Are dark genes performing prime factorization?

Adelic physics, $M^8 - H$ duality, and zero energy ontology lead (ZEO) to a proposal that the dynamics involved with "small" state function reductions (SSFRs) as counterparts of weak measurements could be basically number theoretical dynamics with SSFRs identified as reduction cascades leading to completely un-entangled state in the space of wave functions in Galois group of extension of rationals identifiable as wave functions in the space of cognitive representations. As a side product a prime factorization of the order of Galois group is obtained.

The result looks even more fascinating if the cognitive dynamics is a representation for the dynamics in real degrees of freedom in finite resolution characterized by the extension of rationals. If cognitive representations represent reality approximately, this indeed looks very natural and would provide an analog for adele formula expressing the norm of a rational as the inverse of the product of is p-adic norms.

The application at the level of genes is especially interesting.

Adelic physics very briefly

Number theoretic vision leading to adelic physics (see `http://tinyurl.com/zylrd7w`) provides a general formulation of TGD complementary to the vision about physics as geometry of "world of classical words" (WCW) (`http://tinyurl.com/sh42dc2`).

1. p-Adic number fields and p-adic space-time sheets serve as correlates of cognition. Adele is a Cartesian product of reals and extensions of all p-adic number fields induced by given extension of rationals. Adeles are thus labelled by extensions of rationals, and one has an evolutionary hierarchy labelled by these extensions. The large the extension, the more complex the extension which can be regarded as $n-D$ space in K sense, that is with K-valued coordinates.

2. Evolution is assigned with the increase of algebraic complexity occurring in statistical sense in BSFRs, and possibly also during the time evolution by unitary evolutions and SSFRs following them. Indeed, I have considered (`http://tinyurl.com/quofttl`) the possibility that the time evolution of self in this manner could be induced by an iteration of polynomials - at least in approximate sense. Iteration is a universal manner to produce fractals as Julia sets and this would lead to the emergence of Mandelbrot and Julia fractals and their 4-D generalizations. In the sequel will represent and argument that the evolution as iterations could hold true in exact sense.

   Cognitive representations are identified as intersection of reality and various p-adicities (cognition). At space-time level they consist of points of imbedding space $H = M^4 \times CP_2$ or M^8 ($M^8 - H$ duality (`http://tinyurl.com/vm62vjv`) allows to consider both as imbedding space) having preferred coordinates - M^8 indeed has almost unique linear M^8 coordinates for a given octonion structure.

3. Given extension of given number field K (rationals or extension of rationals) is characterized by its Galois group leaving K - say rationals - invariant and mapping products to products and sums to sums. Given extension E of rationals decomposes to extension E_N of extension E_{N-1} of ... of extension E_1 - denote it by

$E \equiv H_N = E_N \circ E_{N-1} ... \circ E_1$. It is represented at the level of classical space-time dynamics in M^8 (`http://tinyurl.com/quofttl`) by a polynomial P which is functional composite $P = P_N \circ P_{N-1} \circ ... \circ P_1$ with $P_i(0) = 0$. The Galois group of $G(E)$ has the Galois group $H_{N-1} = G(E_{N-1} \circ ... \circ E_1)$ as a normal subgroup so that $G(E)/H_{N-1}$ is group.

The elements of $G(E)$ allow a decomposition to a product $g = h_{N-1} \times h_{N-1} \times ...$ and the order of $G(E)$ is given as the product of orders of H_k: $n = n_0 \times .. \times n_{N-1}$. This factorization of prime importance also from quantum point of view. Galois groups with prime order do not allow this decomposition and the maximal decomposition and are actually cyclic groups Z_p of prime order so that primes appear also in this manner.

Second manner for primes to appear is as ramified primes p_{ram} of extension for which the p-adic dynamics is critical in a well-defined sense since the irreducible polynomial with rational coefficients defining the extension becomes reducible (decomposes into a product) in order $O(p) = 0$. The p-adic primes assigned to elementary particles in p-adic calculation have been identified as ramified primes but also the primes labelling prime extensions possess properties making them candidates for p-adic primes.

Iterations correspond to the sequence $H_k = G_0^{\circ k}$ of powers of generating Galois groups for the extension of K serving as a starting point. The order of H_k is the power n_0^k of integer $n_0 = \prod p_{0i}^{k_i}$. Now new primes emerges in the decomposition of n_0. Evolution by iteration is analogous to a unitary evolution as ex^{iHt} power of Hamiltonian, where t parameter takes the role of k .

4. The complexity of extension is characterized by the orders n and the orders n_k as also the number N of the factors. In the case of iterations of extension the limit of large N gives fractal.

5. Galois group acts in the space of cognitive representations and for Galois extensions for which Galois group has same order as extensions, it is natural do consider quantum states as superpositions of cognitive representations as wave functions in $G(E)$ forming n-D group algebra. One can assign to the group algebra also spinor structure giving rise to $D = 2^{M/2}$ fermionic states where one has $N = 2M$ or $N = 2M + 1$). One can also consider chirality constraints reducing D by a power of 2. An attractive idea is that this spinor structure represents many-fermion states consisting of $M/2$ fermion modes and providing representation of the fermionic Fock space in finite measurement resolution.

Number theoretical state function reductions as symmetry breaking cascades and prime factorizations

This has very important quantal implication and allows to interpret number theoretic quantum measurement as a number theoretic analog for symmetric breaking cascade and also as a factorization of an integer into primes.

