Title: **The fine structure constant in a PhR context.**

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Abstract: *The fine structure constant is a fundamental parameter in Physics and its value and properties must not be in conflict with a candidate Physical reality model as proposed on viXra ("About Physical Reality"). This document goes one step further and outlines its crucial role in the evolution of our cosmos. It explains the significance in PhR terms of a fixed value 137 of the inverse parameter and calculates its fractional part for matter and contra-matter.*

1. **The fine structure constant (FSC) in Physics**.

- In particle physics and quantum mechanics the fine structure constant is a dimensionless parameter that shows up in many equivalent mathematical descriptions of physical behavior. Its value does not depend on the chosen system of units.
- Its inverse value is about 137,036.. and at the time of its first application (Sommerfeld – the end of the 19th century) scientist thought that its real value should be equal to the natural number 137. Physics is focusing on how nature behaves, sometimes without questioning why it does so, although in this case many famous scientists tried to explain the origin and the underlying rational of its many equivalent dimensionless expressions and its constant value in several equations under varying circumstances.
- An intriguing property of the FSC is its appearance in several combinations of other parameters, formulas and values, each sometimes belonging to distinct domains and physical models of our cosmos and its content.
- An example : $4\pi\varepsilon_0\,\hbar c^2\alpha = q^2$ (*1) whereby α= inverse fine structure constant, ε_0 = dielectric constant in vacuum, $\hbar = h/2\pi$ is Planck's constant , c = speed of light in vacuum, q = Coulomb unit charge. Several related formula's of this type exist.
- In particle physics and QM the approximate value 137 seems to represent the ratio between the strong nuclear (or color-) force and the electromagnetic force.
- More recent Physical experiments in the field of the quantum Hall effect made it possible to calculate a quasi exact (as observed) value for the inverted FSC with an astonishing precision of up 10 digits after the comma (137,035999…).
- Discussions are still ongoing about the universal character of the FSC and about its constancy in the course of the evolution of our cosmos.
- We refer to many interesting articles and theories about the FSC parameter and its inverse value , published over the last hundred years in several domains of physics, as well as in cosmology.

2. The fine structure constant in PhR.

- In PhR (see the main article "About physical reality" on viXra) the inverse FSC has been identified as the ratio (or the reduction factor) between the high dimensionality number M of the dynamic point grid (the CPS) and an N-dim zeron subspace (dynamic 2-point patterns with a time ordered property, embedded in the CPS).

- In PhR terms: within an M-dim point space volume free of particle-like patterns, a dynamic subset of phase shifted two-point patterns succeeded in conserving, by a bidirectional charge info exchange process between a 2-point nucleus, repeated 137 times in a row (and called a (point) replication process) a point state (connector) with a fixed charge type property. Each successive compliant connector state of a time string can be numbered by an index "i" up to a maximum value i-max=137. The initial reduction process of the cosmic time dimensionality by selecting and ordering properly phase shifted CPS points and the spontaneous appearance of dynamic and standard stationary zeron subsets (the UZS) took place, soon after the genesis of our cosmos as the outcome of a single creation event. The UZS kept its fundamental properties in the course of the evolution, be it that the selection of points contributing to zeron patterns, is and has been a dynamic process with a varying (in space and time) impact on some of its secondary properties and implications. However a minimum set of invariable properties of a zeron in combination with the 6 fundamental laws of nature (PhR), made a dynamic successful formation possible of symmetric particle-like zeron compositions with a behavior (again by internal and external charge info exchange based interactions) as in line with their equivalent mathematical description(s) in physics and cosmology.

- The point and zeron content of any particle (including field- components and difference-particles, like gravitons, photons etc…) is, as just stated, "dynamic". It means in PhR terms that a simple qua format-persistent particle like (e.g.) an electron propagating at fixed velocity, has a unique growth and shrink life cycle, whereby subsequent copies (or versions) of its pattern reappear as new, over relative and quantized distances (in space and time) shifted compositions of zerons and points, selected in the double CPS-UZS grid by properly synchronized, superposed and quantized charge info packages, emitted by "free" string connectors of subsequent versions of such electron pattern.

- These presuppositions imply also that UZS-zerons represent only a small fraction of the total number of potentially and locally available points or random point-made "building blocks" . Idem for the number of particle like patterns in relationship to the local UZS zeron density. In PhR we called this presupposition a "perturbation-type behavior and presupposition", accepting in this way that the presence of particles in the CPS-UZS does not change substantially the fundamental properties of the underlying double grids, neither it prohibits a necessary quasi unlimited availability of elementary building blocks as required to create and to sustain (e.g.) periodic zeron

versions, each with appropriate and fixed life times and growing and shrinking around a quasi-persistent but dynamic 2-point nucleus. Implicitly such model presupposes very high dimensionality figures M and N for point and for zeron space.

- Although this principle holds in most circumstances, it can get partly lost in case of extremely high particle densities, e.g. like in black holes, laser beams, solid state crystals etc…(se hereafter) .

- If M and N are just numbers of dimensions, what means in that concept a <u>fractional</u> inverted fine structure constant ? And why a reduction factor of about 137 ? In PhR any pattern formation process, subject to multilevel, multidimensional and interfering charge info emissions, involves implicitly a probability calculation, whereby simple equivalent formulas can be expressed as a combination of constant, even more elementary parameters and processes. "Elementary" means that they cannot be expressed in terms of other underlying more elementary objects and properties of the cosmos. In this PhR model there are just a few parameters that satisfy this definition: a smallest object is a point with a 2τ life time and a single quantized property <u>charge</u>, with a total amount equal to q. The equivalent action quantum needed to create a point in emptiness within a time period τ is h/2 being the convolution of charge (the only discriminating property at point level between "something and emptiness" in PhR and in fact the most primitive form of energy) and time whereby h/2= E(q)*τ.

- Conform the basic PhR principles and as a unique process starting from nihil, all calculations with an impact on physical behavior, can only be the result of multiple additions and subtractions of natural numbers and of finite series of simple counting operations (the natural number set can be defined in an empty cosmos(0) state).

- The bidirectional growth of a single zeron point-pattern (a process called "point replication ", in fact initially an hazardous set of multiple two anti-symmetric 180° phase shifted 2-point patterns, acting as central point string antenna's with a built-in anomaly) will stop, when the probability of still finding in the immediate neighborhood (in space, time or dimensionality) other point patterns in compliant states and dimensions around a common central symmetry location permitting statistically a further growth in time of its format, gets smaller than the probability of an (axion type phase jump) interaction with another adjacent candidate zeron in a compliant connector state. Under this condition the impact of the initial anomaly (a 180° phase jump of an antenna-point state) and of local over τ phase shifted transversal points, will lead to a shrinking in time of the ordered pattern under the impact of charge info quanta exchanged with enclosed higher "than i-max" dimensional and properly phase shifted pattern points (attention: when the index number i goes up, dimensionality numbers decrease – shrinking means that released points become again non-synchronized CPS points). A more elaborated description of point replication is given in other viXra publications: a distinction has been made between the gradual emergence of a primitive UZS and its regime state as of today.

- Once in a contracted state, the "roles and properties " of the initial point pair pattern are reversed in parity (P) and charge (Q) : e.g. the connector state point with opposite charge type and relative position grows first. But this is not the only, be it global restriction: zeron patterns emerged initially per pair, each with an opposite charge excess type, so charge must be conserved globally over the cosmos with an error in time margin < τ . A zeron-conform point replication string is dense, meaning that the time delay between the reset and the induction by selection of a next point (version) is null: this requirement is crucial in order to guarantee that the life time of a zeron before making contact with a neighbor, is <u>an exact multiple of 2τ for both zerons of the original 2-point pair</u>. The local subset of zerons should form a consistent and persistent standard raster pattern set whereby subsequent interactions in contact locations between zerons sustain a complex but stationary resonant network of zerons, meaning that a single contact between 2 zerons does not lead to multiple non-local adjustments or interactions with other zerons in the neighborhood. It also means that the reduction in dimensionality and the number of point states in a point string must be <u>prime</u>, otherwise "short lived zerons" could be mixed up with full time-length zerons, leading to a non-stable UZS with heuristic properties at a deepest level of our cosmos. In PhR any local and fundamental difference in cosmic behavior would require an extra discriminating property in the CPS and such property does not exist, so the restrictions imposed to a realistic UZS can be fulfilled. The smallest valuable prime number seems to be 137 and this value depends fundamentally on the unknown values of the fixed parameters M and τ. In this PhR model the CPS will house a priori (perturbation principle) several <u>dynamic and connected</u> N-dim UZS subsets with identical inverse FSC values. This principle is important because an hypothetic model based on a single interconnected and globally synchronized zeron network (a kind of super UZS') could not propose, as a next step in the cosmic evolution, the heuristic formation of EZP's and EZO's (Higgs) whereby 2 or 4 zerons are (e.g. in an EZO-like 8-zeron pattern) orthogonal and 90° phase shifted to each other in space as well as in time. Between individual zerons that belong to distinct dynamic UZS sub-networks, just axion type interactions at point level are possible. All these dynamic sub-networks in order to be compatible with each other need to have the same fundamental FSC parameter value 137. There could be other short-lived point subsets in the CPS with randomly sustained numbers of equal point charge types, but they do not belong to the zeron class : these collections will never lead to (like in case of zeron sets) to, on large-scale stationary states and are useless for high order pattern formation (e.g. like particles).
- The process of zeron formation is dynamic but in this model is implicitly presupposed that once ordered point sets emerged in a young CPS as zeron-like interacting patterns, they will persist as standard dense stationary point patterns (the UZS).

