has long been recognized. Over 2300 years ago, Aristotle (384e322 BCE) noted his conception that means "Human being is born from human being. Chair bed is not born from chair bed" (Fig. 1a) [1]. Even the most human-like modern robot is not considered to be a living creature mainly because that is not capable of self-replication so far.

Another characteristic feature of life is that the essential molecules of life such as amino acids and sugars exhibit overwhelming one-handedness of enantiomers, e.g., L-amino acids and D-sugars. The characteristic of handedness is the same in all species on Earth. This phenomenon is often called biological homochirality [2]. Biological homochirality is not a mere phenomenon; it has been considered to be an essential prerequisite for the emergence and function of life. Proteins are formed from the peptide condensation of L-amino acids. If D-amino acids are involved irregularly in proteins, then the structures of the proteins will become diastereomers with different chemical and physical behaviors. Subsequently, the proteins will lose the capability to perform, for example, enzyme functions. It is known that DNA is composed of D-deoxyribose (Fig. 1a). If DNA incorporates L-sugar in random manner, the conformation of the DNA changes and the transfer of genetic information to the next generation becomes very difficult. Indeed, Eschenmoser described that the reaction of the self-assemble by ligative oligomerization of tetrameric D-pyranosyl-RNA (analogues of RNA) is slower by at least two orders of magnitude when one of the components is substituted by the L-enantiomer [3]. Biological homochirality was first noted in the 19th century, which is recent compared with life's feature of self-replication. In the 19th century, many biologically related compounds were found to exhibit optical rotation of plane polarized light. In 1848, Pasteur crystallized two hemihedric crystal forms from a solution of racemic sodium ammonium tartrate and isolated each crystal form [4]. Solutions of each form exhibited opposite directions of optical rotation. Pasteur's discovery proved that the optically active molecules have dissymmetry, i.e., chirality incontemporary terminology, in their molecular structures.

Asymmetric autocatalysis is a reaction in which chiral product acts as chiral catalyst for its own production (Fig. 1b). The process is an automultiplication (self-replication) of a chiral molecule with amplification of enantiomeric excess (ee).

Asymmetric autocatalysis has the following advantages over conventional asymmetric catalysis: (1) The efficiency is high, because automultiplication is a system that life adopts; (2) In sharp contrast to conventional catalysis, no decrease in the quantity and deterioration of catalyst is observed because the newly formed product becomes new catalyst; (3) Separation process of the product from catalyst is not necessary because their structure is the same."

Weinberg S.
The First Three Minutes

„The first One-hundredth Second: Our account of the first three minutes in Chapter 5 did not begin at the beginning. Instead, we started at a „first frame" („ein erstes Bild") when the cosmic temperature has already cooled to 100000 *million degrees of Kelvin, and the only particles present in large numbers were photons, electrons, neutrinos and their corresponding antiparticles. If these really were the only types of particles in nature, we could perhaps extrapolate the expansion of the universe backward in time and infer that there must have been real beginning, a state of infinite temperature and density, which occurred* $0{,}0108$ *seconds bevor our first frame (our „erstes Bild")"*

Weyl H.
Philosophy of Mathematics and Natural Science
Relationship of physics to chemistry & biology
Organic & inorganic matter

(WeH) p. 266: „The current understanding of the relationship of physics and chemistry may be briefly sketched by the statement that

> *„the valence bonds are an abbreviated symbol for the actual quantum-physical forces acting between the atoms, which themselves are complex dynamical system““*

(WeH) p. 276: „The current understanding of the relationship of physics and biology may be briefly sketched by the statement that

> *„One of the profoundest enigmas of nature is the contrast of dead and living matter. .... Incidentally, the gap between organic and inorganic matter has been bridged to a certain extent by the discovery of virusses. Virusses are submiroscopic entities that behave like dead inert matter unless placed in certain living cells. .... Many virusses have the structure typical of inorganic matter; they are crystals.“*

(WeH) pp. 276-278: „Incidentally, the gap between organic and inorganic matter has been bridged to a certain extent by the discovery of viruses. Viruses are submicroscopic entities that behave like dead inert matter unless placed in certain living cells. As parasites in these cells, however, they show the fundamental chracteristics of life – self-duplication and mutation. On the other hand many viruses have the structure typical of inorganic matter; they are crystals. In size they range from the more complex protein molecules tot he smaller bacteria. Chemically they consist of nucleo-protein, as the genus do. A virus is clearly something like a naked gene. The best studied virus, that of tobacco mosaic disease, is a nucleo-protein of high molecular weight consisting of 95 per cent protein and 5 per cent nucleic acid; it cristallizes in long thin needles. ...