1. The wave functions in $G(E)$ - elements of group algebra of $G(E)$ can be decomposed to tensor products of wave functions in $G(E)/H_{N-1}$ and H_{N-1}: these wave functions in general represent entangled states. One can decompose the wave functions in H_{N-1} in similar manner and the process can be continued so that one obtains a maximal decomposition allowing no further decomposition for any factor. These non-

decomposable Galois groups have prime order since its group algebra as Hilbert space of prime dimension has no decomposition into tensor product.

2. In state function reduction of wave function $G(E)$ the density matrices associated with pairs $G(E)/H_{N-1}$ and H_{N-1} are measured. The outcome is an eigenstate or eigen-space and gives rise to symmetry breaking from $G(E) \equiv H_N$ to $E_N \times H_{N-1}$. The sequence of state function reductions should lead to a maximal symmetry breaking corresponding to a wave function as a product of those associaetd with Galois groups of prime order. This define a prime factorization of the dimension n of Galois group/extension to $n = \prod_{i=1}^{N} p_i^k$! The moments of consciousness for self would correspond to prime factorizations! Self would be number theoretician quite universally!

Also also the fermionic cognitive representation based on finite-D Fock states defined by spinor components of $G(E)$ is involved and reduction occurs also in these degrees of freedom and leads to qubit decomposition. The interpretation of Fock state basis as a a basis of Boolean algebra in TGD: the spinor structure of WCW could be representation for Boolean logic as a "square root" of Kähler geometry of WCW. Cognition indeed involves also Boolean logic.

SSFR as number theoretic state function reduction cascade and factorization of integer

A highly interesting unanswered question is following. "Small" state function reductions (SSFRs) define the life cycle of self as their sequence. What are the degrees of freedom where SSFRs occur?

1. SSFRs take place at the active boundary of CD which shifts in statistical sense towards future in the sequence of state function reductions. State at the passive boundary is not changed.

2. $M^8 - H$ duality (`http://tinyurl.com/vm62vjv`) leads to the idea that quantum randomness could correspond to classical chaos (or complexity) associated with the iteration of polynomials (Mandelbrot and Julia fractals) (`http://tinyurl.com/quofttl`) led to reconsider the hypothesis that the polynomial representing space-time decomposes to a product $P = P_2(T-r) \times P_1(r)$. T corresponds to the distance between the tips of CD and $r = t$ to the radial coordinate of M^4 assignable to the passive boundary of CD and equal to time coordinate t. $P_i(0) = 0$ is assumed to hold true.

   P_2 would change in SSFRs whereas P_1 and state at passive boundary would not. SSFRs (analogous to so called weak measurements) at active boundary would give rise to sensory input and various associations - Maya in Eastern terminology. P_1 would correspond to the unchanging part of self - "soul" or real self as one might say.

   I was also led to consider a simplified hypothesis that P_2 is obtained as iteration $P_2 = Q_1^{\circ n}$ in n:th n unitary evolution preceding SSFR. One would start from some iterate $Q_1^{\circ k}$. This would reduce quantum dynamics to iteration of polynomials and to a deep connection with Mandelbrot and Julia fractals but it was quite clear why this would be true.

3. The mere factorization $P = P_2 \times P_1$ implies that the Galois groups associated with active and passive boundary of CD commute and number theoretic state function reduction cascade for the wave functions in $G(E)$ for the extension determined by

P_2 at active boundary could correspond to SSFR. Or course, also other commuting degrees of freedom are possible but number theoretic degrees of freedom could be the most important degrees of freedom involved with SSFRs.

The quantum dynamics of dark genes as factorization of primes

Gene level provides a fascinating application of this picture.

1. As found, dark photons and dark protons forming DNA codons as triplets could correspond to triplet representations for prime factor Z_3 of Galois group of Z_6. Codon and conjugate codon could in turn correspond to the prime factor Z_2 of Galois group Z_6 so that double strand would correspond to Z_6 suggested by findings of Mills (http://tgdtheory.fi/public_html/articles/Millsagain.pdf) and TGD inspired model color vision (http://tgdtheory.fi/public_html/articles/colorvision.pdf).

2. DNA codons could correspond to extension with Galois group Z_3, and one can consider an entire hierarchy of extensions of extensions of .. .extensions with dimensions n_i satisfying thus $n = \prod_{i=1}^{N} n_i$ and having Z_6 as subgroup at the lowest level of the hierarchy. The number N of factors would be the number of polynomials in the functional composition and thus define a kind of abstraction levels (abstractions are thoughts about thoughts about..., maps of maps of ...). N is expected to increase in evolution.

3. Could this abstraction hierarchy be realized at gene level? Genes decompose into transcribed regions - exons - and introns. Could different decomposition of genes to exons and introns correspond to different values of N and n_i and to different Galois groups. Could genes themselves form larger composites?

   Could genomes form even large structures such as chromosomes with larger Galois groups. Years ago I considered the possibility of a collective gene expression based on the collective MB of organelle, organ, or even population: could this correspond to an extension associated with several genomes?

4. Could SSFR correspond to a sequence of symmetry breakings for the Galois groups of these structures decomposing them to sub-groups? Number theoretic interpretation would in terms of decompositions of integers to primes! Genome would be a quantum computer performing number theory!

5. Metabolic energy feed would increasing h_{eff} would also increase the orders $n_i = h_{eff}/h_0$ of the extensions appearing in the composition of extensions and thus the orders of polynomial factors P_i in the functional composite defining the extensions. Therefore the decompositions would be dynamical.

   Metabolic energy feed requires BSFR changing the arrow of time if metabolic energy feed is actually feed of negative energy to environment. The emergence of a new prime factorization would require BSFR. That the time evolution by iterations would not require BSFR would support the proposal that time evolution by BSFRs could be induced by iteration dynamics for the polynomial P_2 assignable to the active boundary of CD.