3. **The fractional part of the FSC.**

- When growing zerons in their i-max state interact with a compliant neighbor zeron connector, a few scenarios are possible. Hereby we need to take into account that a zeron-like point string growth cycle emerges out of a point pair nucleus whereby both points have opposite charge types and their "life cycles" are phase shifted over a time quantum τ. If that would not be the case, the charge info exchanged in the initial 2-point state would annihilate by destructive interference, so a zeron-like point pattern could not even emerge.

- If we observe a single 2-point string in any non-transitory state of its life cycle, one (connector) point could be in the charge state, the other would be in the empty (or hole) state. If two compliant neighbor zerons with equal i-max state numbers make contact, any successful interaction will depend on the connector type combination and eventually on their charge type signs. For a single point string, any contact schema must respect CPT conservation rules : hereby C = (connector) charge type, P = left or right contact (which one is the successful emitter) and T = time, meaning that the string has still the opportunity (or the chance) to grow by inserting an extra point in the hole connector location of its neighbor or eventually, to reset the point connector of its neighbor if it shows the adequate charge type (T=+) or is eventually phase shifted and reset by the impact of the zeron connector charge info of the neighbor (T=-). If a connector point in i-max is reset by a neighbor, its opposite connector in the hole state will still complete its final "growth" step and becomes implicitly the new longest-living point connector, be it with an opposite charge sign. So CPT conservation is guaranteed per string and per interaction over a pair of strings. We call hereafter for a particular string in a 2-point string combination, the "contact with growth in a hole location" an A contact, a "growth by successful axion interaction with a neighbor point connector" a scenario B contact.

- These a priori heuristic processes will lead after a high number of replication cycles to a local regime state of a subset of zerons, whereby the life time of a zeron is always 137 * (2τ) plus an extra number of pseudo-life cycles depending on the probability distribution of distinct contact scenarios. Hereby the probability figure of a scenario A is 5, of scenario B is 3 out of 8 theoretical combinations of the binary properties C, P and T. Why this difference and not (e.g.) 2 * 4? The growth scenario A whereby an extra point is inserted in the empty hole location of a neighbor zeron is successful whatever its connector charge type C+ or C- is . So this A scenario will have on average at the time the UZS enters locally into a regime state, an I-max life time value that is twice a fraction of 137*(2τ) larger than a zeron with a B contact scenario. Both contact scenario's lead to distinct inverted FSC values that are slightly higher than 137. When in this text, the terms "FSC parameter" and the "zeron life cycle tenor (T)" are mixed up, it must be clear that the FSC is just a figure and a dimensionless probability factor. Any as perceived distinct tenor reflects in fact a small difference in probability of a particular connector interaction state in i-max. This, in fact delayed

shrinking scenario, has to be confirmed by computer simulations whereby also transversal (or auxiliary) points could eventually been taken into consideration.

- The original UZS is a collection of zerons, belonging to two distinct, a priori dynamic i-max type subsets, whereby each individual zeron is a dynamic point pattern that belong to a class for which, taking a high density M-dim point space into account, the perturbation principle applies. When later in the cosmic evolution and conform this PhR model, more complex zeron patterns emerge spontaneously (e.g. EZK zeron (Higgs) quartets, in fact zeron replication patterns with transversal strings with <u>fixed</u> 2-zeron hole tenors) and for conservation arguments, two different subclasses of particles will emerge (particles and contra-particles) out of two contra-symmetric EZK's in broken EZO's , each with distinct properties in case of polaron interactions. When replicating and moving over the UZS grid, they select dynamically the (usually abound) appropriate contact-EZP's, making implicitly use of slightly different embedded hole tenor values, proper to their original contact scenario.

- The calculation of the average value of the inversed FSC , as applicable to matter-like patterns is simple: T= 137 + 5/137 = 137,03649. However if we trait the present state of the UZS as the outcome of an quasi-infinite stochastic selection process, we must replace this straightforward calculation by a continued fraction : T = 137 + 5 /(137 + 5 (137 + 5/(137 .....))). Its value is the root of an equation $X^2 - 137 X - 5 = 0$ or T = 137,0364866.... The small difference versus the most precise measurement results on earth of the inverse FSC (137,035999...) is about 0,000487...

- A similar calculation for the second contact scenario (the root of $X^2 - 137X - 3 = 0$) leads to T = 137,021894...., a figure theoretically valid for contramatter. We presuppose that there is no correlation between a particular contact scenario and the probability distribution for a next contact (except what has been stated above). These simple formulas do not require nature to make complex calculations in order to find out "how to behave".

- The small difference between measurements and theoretical values could be due to the fact that the theoretical value is valid only in an UZS deployed of particles. Because a contact-EZP can be of both types, differences between theory and practice are influenced by the distinct local densities of particles and contra-particles, including gravitons and contra-gravitons, as released by accelerated particles and contra-particles propagating at an increasing velocity towards a spherical central symmetric matter or contramatter condensation hub (e.g. a black hole or our sun or planet earth). Where neglecting the impact of local standard particle densities on average UZS properties seems to be acceptable, it is less certain that this rule still holds in case of very dense graviton and contra- graviton distributions. A single proton emerging in the past in a "flat or unbiased" UZS border volume of a young galactic system and accelerated gradually towards a central symmetric black hole hub, left behind along its propagation path a gigantic number of non-mobile small graviton patterns. Their embedded-hole distribution has an impact on local UZS

properties. If (e.g.) the earth is surrounded by an historical graviton-type density excess, the remaining freely available density of contact-EZP's in a contra- type state will be <u>larger</u> than in an hypothetical local empty UZS volume….a situation leading to <u>smaller</u> local experimental inversed FSC values for matter than what this PhR conform model predicts. Obviously one cannot be sure to what extend the graviton density on and around our earth corresponds exactly with a local FSC parameter value, as measured: anyhow, if the anomaly for both types of FSC parameter values would be too distinct, the chances of spontaneous EZO-formation would decline.

4. **Conclusion.**

- The fact that this PhR model is able to calculate the inverse FSC parameter(s) with a remarkable precision confirms many of this theory's basic principles and assumptions. In PhR the value of this crucial parameter relates to the fixed hole tenor of contact-EZP's, integrated as transversal EZP's in matter particle strings. For photons (materializing EM-waves propagating in vacuum at speed $c^2 = 1/\varepsilon\mu$), the ε parameter depends on point densities in the CPS and is not sensitive to different hole tenors, the μ parameter however is an UZS grid property and depends on the free matter- compliant contact-EZP density along a photon propagation path. From this perspective variable matter and contramatter excess densities have both a distinct impact on the local c values. High matter densities (e.g. light passing thru a dense medium like glass or water) slows its speed down. But a high contramatter density (e.g. a huge contra-graviton density surrounding a black hole) facilitates ordinary light propagation and leads to ordinary light ray bending and confinement, as the outcome of pre-polarization effects. Recent pictures of a black –hole show a light halloo surrounding the central invisible black hole: this phenomenon confirms that light is not attracted by the black hole itself but is just confined to virtual paths with an excellent conductivity value due to a high remaining (= not engaged in contra-particle production) relative contact-EZP density. The by a black hole emitted contra-light itself remains anyhow invisible to most of our instruments.
- A difference in speed between light and contra-light should be confirmed when the number of successful measurements of "gravity waves" will be high enough for calculating more precisely their (average) speed. Conform PhR gravity waves do not exist, they are contra-EM waves. So a difference in the values of the inverse FSC for EM and contra-EM waves in vacuum at the order of 0,02 (see (*1) whereby $c^2=k/\alpha$, k=constant) will have an impact on the relative speed of contra-light versus light in an "on average although unproven" unbiased UZS volume, of the order of 0,01 % (about 30 km/sec) and it is doubtful that the precision of LIGO's instruments will ever be able to locally detect such small variations in speed. Interesting was that at some occasions (e.g. see ESA INTEGRAL satellite spectrometer report on 17/8/2017, plus corresponding LIGO reports on https://www.ligo.org>science), "collisions"

between stellar systems and black holes or between neutron and contra-neutron stars produced "gravity waves", sometimes followed <u>a bit later</u> (in casu less than two seconds) by a burst of ordinary EM-waves (in PhR: gamma rays and the outcome of axion-type interactions between nuclei of opposite types as present in a very young neutron/contra-neutron high density volumes): both reports concluded that these two types of rays emerged from a common source.