The specific properties of living matter will have to be studied within the general laws valid for all matter; the viewpoint of holism that the theory of life comes first and that one descends from there sort of deprivation to inorganic matter must be rejected. It is therefore significant that certain simple and clearcut traits of wholeness, organization, acausality, are ascribed by quantum mechanics to the elementary constituents of all matter. ....

The quantum physics of atomic processes will become relevant for biology wherever in the life cycle of an organism a moderate number of atoms exercises a steering effect upon the large scale happenings. .... On a broad empirical foundation, genetics furnishes the most convincing proof that organisms are controlled by processes of atomic range, where the acausality of quantum mechanics may make itself felt. ... The mere fact of such X-rays induced mutations proves that the genes are physical structures. ...

By ingenious methods H. J. Muller, N. W. Timoféeff-Ressowsky, and others have succeeded in establishing simple quantitive laws concerning the rate of induced mutations. These results indicate that the mutation is brought about by a single hit, not by the concerted action of several hits, and that this hit consists of an ionization, and is not, as one might have thought, a process directly released by the X-ray photon or absorbing the whole energy of the secondary electron.

These facts suggest the hypothesis that a gene is a (nucleo-protein) molecule of highly complicated structure, that a mutation consists in a chemical change of this molecule brought about by the effect of an ionization on the bonding electrons, and that thus allele genes are essentially isometric molecules.“

Whitehead A. N.
Process and Reality
An Essay in Cosmology

„The reformed subjectivist principle adopted by the philosophy of organism is merely an alternative statement of the principle of relativity. This principle states that it belongs to the nature of a „being“ that it is a potential for everything „becoming. Thus all things are to be conceived as qualifications of actual occasions. According to the ninth Category of Explanation, how *an actual entity becomes constituted* what *the actual entity is“,* (WhA1) p. 166

Whitehead A. N.
Actual entities

„Die Monaden sind zwar alle miteinander kompossibel und jede Monade drückt gewissermaßen die ganze Welt aus. Aber sie sind nicht wirklich untereinander vernetzt. Die Monaden sind fensterlos. ...

*Die actual entities sind dagegen wirklich miteinander vernetzt. Ja gerade durch die Vernetzung entstehen neue actual entities. Der zentrale Satz der Prozessphilosophie Whiteheads lautet: „*Die vielen werden eins und werden um eins vermehrt.*“ Wir müssen den Begriff actual entity einsetzen: Die vielen actual entities*

werden in einem neuen actual entity eins und so werden diese um ein actual entity vermehrt. Es entstehen und vergehen also ständig neue actual entities“, (PfM) S. 82

Wong M. L. et al.
On the roles of function and selection in evolving systems

„Physical laws - such as the laws of motion, gravity, electromagnetism, and thermodynamics - codify the general behavior of varied macroscopic natural systems across space and time. We propose that an additional, hitherto-unarticulated law is required to characterize familiar macroscopic phenomena of our complex, evolving universe. An important feature of the classical laws of physics is the conceptual equivalence of specific characteristics shared by an extensive, seemingly diverse body of natural phenomena. Identifying potential equivalencies among disparate phenomena - for example, falling apples and orbiting moons or hot objects and compressed springs - has been instrumental in advancing the scientific understanding of our world through the articulation of laws of nature. A pervasive wonder of the natural world is the evolution of varied systems, including stars, minerals, atmospheres, and life. These evolving systems appear to be conceptually equivalent in that they display three notable attributes: 1) They form from numerous components that have the potential to adopt combinatorially vast numbers of different configurations; 2) processes exist that generate numerous different configurations; and 3) configurations are preferentially selected based on function. We identify universal concepts of selection - static persistence, dynamic persistence, and novelty generation - that underpin function and drive systems to evolve through the exchange of information between the environment and the system. Accordingly, we propose a “law of increasing functional information”: The functional information of a system will increase (i.e., the system will evolve) if many different configurations of the system undergo selection for one or more functions“, (WoH1)

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