Vocabulary of terms frequently used in a PhR context (version 2).

Antenna: *A set of symmetric, coherent and free (e.g. being special connector states of a particle) point or zeron components can act as the emitter of charge info, capable by superposition and interference to induce a new short-lived or persistent particle-like pattern of raster components. This induction or selection or ordering process has to respect conservation of energy rules and the FLN principle. In a young cosmos an antenna can emerge in the CPS and UZS spontaneously, just by coincidence (e.g. an EZO antenna format in the UZS). A successful antenna impact presupposes the ample presence of building blocks, available for selection. In further steps of the cosmic evolution a similar mechanism can lead to the emergence of more complex patterns like molecules and even DNA-strings.*

Axion (interaction): Where a polaron (*charge info emitted by an EZP connector zeron pair of a replicating zeron string in I-max)* has an impact on the momentum property (Physics) of a particle-like pattern (and indirectly on the local point-hole density ratio in the UZS), an axion *(in fact a point level interaction of zerons in an i-max state, between replicating zerons in I-max) has an impact on the charge type property of a particle (Physics) and* changes the local charge density and the net quantized charge info distribution in the UZS. This means that a one-shot charge info pattern emitted by a point (e.g. *as component of a dynamic* zeron *connector or an EZK*) has forced another *compliant* point (in an *UZS- or in a particle string-*zeron, being the receiver) *after a shortest or quasi zero time interval* into two subsequent identical charge states *(any CPS interaction conform the base laws between a shrinking points and an empty location is obviously axion-like but the induction of a new point is slightly delayed and takes place in a distinct location: it does not belong to the class of interactions as meant here).* Such dynamic excess-charge can be (e.g.) stored in the connector of long branch of a particle and will be maintained *during a certain number of replication cycles.* Its impact *in special replication states (I-max or the contraction state)* on the double CPS/UZS raster (a *Gauss or Coulomb* polarization line) is assimilated with an electric field line. If a particle's dynamic excess charge distribution is producing (by *constructive* interference *along a trisectrice of 3 phase shifted branches*) a quantized charge info pattern, it materializes a magnetic field in physics (*e.g. magnetic spin of an electron).* As charge is a conserved quantity on a cosmic scale, an axion-type interaction must create simultaneously two excess charges with opposite charge types in two interacting patterns *with respect of a CPT conservation rule*. In nuclear binding with role interchanges between protons and neutrons, direct short range axion coupling (in combination with polaron coupling) is important and materializes (as a gauge particle) the strong interaction force in Physics. A successful long range axion coupling between uncorrelated particles has an extremely low probability rate, *as it has to take place between pattern points in appropriate free connector return states . In particle physics, axions may have a disturbing impact and lead often to a decay of the original pattern after mutation by high energy collisions, increasing hereby the probability of successful short range axion coupling.*

Base Laws: 6 base laws determine cosmic behavior at point level.

- Law 1: Law of inertia. Any quantized change of the cosmic state cannot take place without any delay (or in a zero time lapse). At point level it means that *it takes a* fixed *and* finite time lapse τ *for* any *empty location or an empty* point state *to* change into a charged state q or vice versa. This law creates a local symmetric quantized time dimension *whereby* we neglect the *global* asymmetric impact of charge info on the large scale cosmic growth *, a macro-process with its own time dimension*.

- Law 2: Emission Law. Any change of the charge property of a cosmic state leads to the emission of charge info in all directions by any point that flips its charge state. The sign of this charge info is such that it is meant to annihilate the change *at the source or at least its external* impact *by compensating w*hat was the cause of its emission. *An empty location cannot emit spontaneously charge info but enables the propagation of charge info according to law 6 or the induction of a new properly signed point according to law 3.*

- Law 3: Induction-reset Law: The impact of a well synchronized charge info quantum *emitted as proposed in law 2,* on the cosmic state is such that if it hits first an empty location (*a new location in a growing cosmic volume or the empty state of a former point)*, a new point will be induced with an appropriate charge sign, taking the sign and the state of the one that emitted this info (the source) into account. If it hits first a point in an appropriate regime state (a *compliant* target), it will reset this point into an empty state. *This process has to respect law 4.*

- Law 4: The coupling Law: Any exchange of an *effective* charge info quantum between two points or between a point and an empty location and synchronized as required to reset or create a standard point (a point interaction), has to respect the "overall conservation of <u>charge</u>" principle, counted over source and target. It means that a combined successful induction-reset process (called a coupling) is restricted to both interacting objects. Any <u>point</u> being a source or target, cannot simultaneously be involved in two ongoing coupling processes. The fastest potential exchange along the shortest path will be the most successful. It does not prohibit a point, once its charge content starts to change *due to a successful coupling*, to emit on its turn charge info to be used later in a next coupling process. This new emission should not interfere with charge info exchanged in the course of an ongoing coupling (*see CPT conservation).*

- Law 5: The superposition Law: Charge cannot be superposed (e.g. a point charge q cannot be more charged and grow (e.g.) to a value 2q). <u>Charge info</u> is subject to destructive interference, leading to its partial annihilation in a subset of locations or directions. Quantized phase shifted charge info can lead to constructive interference, meaning that the tenor of an empty (= *point free)* location can be lengthened or that a point's null state can change again without delay. The latter can lead to a compact or dense growing or shrinking (axial) <u>replication</u> process, *protected and conserved against random charge info interactions.*

- Law 6: The constant speed law: Charge info propagates in emptiness at a fixed speed, a value much higher than at least 137 times c, being the speed *in "emptiness"* of ordinary light in physics.

- **Comment: These 6 laws apply simultaneously in any combination. Their ultimate goal is to annihilate the impact of the creation event and to restore the ideal empty state of the cosmos. Such attempt is not immediately successful and leads in a first phase to the creation of a dense, fast growing, dynamic spherical volume around the creation point, filled with short-lived anti-symmetric positive and negative points embedded in empty space (the CPS). We assume that the perturbation principle applies, meaning that there will be more empty space than points in a random cosmic unit volume in its regime state.**

Bifurcation: *an interaction within or between components of a complex pattern that splits its format and main event sequence into two independent sub-patterns (meaning: non- sensitive to new interactions of another type then the one that has led to the original split), each involved in complementary chains of events. An example is a split of an EZO by an internal axion type interaction into two EZK's (a Higgs and a contra-Higgs) whereby both sub-patterns will not be sensitive in the future to polaron-type interactions, proper to each other's class. Conservation rules apply. In case of an EZO split, it means that CPT is conserved between the original EZO and the two sub-patterns together. As a result, the new emerging complementary matter and contramatter particles will have opposite charge types (C conserved) , 2 orthogonal strings that respect opposite relative phase shifts in space versus the 3°, leading to opposite spins (P not conserved) and there will be a 180° phase shift τ at point level between shrink and growth cycles of replicating strings (T not conserved). Classic electricity laws applied on contramatter are different, meaning (e.g.) that the left-hand rule becomes a right hand rule and that the relative phase shift between an E and B field vector in Electromagnetic waves has to be reversed.*

Charge: is the only discriminating signed, *dynamic* and quantized property of a point. Its *fixed regime* amount +/- q for a single point equals one Coulomb unit charge in Physics. *At any moment over a time lapse of order τ, in a representative M-dim cosmic reference frame t*he total net amount of charge is a conserved quantity, equal to the initial quantity q induced in cosmos(0) by the creation event. Charge cannot be described in other more elementary *terms* and properties *of* our cosmos. *The context has to make clear that the term "charge" refers to the regime state of a point or to such dynamic flow of charge info that it will be able to build up (or reset) a state q (or an empty location) in a fixed time lapse τ.*

Charge info(rmation): an abstract fluid *continuously* emitted (*and propagating* conform the base laws) in an infinite number of directions, as the outcome of a change in the charge state of a point or a set of points (see base laws). Quantized charge info patterns and amounts can be assimilated with magnetic fields in Physics. *Charge info is subject to interference conform the superposition base-law, so symmetry in space and time of emitting point antenna's is crucial to determine their impact on targets .*

Connector(s): The dynamic and composite state of the most external *(or free)* set of points or zerons of (a) replicating string(s). *Hereby "external" refers to a maximum phase (or time, dimension and rotation angle) for point strings in zerons and additionally, to space or length or index-value in case of zeron strings.* Each *short* branch of a string has its *proper* connector

*with a complementary state reached after a quantized shift (or delay) of order τ or 2τ versus the "fastest" connector in the longer branch. A*ll the dynamic connector versions have phases *(time shifts)* and/or positions relative to a central nucleus pattern (*for particles the central antenna Higgs)*, that will gradually change or grow and shrink whereby the position index value is increasing or decreasing between 1 and I (or i) -max. *For zeron made patterns this replication process along a fastest path is driven by axion and polaron interactions between pattern components of a branch and/or with well synchronized components of a central EZK pattern.* What is most important is its ultimate return state value (I-max or i-max), where in case of zeron-made patterns, external interactions by exchange of polaron- or axion-like charge info *packages* are enabled: small I-max values imply higher frequencies of full replication growth and shrink cycles and more momentum / energy (Physics) as *stored and maintained (without external interactions) in/by subsequent particle versions*.

Conservation rule: dictates that a specific property or sum of properties of a pattern (or set of *interacting* patterns) will not change under certain *external* interactions or over a certain time lapse and /or space volume *under internal interactions*.

Contact-EZP: *see EZP. It is a short lived 2-zeron UZS pattern between two compliant point connectors of neighbor UZS zerons, both in their i-max states. Several type of interactions are a priori possible and the number (137) of point replication steps, determined by the values τ, M and the CPT conservation rule guarantees a local stationary oscillating state of any* <u>*free*</u> *(= not engaged in more complex pattern formation) dynamic replicating N-dim zeron set.*

Contraction state: That particular state of replicating strings where two branches (or a complex phase shifted pattern of 6 branches in case of EZK based zeron replication) shrink their axial strings to standard *phase shifted 2-zeron* antenna length values, whereby *in a next step* the roles and properties of antenna components are inverted versus a virtual central symmetry location. This inversion materialize the (*unsuccessful)* tendency in nature to wipe out any non-empty pattern state, but it just causes the creation *by induction or selection,* of *its inverted* anti (*or contra*)-symmetric copy (*see Base law comment*). In case of *dynamic* complex pattern like a 4-zeron (or Higgs or EZK) replication cycle, 4 string *growth and* contractions and inversions are needed before a pattern connector set reenters into an identical configuration state (a spin ½ particle in Physics). *In case of anomalies stored in connectors and unbalances between contracting branches, a position shift of a virtual symmetry center over a standard UZS raster length takes place and eventually one or several autonomous difference patterns can be separated from the parent in this contraction process. Both processes respect all conservation rules.*

Contramatter: Any anti-symmetric copy of an ordinary matter-like particle (e.g. a positron with a charge type and some other QM properties opposite to those of an electron) but additionally with an opposite mass or embedded *EZP* hole type property. A difference in hole type of *high (or low)* local contramatter densities has consequences for the UZS and for μ, c (speed of (contra) light) and for the fine structure constant parameter values in its neighborhood. The speed of light is indeed depending on local raster properties and the *local*

excessive (or reduced) presence of contramatter versus matter will lead to a *relatively* reduced (or increased) density of raster contact-EZP's available for fast (contra-) light propagation.

Cosmos(0): the initial unbounded empty state of our cosmos.

Cosmos(1): the first non-empty state of our cosmos and the outcome of a single creation event. Its one-point state implements a simplest *short-lived* cosmic set with Shannon entropy zero.

CPS: Complementary Point Space is the *initially* growing spherical collection of points *still* available for pattern formation. The full *M-dim* set of points (including points involved in high order pattern formation) is simply called "Point Space". Without high order patterns, point space is on a relevant scale, homogeneous with a <u>net</u> charge density that is null per unit volume. The point-hole density ratio per reference volume without the presence of patterns, is fixed.

CPT-conservation: a term in particle physics, referring to the fact that certain relevant mathematical descriptions (alias) of (a) particle state(s) or real behavior in case of interactions (alibi), are invariant for specific combinations of inversions of reference frames or relate to real *signed* properties like Charge, Parity and Time in equivalent math-equations. Some violations of the combined CPT conservation rule seem to exist and these anomalies are sometimes hard to explain in physics. In terms of PhR, *differences in results* could be *the outcome of the* absence of contramatter in physical models. *The CPT conservation rule is a direct outcome of the base laws: an example is how a properly phase shifted interaction in I-max of an axial connector of a replicating particle can lead to excess charge conservation (C+) and the shrinking (P-) of a string (T-). The most primitive expression of this law in a primitive CPS refers directly to the base laws. An example on an oriented axe P: a growing (T+) positive point (C+) will emit <u>effective </u>charge info along a "fastest" direction, opposite to the "by coupling" still growing edge (P+), "effective" because destructive interference makes this path non-sensitive to charge info propagating along other symmetric backward paths around the axe P (see Feynman) . This situation enables the* original antenna *point to induce by a new coupling "as soon as possible at its left side (P-)" in an empty location a new growing (T+), (P+) positive point (C+) or to reset an existing negative point (P+,C- and T-), meanwhile resetting (T-) its own positive point state (C+). In both cases CPT is conserved over the two patterns involved in this new interaction.*

Creation event: the first and single event that transformed Cosmos(0) into <u>Cosmos (1)</u> by inducing a single <u>point</u> with a single discriminating property (<u>charge</u>) in an undetermined <u>location</u> at an undetermined <u>time</u>. This concept replaces a Big-bang event in Physics. Its origin is unknown and beyond the scope of this PhR model.

<u>Dense:</u> *a term used when describing replicating pattern strings. It expresses the fact that subsequent point or zeron knots are added in time and/or space without any delay and/or distance, contributing in this way to the formation of a dynamic <u>shortest and fastest path</u> between dynamic connectors and a central antenna. Such property is in line with the base*

laws and conservation principles, it imposes strict conditions of symmetry on a central antenna and requires locally a sufficient density of free appropriate raster components.

Difference Particle: A pattern that emerge as the difference between *the grid components involved in* a parent particle's *replication cycle* and its sub-products in case of *contraction, decay or transformation* (e.g. when a neutron decays into a proton and an electron, a neutrino will emerge as difference particle). It carries *often* a difference in *the* central EZK (*free zeron)* layout and behavior before and after decay. The transformation of a *mutated* particle into a next *more stable* version *in the contracted state is a potential* source of difference pattern production (e.g. an accelerated particle shifts its position *faster* and shrinks its replication length, emitting a photon or, as another example, a contracting neutron moving at constant pace in a gravity field and absorbing a graviton that will be afterwards released in a backward position). A *difference particle (e.g. an electron after neutron decay) integrates in its pattern often one of the time shifted or superposed versions of a parent core (mostly a complex EZK) , enabling autonomous replication according a simpler schema. Its format is often the outcome of symmetry, interference and the FLN rule applied on superposed charge info emitted by embedded connector antenna's in special intermediary particle states before and after a first decay step (e.g. W and Z bosons).*

Dimensionality: A dynamic property of a single pattern of points or, of a pattern of patterns. In physics (and in linear algebra) it refers to the *adequate* number of base vectors (forming a reference frame) needed to describe analytically the behavior *and/or state* of a single particle or a set of particles (e.g. in a crystal lattice) *in space.* If refers also to its capability to maintain (*or change)* its properties before and after a real or virtual symmetry operation in space and/or time. In PhR a generic definition refers to the number of directions (in space and time or phase) along which a central antenna has a priori equal probabilities to couple successful with surrounding compliant patterns or particles, *although the effective probability remains subject to a "fastest or shortest path in time" rule.* As an example: a *replicating* Higgs-formatted tetrahedron antenna of a proton enables a successful coupling (by *interaction in I-max*) between one of its 6 connector *states* and a *compliant* connector of another particle, *most often (graviton coupling is an exception)* with a similar central Higgs architecture whereby *at least one* of *each pattern's* axial replication *string* directions are coplanar, intersecting each other virtually *and periodically.* This (*in combination with an orthogonal graviton density distribution around a sphere)* explains why Physics "sees" our cosmos in 3D. *It confirms the dependency on the collision angle for elastic collisions in particle physics.* Emptiness in PhR is infinite-dimensional, the CPS is M-dim, the UZS N-dim and their reduction factor is M/N=137 (in phase space, as set by point replication). *M was initially the maximum number of neighbor points able to interact with the creation point without any increase of the cosmic volume. If M would have been infinite, the maximum cosmic size would be equal to two point sizes. The minimum time shift between to neighbor points sets the maximum size of the cosmos.*

Discriminating Property: a property of a point or point pattern that makes the difference, either between an object and emptiness or between two objects of a quasi-identical population in our cosmos. Charge is the only discriminating property that in case of a simple point,

makes the difference between something and nothing. This term is also related to the concept and the definition of symmetry *and to the generic definition of the term "energy".*

Energy: Its most general PhR conform definition is the capacity (*or capability)* of a pattern (or a particle) to change the state of the cosmos. It encompasses internal changes (e.g. by replication) and external modifications of patterns. It is used as a quantity of change, *as well* as a quantity of state. Energy transfer *between patterns* requires necessarily a discriminating property between *both whereby simple but dynamic characteristics like time (phase), charge and symmetry states (or dimensions) could play that role*. Energy transfer needs *a quantized charge info based interaction and has an impact on the pattern lay-out of both interacting objects. This process* cannot be performed in a zero-time lapse *and its probability distribution has a stochastic character. The combination of energy and time at point level is a quantized property called "action" with value h/2= τ * q (see point). High level transfers need multiples of h/2.*

Event: a *smallest* <u>*successful*</u> (inter)action *between patterns, between pattern components, between a pattern and one of the two grid elements or between a pattern and an empty location ,* that changes the state of our cosmos. An *action driven* event *presupposes* a convolution of energy and time. *Such action itself it is quantized (a multiple of h/2) and formatted as an axion- or polaron-type charge info exchange process.*

EZK or Higgs: a super-symmetric set of 4 adjacent UZS zerons. In a perfect EZK, they form geometrically a regular tetrahedron, whereby the 4 zerons (or two perpendicular phase shifted EZP's) show 90° phase shifted point replication cycles. Theoretically they are simultaneously in interchangeable DZ,CZ,DH,CH states. Such ideal EZK state is unstable (*as a pattern)* because a shortest or fastest exchange of charge info between zerons *in order to make this state persistent,* would imply annihilation by destructive interference in their central symmetry location. It means that at least one replication cycle need to be slightly phase shifted and this "property" is dynamic (*see also contact-EZP's)* what leads to superposed states *in time* of several pattern versions (by dynamic role interchanges) and *enables* finally zeron replication *whereby the central EZK acts as an antenna for quantized charge info*. The symmetry properties of a *central replicating* Higgs explain why we observe *a subset of* particles and other patterns our cosmos is made-off, successfully in 3 *orthogonal geometrical dimensions. An EZK does not appear solely and spontaneously in our cosmos, as it would create an unbalance in charge and mass-type energy. As long as it is part on an EZO such unbalance does not exist. "Partial" and opposite energy amounts will be the outcome of a stochastic internal axion-type interaction between an EZO's internal over τ phase shifted EZK and contra-EZK sub-pattern states, each owner of an opposite mass type.*

EZO: An *8-zeron* anti-symmetric over order-τ phase shifted EZK pair (*two tetrahedrons with a common symmetry center,* whereby each *EZK shows* an opposite embedded mass type – so in fact a contra-symmetric EZK pair).

EZP: an *at least theoretical* 2-zeron pattern, 180° phase shifted whereby one zeron connector is in the DZ return state when the other is in the CZ state. Such ideal 2 zeron pattern is unstable (see also EZK), *so the definition applies mainly in case of two slightly phase shifted*

zerons integrated in a more complex pattern (like a Higgs) . A <u>contact-EZP</u> (see above) is not a particle but a short lived pair of adjacent UZS zerons, interacting *when both parent patterns (zerons) are* in their *compliant* return states. Ordinary phase shifted EZP's *could be treated as "frozen" contact EZP's whereby the tenor of the enclosed time shift remains fixed and the two i-max connectors have opposite charge signs.* The two *possible distinct* interaction *scenario's for EZP's and contra-EZP's* on a stationary *unbiased* UZS raster explain a difference in an *effective* μ *value*, in the local fine structure constant and a difference in c, the speed of light. Depending on the connector combination, they materialize a slightly different *enclosed* mass quantum. Ordinary phase shifted EZP's are integrated as transversal string components in replicating contramatter or matter patterns and particles. Hereby along a growing string, two *orthogonal* phase shifted axial and transversal EZP's form a local EZK *that is a phase shifted interconnected multi-state copy of a central EZK antenna. See also: "free zeron" and its matter/contramatter related properties.*

Field: : *A concept used in mathematics and modern quantum physics but in PhR it is a term that refers to large dynamic subsets of raster components with specific properties (most often primitive zeron patterns that share a common anomalous property). They materialize, in classical physics, abstract large scale location sets, enabling distant forces between particles (gravity, gauss, magnetic fields).*

 (Inverse) Fine structure constant: See Physics. The dimensionless inverse fine structure constant should be exactly 137, the maximum number of replication steps "in time" of a zeron-like point pattern and the reduction factor between the number of dimensions M and N of the CPS and the UZS. However the interaction in i-max with a neighbor zeron should explain the small discrepancy between the theoretical and the really observed value (*137,036 for matter) . The fraction above the value 137 is* different for a matter- and contramatter-like i-max contacts , *due to* distinct *contact-EZP* hole tenors *and charge types*. The *dynamic* combination of these *two* types at the return states of each single point string should be capable to sustain in the UZS, a stationary local oscillation process over a marginal time shift of order τ *that is CPT conservation compliant.*

Flatness: the *dynamic* state of a CPS/UZS volume with a local density of free points and holes that guarantees a probability of spontaneous EZO formation up to a level that is comparable to that of an initial particle-free CPS/UZS volume. A natural or artificially flat state in a with patterns filled cosmic volume can produce (with a probability depending on the flatness level) slow neutron-contra-neutron pairs (*interacting with (e.g.) Li-atom nuclei, a potential source of Cold Fusion energy).*

FLN-principle: *This Fundamental Law- of- Nature refers to the rule that the base laws and interactions deduced from these laws, try (without success) to re-implement (by the emission of properly signed charge info) the initial ideal empty cosmos(0) state. An inverted charge info pattern emitted by a coherent set of points in order to achieve this goal, could have an impact "by selection of grid or particle components" in a distinct set of locations at a distinct time, producing anti- or contra-symmetric copies of the original antenna pattern. This law*

relates to the CPT conservation rule and to phenomena like replication or to the formation of new (difference) particles.

<u>Forces:</u> There are no forces in PhR. Transfer of energy, momentum, mass etc… like in Physics are the result of the *dynamic probability distributions of* basic interactions between patterns whereby Axions and/or Polarons are exchanged between compliant patterns or pattern components in appropriate *point or zeron* connector *return or contraction* states. *These axions or polarons can be embedded in micro-patterns like photons or gravitons.*

<u>Free zeron:</u> In a realistically replicating EZK, stability of the pattern and binding of the 4 zerons requires only *a <u>dynamic</u> subset of* three out of four zerons involved in quasi simultaneous interactions in phase shifted time-dimensions. In an extremely short-lived EZK (an Higgs) , a single axion-like charge info quantum is interchanged between 3 local zerons leading to what is called their binding by role interchanges and to the superposition of several quasi-identical "rotating" versions of the same antenna pattern in the UZS. However non-simultaneous replication in 3 orthogonal symmetry *directions is engaging bidirectional axial zeron strings, a process that* requires 3 extra τ shifts. It means that once replication out of *each* central EZK antenna starts off as the outcome of an axion exchange between two zerons of two contra-symmetric EZK's in an EZO, strings will emerge *dynamically along* 3 superposed orthogonal directions whereby the phase angles of 3 of the 4 central zeron versions are determined and fixed. Nevertheless the phase (*in an 137 dim point replication schema)* of the 4th is still <u>free</u> and dynamic. The effective inverse fine structure constant for these naked zerons *in a superposed multi-state* neutron nucleus is reduced from 137 to 133. Hereby we must understand that role interchanges and superposition implies that at least 6 (one per branch) *phase shifted (in 137 dim)* versions of free zeron states in the EZK co-exist. They act as a memory set (or counter) of the momentum state of the pattern (*determining its I-max value).* Their *effective state index (expressed in 2τ units) and dynamic behavior* are the outcome of the impact of, by polaron interactions in I-max imported excess holes. Where the symmetry of a replicating string is such that the value of this *state* counter remains fixed for a particle moving at a normal constant speed (*meaning:* with a fixed but reduced I-max value), this is no longer true in a transition state just after a polaron interaction. Restoring an equilibrium needs several replication cycles *and contractions* in order to change the central EZK pattern to a new stable state that *will* lead *finally* to a *new stationary* position shift *frequency* of each next version of the pattern (observed as "motion" in physics), an *appropriate change in I-max value of each string and an updated version of the multiple superposed short-lived versions of free zerons in the central EZK.* At very high speeds where I-max has reached a limit value *slightly above* 1, this complex *process in a particle's contraction phase,* is the cause of an extra <u>delay</u> in the pattern's *position shift. It is due to a chain of complex state interchanges in the EZK itself*, increasing in this way its <u>mass</u> (*see* Special Relativity *in Physics). The initial phase shift of a free zeron in a contra-EZK versus its transversal partner is different over a value of order τ versus the corresponding value in a matter like EZK. If this would not be the case, a transversal contramatter string connector could not sustain a different polaron emission pattern, not release in the contracted state a contra-graviton etc….*

Graviton: A flat rotating circular 2-zeron UZS pattern able to sustain a polaron-like hole. A graviton is a pattern equivalent to a unit gravity quantum (Physics). It is unable to move and its large scale density distribution on the CPS/UZS raster materializes a large scale gravity field. Versions exist with two distinct hole formats (gravitons and contra-graviton with a different *sustained* hole tenors) whereby cross-coupling with each other or with particles and contra-particles are impossible. *Like a polaron (a virtual photon in physics) it is charge neutral but it has a spin-2 property meaning that the roles and signs of both enclosing zerons are frequently interchanged per tour by an internal axion exchange process, making a graviton persistent: it takes halve a micro life-cycle (one growth +contraction) to reenter into the same effective quantum state. This means that it is able to couple successfully by polaron exchange with spin 1 and spin ½ particle connectors in subsequent I-max states, although with an opposite momentum impact. It is released as a difference particle between contracting transversal EZP strings, by an Higgs based replicating particle at the time of its position shift on the UZS.* Gravitons and contra-gravitons are persistent as long as they do not interact *with a particle*: they can sustain the hole in their symmetry center until they couple by polaron exchange with a *zeron* connector of a replicating *particle* in one of its return states. *However this event will release in the adjusted and stable contraction state of the particle, a new similar graviton version in a slightly space shifted position: in fact the relative central positions on the cosmic grid of the particle and the (new) graviton are interchanged.*

Hole: a hole is a *dynamic* short-lived and free-of-charge location state, carrying nevertheless a *by constructive* interference quantized amount of charge info *(so there exist plenty of empty locations in the CPS that are extremely short lived, non- standard holes).* This quantization requires a fixed delay between replication cycles of enclosing patterns whereby the fastest path principle and a fixed speed of charge info in emptiness (a base law) apply. When a point is reset into an empty state, its charge info content has *a sign that is different, whether* it is the outcome of the reset of a positive or of a negative point. In this context we use sometimes a notation DH and CH. A contact between a pair of connectors of adjacent point-replicating UZS zerons in their return states are producing short-lived holes with *alternatively two* slightly different tenors. They materialize positive and negative embedded hole densities (*meaning: above or below UZS average)* that impact several parameter values proper to the UZS raster. Polaron interactions with a connector in I-max of a short branch of a replicating zeron pattern (a particle) change the tenor of an embedded hole *state* in a connector-EZP over a time quantum 2τ, *changing* after a number of *replication cycles*, momentum *state and or particle mass values.*

I-max (or i-max) : the maximum number of steps (or knots) of a replicating zeron (*or point string*) in a particular momentum state (*or growth in time state*) *before it starts shrinking again (in time and/or space).* These index values (I and i are integers *–counting is the only math operation allowed in PhR*) refer to reaching the *i-max or I-max* return state of a string. Where i-max is *quasi* fixed, this is not the case for I-max for a zeron-replicating particle out of a Higgs-like core antenna. Its value depends on its momentum state *and implicitly on the relevant free zeron phase (or dimension) state in the central EZK of a replicating particle*.

Induction or induced: *a term used to describe the impact of quantized charge info in two distinct cases. In a primitive cosmos it refers to the creation of a new CPS point version in an empty location. In a later cosmic state and frequently used in combination with the term "by selection", it often refers to patterns of primitive UZS zerons or contact-EZP's selected because they are (by coincidence) properly phase shifted in order to producing inversed copies of charge info emission patterns (FLN principle), sustaining in this way dynamic UZS patterns (fields, paths and states) that will support successful axion or polaron transfer and "interactions along shortest paths", based on charge info emitted by one or several correlated particle antenna's in I-max states. Symmetry of the antenna's and charge info interference rules combined with the FLN rule determine the probability of the emergence of new sometimes complex and dynamic patterns. An example is the induction in a flat UZS of EZO's by charge info emitted by Ni-FCC crystals, intensively doped with Hydrogen atoms.*

Interaction: Any exchange of quantized charge info between pattern components *in special states*. Within replicating patterns, interactions are internal between knot-like zeron components and between the central antenna *components* and *axial and transversal* string knot *zerons* according to a strict *fastest* charge info exchange schema. When the longest string of a replicating particle is reaching an i-max or I-max state, external interactions with appropriate connector states of other compliant patterns or particles are *mandatory (for i-max) or enabled* (*in I-max)*. Between zeron-made particle *connectors*, exchanges of normalized *effective* charge info quanta are packaged as axion or polaron-type micro-patterns.

Inversion: When a replicating particle-like pattern is reaching its contraction state, a next anti-symmetric version (versus a virtual symmetry center) is induced in the CPS/UZS that leads again to a new growth cycle of the pattern. This process will at the lowest level respect the base laws of PhR , meaning that this new version tries to restore the empty cosmic state by inverting charge types and certain geometrical properties like string-spin (*FLN principle*) . However perturbations and space and time shifts make it impossible to annihilate the original pattern. Contraction will respect overall conservation laws: if this is impossible by the inversion process as such, one or several difference particles will be stepwise induced and released, eventually after several contractions of a replication process. *Inversion does not change the mass type (a hole property) of a pattern and conserves energy.*

Knot: a successfully selected component of a replicating string (a point or zeron string) indexed by an integer i or I. Selection of candidate components out of a locally available source (like the CPS or the UZS) *imposes* an appropriate distance in space and time, taking the superposition and interference of charge info quanta emitted by a central antenna and *or/*by partial string connectors, into account. This *quasi* deterministic, on the symmetry of the central antenna and on the shortest path principle based process, leads to a perfectly (in terms of geometry and time or phase *or dimensionality*) distributed set of *dynamic interconnected string* components. It explains why normalization and *increasing* complexity of composite patterns in further steps of the evolution of our cosmos, are possible and why (in Physics)

equivalent mathematical descriptions of their *real PhR-conform* behavior can be correct and successful.

Location: any abstract position in space and time in cosmos(0). Any event or any object taking place or induced in a location can only be referenced to in relative and/or abstract terms (there are no pre-existing rulers in cosmos(0), able to locate *or to refer* to cosmos(1….X) state(s) or to their content).

Mass: A measure for (in PhR terms) a net quantized amount of time *(or delay)*, stored as *or sustained by* dynamic and eventually (b*y constructive interference)* superposed holes in a set of *(contact-)* EZP-like components of a replicating particle. Unit-mass values are different for matter and contra-matter, as *their built-in hole tenors are different*. In PhR, intrinsic particle mass (like inertial mass in *momentum formalism (Physics) or in* E=mc² or like a gravity related mass) *all* refer to the same fundamental pattern and/or particle property.

***Neutral-EZP*:** *Often used as synonym of charge-neutral EZP. It refers mostly to by polaron interaction phase shifted and hole type energy carrying EZP's in connectors or in gravitons.*

Particle spin(s): a phenomenon identical with magnetic spin or an internal orbital quantum spin of particles observed in Physics. As an example and for *replicating* electrons, the spin vector in PhR terms is oriented along the trisectrice between the 3 axial phase shifted orthogonal replicating strings. It represents the net (taking interference into account) charge info impact of the dynamic slightly phase shifted free zerons and holes of the connectors of 3 orthogonal, *about synchronously* in length varying strings. For holes such an interference effect is less obvious because a hole as such does not emit charge info but the enclosing zerons do. *The internal* relative *phase values of the 3 over 2τ shifted connectors of the long branches will change each time a particular string participates in an external polaron interaction that impacts the particle's momentum: it interchanges the "fastest connector or longest string" property within the string triplet. This event will have an impact on the orientation of the spin vector in a virtual fixed 3D reference frame with axes that coincide with the 3 axial particle strings. In PhR and contrary to Physics, there is no conflict between a description of a magnetic spin phenomenon in terms of a (pseudo or virtual) rotating charge and (e.g.) a maximum speed limit c for a moving particle: in PhR an electron string set does not even rotate when replicating.* For protons and neutrons the spin concept is more complex. The magnetic spin is weaker, taking role and *free charge type (mass types remain the same)* interchanges and symmetry of the central EZK tetrahedron and their impact on the replication process into account.

Pattern: A coherent and dynamic set of points (*and/or zerons*), interconnected by the exchange of appropriate charge info quanta along fastest paths. Large objects are patterns of patterns whereby connections can be broken by external or internal interactions. In this sense very few patterns are persistent as a pattern *(and they are* never as a version: their raster point and zeron content is anyhow changing). Examples of *quasi* persistent patterns of points are zerons, EZK's (Higgs), electrons and protons…. Particles (Physics) are patterns but not all patterns (in PhR) are observed in Physics as particles (e.g. a single UZS zeron).

Periodicity (of a cyclic process): The time it takes (expressed in multiples of a time quantum τ *or in number of contractions*) for a replicating pattern to re-enter into the same connector configuration state, *including relevant i-max / I-max index numbers.*

PhR (Physical Reality): the (proposed) set of unproven most elementary components, processes and laws that constitute our cosmos and dictate its behavior. It is a theory and its correctness cannot be proven but its internal consistency, on top of compliancy with *proven laws and confirmed results of experiments in* Physics can be used to check the validity of whatever proposal.

Point: The single *quantized* most elementary particle-like object in our cosmos and the direct outcome of the Creation event. It owns a fixed signed amount of charge "q" as the sole discriminating property between something and nothing, *be it with two possible but opposite sign states.* A point owns a fixed growth / shrink cycle *time τ*, and $h/2=E(q)*\tau$ is the action needed to set (*or induce)* or reset a point.

Point Replication: two orthogonal anti-symmetric pairs of two appropriately phase shifted points with a shared central <u>symmetry</u> location are able to induce by a single (axion-like) <u>interaction</u> *between* one point of each pair, two successive charge states of the same *charge* type (but opposite in the two pairs, in order to guarantee overall charge conservation in the cosmos). Each pair is able to maintain this single anomaly several times in a row whereby along fastest paths in time, an anomalous point state is copied, alternatively left-right, be it with a phase shift of order τ. An event sequence that creates and sustains this growing two sided point pattern is called a <u>point replication process</u>. Each 2-point pattern is called a <u>point string</u> or a <u>zeron</u>, an in <u>time</u> (or phase) growing linear composition of two <u>branches</u> whereby their last position and/or time shifted point states are called dynamic <u>connectors</u>. Adding points to a string is a selection exercise of appropriately phase shifted point pairs, being dynamic connectors, out of a set of replicating <u>partial</u> *(or shorter)* point strings, emerging as short-lived versions replicating (*at extremely high but gradually decreasing frequencies)* in multiple superposed (slightly phase shifted) time dimensions around a common central location. All successful selected points (or knots) of a growing branch are connected with each other and with one of the central (antenna) points by well synchronized (or in time equidistant) charge info exchanges (a case of constructive interference). This means that the sequence of successive selected internal *connector* point states of each partial successfully completed string branch, are 2τ phase shifted. Charge info emitted by enclosed "<u>axial</u>" points "set" a connector state, a local and appropriate "<u>transversal</u>" CPS point "resets" it again into an empty state. With respect of the fastest path selection rule, the longest pattern "in time" s*ustaining a fixed charge excess,* is able to persist over 137 successive quantized replication steps. *This in time axial string is <u>dense</u> meaning that successive point shrink and grow cycles take place without delay, protecting the string against random external charge info based interaction attempts from abroad.* When reaching *a critical* limit (<u>i-max</u>), the probability of interaction with a neighbor zeron in a compliant short-state and acting as a short lived transversal string, *becomes* higher than the probability of a delayed successful internal coupling with another appropriate superposed 2-point antenna string of the same (*time)* length *around the shared symmetry center.* This external interaction is the cause of a phase jump τ

what leads to a shrinking (in time) under the impact of an ongoing internal axial charge info exchange process, whereby the initial net charge type is maintained until the string re-enters into a contracted 2-point state and the charge type is inverted and (as a new version) an anti-symmetric string restarts its growth. The contact state between two adjacent interacting zerons in i-max, generates or eliminates a hole, in fact a positive or a negative deviation from a standard local charge-hole density ratio, being a form of positive or negative *embedded* "mass" and *as a discriminating property,* a source of energy: as two *scenario's* of interaction are possible (*the induction of an extra point in a still empty short branch connector location or the reset of a point in a long branch connector*) an excess point *state* is reset *or induced and conform CPT-conservation, the shortest branch becomes the longest* or a hole is filled with an extra induced point a*nd that short branch becomes the longest*) two dynamic zeron-<u>state</u> classes exist *with a slightly distinct replication length in time*, leading to matter and contramatter-like behavior. Each class contains zeron *pair* states (*see contact-EZP*) with a slightly different hole tenor (τ *shift*) as unit mass quantum *(e.g. in E=m'c'²)* and a slightly distinct fine structure constant 1/137, xxxx (physics). The intrinsic, a priori fixed, tenor of $137X2\tau$ is determined by successive internal interaction shift over small time quanta and the requirement that, despite the distinct impact of an external interaction between zerons in i-max, the original oscillation-like growth-shrink like process must be stationary (otherwise the CPS/UZS raster as a global coupled quantum macro-object could not reach an equilibrium state, *in fact required* to permit any further evolution of the cosmos) could determine the prime number value 137 (why 137 and not another prime number *depends on the values τ, M - a suggestion to be confirmed by computer simulations*).

<u>Polarization (or pre-polarization):</u> *Free zeron or EZP states emitting quantized charge info, might induce by UZS zeron selection in the UZS, paths of zerons or contact-EZP's that materialize gauss or fotino (or magnetic) or graviton field lines. Hereby the FLN principle applies (inverted copies try to cancel out the impact of an original pattern version in order to (re-)implement an empty cosmos(0)). Pre-polarization lines facilitate the propagation and exchange of standard energy-carrying interaction patterns (polarons, photons…) between candidate particle connectors. The Induction of polarization patterns as a process, makes use of quantized charge info emitted by one or several "antenna points or zerons" not involved in internal binding, whereby symmetry and interference rules, applied to these charge info quanta might select or induce an inverted copy of this antenna, able to behave as a new virtual particle . Overall energy and charge conservation rules apply if these new patterns will behave as quasi persistent particles (e.g. gravitons or particles in high energy collisions in LNC). Successful selection of pre-polarization components requires the local availability of appropriate potential "building blocks" (free UZS-zerons and contact-EZP's of the right type) in order to compose FLN-conform inverted pattern copies.*

<u>Polaron (interaction):</u> One of the two fundamental quantized types of interactions *between patterns on a double raster that are possible (see Axion for the other type). Interactions* permit an exchange of an appropriate charge info package between compatible patterns or pattern components *(e.g. connectors)* with respect of conservation principles, leading to a change of certain properties in both, the emitter and the receiver of the package. In the

polaron case it changes the quantized hole content and/or tenor in both interacting objects and because these objects are just raster point compositions, it has a small impact on the local point-hole density ratio in the UZS itself (*a form of energy)*. To change the hole tenor of a particle's short *2-zeron* branch connector, a properly synchronized EZP like charge info pattern has to be exchanged. This elementary pattern is called in PhR a polaron. Emitter and receiver of a polaron have to be *either* two particles (or patterns) of which one has an over 2τ phase shifted zeron composition (e.g. gravitons) *or* both have connectors in I-max states of *long (the emitter) and* short branches *(the receiver)* of Higgs based replicating particles *(a low- energy collision type interaction)*. Polarons exchange momentum between particles. Either the exchange is direct (connector to connector via a virtual photon in Physics) or the polaron is embedded in a photon particle or in a graviton o*r in another gauge boson (Physics)*. The hole tenors *of transversal strings* for matter and contramatter are different, so a normal polaron cannot couple with a connector of a contra-particle (and vice versa). *As long as a polaron stored in a connector has not been integrated in a new particle state by effectively reducing the I-max value of a replicating string and/or adjusting the multiple free zeron configuration of a central EZK, the same connector (the extra phase shift between enclosing zerons makes it non-compliant) is not susceptible to a new polaron coupling. This adjusted phase shift of a free connector zeron is supposed not to perturb the replication growth-shrink process as such (to be proven by computer simulations).*

Process: a *correlated* sequence of events.

Quantized: *The smallest fixed charge amount in the cosmos is q (point charge) built up or reset within a smallest fixed elapsed time amount or quantum τ. A single point-life-cycle takes 2τ and equals a quantized charge info amount.*

Raster(s): A generic name for the CPS or the UZS or for both.

Replication: *see point or zeron replication.*

Return state: A special connector state whereby the growth (*in time or in space/time)* of a replicating point or zeron string stops. In case of point replication, growth (in time or phase) stops when two neighbor zerons interact *directly* what happens under standard conditions in a *particle-less undisturbed stationary* UZS raster (after 137 steps). In case of zeron replication out of an EZK antenna, this process stops when a selected phase shifted transversal string zeron *(synchronized with a free zeron in the central Higgs each time the pattern passes thru a contracted state)* in the connector of the longest branch is reaching an appropriate phase state *versus the phase angle of the zeron in the corresponding axial string . When this happens, the roles of two transversal zerons of the connector are interchanged. The new axial zeron state sensitive for coupling with the enclosed axial branch zerons will be shifted over a τ phase quantum whereby CPT conservation leads to an inversion in P and T.* Charge info sent by enclosed zerons in *knots of* the same branch *and used for growth and axial binding along shortest paths,* resets the new *phase shifted axial* connector state and reduces step by step the string length. Former string zerons *are released* again *as* ordinary UZS zerons. The *initial* offset value of the phase angle of a free connector zeron (*determining the actual I-max value) just after contraction* depends on the value of *the appropriate free zeron phase state* in the

central Higgs. This value determines the maximum string length and the life time of a replicating pattern and indirectly its momentum state, being in fact the pace at which subsequent, in position-shifted new particle versions will emerge. So the free zeron configuration (*per string*) in the central Higgs acts as memory of the momentum property of a particle. *Standard photon and neutrino "difference particles" propagate as modified copies of Higgs patterns in critical contraction states, at maximum speed c and their micro-replication and propagation mechanism must be different (for neutrino's computer simulations are certainly required). They materialize at least partly unbalances in the free zeron configurations of particles before and after collisions or decays.*

Role interchanges. *A term used to express the implicit dynamic character of the role of the 4 zerons of a central EZK in a complex pattern. Their behavior is initially the outcome of an at high frequency rotating phase shift, required to bind and to synchronize internally the 4 zerons of a "stand-alone" EZK. It means that more complex particle states derived from such hypothetical initial Higgs configuration and due to external interactions in connectors and indirectly with the central EZK, might coexist as superposed versions of the same basic pattern. Depending on the kind of extra interactions and the binding process with new added components of micro-patterns, this multi-superposition freedom can be limited after a few replication cycles what will explain several distinct decays and replication scenario's and particles with different properties (like mass). Contrary to some theories in physics, PhR rejects a theory that enables identical superposed states of a single pattern, co-existing simultaneously: at least a phase shift (τ or 2τ) between these so called superposed states is required.*

String: a linear coherent set of knots, in fact *compliant and* selected raster components (points or zerons) in an out of a central *unbalanced* antenna zigzag-wise growing coherent pattern. *In regime it is* able to grow and to shrink alternatively left and right (the two branches of a string) *as driven by the FLN principle along shortest paths*. In terms of Physics we could call this process simplistically a form of oscillation whereby the string length (*in time and/or space) would show a variable amplitude*. Knots and part of the central antenna components are interconnected by *left-right* charge info exchanges with a central antenna as well as with enclosed knots of the same string branch (*due to the fastest path rule, there are no direct interactions between components of the two branches of the same string or between strings of the same particle, well indirectly via the central EZK*). This process is called "point or zeron replication", as it is able (without external interactions) to maintain in the course of a by physics measurable time lapse, an initially single anomaly in the central antenna pattern, just by distributing (*in time and space*) its impact over one or several (symmetry depending and *dynamic*) successive string connectors. *The symmetry of the central antenna determines the direction along which one or several axial substrings are able to grow in time and/or space, carrying an initial perturbation in its (their) connectors. Growth takes place in line with the fastest path rule whereby other charge info propagation paths cancel out by destructive interference (a base law):this principle explains why axial growth by replication of many particles is able to take place along straight lines.*

String spin (in case of zeron replication): this term refers to the circular distribution of subsequent free transversal zeron states, *selected and added to* knots of linear axial zeron string of a replicating Higgs-based particle. Its virtual rotation sense is opposite for matter and for contramatter particles. It is linked to the *complex* role inversion process in the central Higgs tetrahedron, *already set at the time of the initial EZO split,* and hard to compare with any equivalent particle property in Physics. *The phase shifted distributions of free zeron versions of the central EZK (or Higgs) are linked by direct charge info exchanges to the dynamic circular distribution of one of both transversal zeron states in successive string knots. See also "free zerons" to understand the differences between matter and contramatter.*

Superposition: Several versions of the same pattern can co-exist as the outcome of the intrinsic symmetry property of a central cyclic charge info emitter (or antenna). As these versions emerge by coupling with multiple central components, internally bound through fixed phase shifted charge info exchanges, these external components are in relative terms also phase (or time) shifted. Where in QM superposition means that (e.g.) a particle can simultaneously be in several superposed states, this statement is not entirely PhR conform. However QM is not able to detect between multiple versions small phase shifts of order τ.

Symmetry: A local or global property of a pattern of points/zerons that refers to its invariance for certain discrete or continuous transformations by virtual or real charge info driven interactions. Examples of transformation classes are translations in space and/or time (over a raster) and/or between dimensional subset (see zerons), rotations, inversions, *virtual* changes in charge or/and mass types …. Transformations can be real (active) or can refer to changes in reference frames in which the behavior of a patter (e.g. a particle) has been (*often*) mathematically described (passive). If a pattern (or a system) has a local symmetry that is embedded in a global (e.g.) raster with its own distinct large scale symmetry properties, a mathematical description of a local state or process has to add a "gauge" term that is representative for a large scale property and has only a limited impact on local small scale behavior, *transformation capabilities* and symmetry properties. In PhR and at the time the UZS/CPS raster was (still?) growing, the negligible impact on (e.g.) local raster parameter values, of a radial translation in space/time of a local subset of dimensions embedded in the global quasi infinite dimensional spherical CPS, is an example of these principles. In physics (QM) the integration of gravity fields *as historically* produced by large mass objects or *the contribution of large* discrete electric/ magnetic *effects* on their small scale mathematical quantum formalism, are other examples.

UZS: The *name of the* collection of zerons *in the cosmos,* being a dynamic raster of *two-sided in time* replicating 2-point patterns. It *once emerged* spontaneously and dynamically within the CPS by selecting (as a *dynamic and* cyclic process) points in appropriate states *and integrating them in by point-replication selected zeron patterns. Growth of the CPS took place at an incredible speed out of the creation event location in the CPS. Even if the chances of point replication are relatively small on a CPS scale, taking the stringent requirements for two successful orthogonal point pairs into account, the regime zeron density of the UZS will be extremely high because dynamic growth processes of replicating point strings take place in quasi-superposition along an extremely high number of 2-point dimensions embedded in an*

M-dim set around a very dense set of candidate symmetry centers and taking off in an absolute time frame that is just slightly phase shifted (emptiness is a continuum). Also in this case the perturbation principle holds, meaning that only a small but variable fraction of points are, at any moment, part of an UZS zeron pattern. In Physics and Cosmology the UZS has to be treated as a gigantic coupled quantum object filled with more complex patterns that constitute matter (Physics or PhR) *and contramatter (PhR). We assume that if the size of the CPS in the cosmos would be finite, the UZS has equally reached its maximum volume. If the dimensionality of the CPS has a fixed value M, the dynamic UZS subset has a dimensionality N after a reduction by 137, being the outcome of point replication. Any dynamic and eventually as a pattern moving UZS point-subset keeps its intrinsic properties, even when its content is made of gradually in M dim phase shifted points and even whenever such pattern would approach the outer shell of a finite CPS, except in an extremely thin outer layer. Other names for the CPS and / or the UZS are "grid" or "raster".*

Zeron: *(See: point replication).* An elementary UZS *raster* component and *as a pattern* the smallest persistent *and* cyclic (with periodicity T) point-made object in the cosmos. Zerons *emerge per pair out of* a two-point central antenna, *in regime* a *combination of a* linear (in time) axial point string *with at each side alternatively growing dynamic* connectors of which one maintains an over T/2 (*or about 137 times 2τ*) persistent charge excess, the other being *50% of the time* in a *dynamic* hole state. *The (physical) length of a point string in a zeron is about two points whereby the two antenna points are internally τ-phase shifted, anyhow meaning that the time and space distances between both are fixed and small (Planck units ?).*

Zeron Replication: A cyclic growth and shrink process of a zeron-made pattern, whereby a one-shot anomaly in a central symmetric antenna (in casu an EZK or Higgs *or their contra versions*) is copied along multiple symmetry directions by adding step by step selected UZS zerons in appropriate states to this pattern, along 3 orthogonal zeron strings *and alternatively left-right for each branch.* These so called zeron knots are bound with each other and with the central EZK by appropriate quantized charge info exchanges *along shortest paths as observed along axial strings.* The initial anomaly (mostly a net unit charge quantum excess) is stored in multiple slightly phase shifted string connectors, a dynamic process depending on the symmetry and the internal behavior of the central antenna. *A replication pattern out of a central EZK (a Higgs) shows geometrically a tetrahedron based symmetry. A simple electron replicates along 3 perpendicular directions or strings, whereby each axial string corresponds with a rib of the central tetrahedron. A neutron replicates in superposition along a double anti-symmetric conic bundle of electron-like axial strings whereby the 3 virtual orthogonal symmetry axes of each double cone are perpendicular to opposite ribs of the central EZK antenna. This complex pattern determines the ratio between an electron and a neutron mass. It is interesting to notice that fastest zeron replication along a single axial string materializes a straight line as the outcome of the charge info superposition base law (see also Feynman - this statement is not obvious in PhR because particles do not move, only pattern versions seem to do).*

Zeron Replication and Collisions. *Except from direct internal interactions with and between central EZK zerons of particles in the contracted state, a r*eplication *process* can lead

to a successful external one shot or cyclic coupling between connectors of compliant patterns like particles *or with photons or gravitons (for the latter two cases, a term "connector" makes little sense)* whereby both are in appropriate (I-max) states. Standard charge info packages can be exchanged (axions or polarons) between both whereby one connector is the emitter, the other the receiver. The roles of both are not pre-determined and synchronization is a statistical phenomenon. Hereby the pattern with the shortest string is more frequently in an I-max state and has more chance to be the *successful* emitter. It explains why in case of two colliding particles *and polaron exchanges*, the fastest particle will statistically, in case of a coupling by repetitive interactions, lose momentum. *Axion exchanges between zeron points in connectors of non-coherent particles are extremely short range in space and time and have extremely low probabilities to happen. As the binding by strong interactions (the strong force in Physics is not a different type of interaction in PhR) in the nucleus of an atom is a combination of cyclic axion and polaron exchanges between neutron and proton states it explains confinement (Physics) and why "color force" (point based axion exchange) and zeron-based (in PhR) polaron coupling (EM interaction in physics) have a strength- ratio with value 137 and show different ranges of effectiveness.*