Chemical qualia as number theoretical qualia?

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Abstract

Certain FB discussions led to a realization that chemical senses (perception of odours and tastes) might actually be or at least include number theoretical sensory qualia providing information about the distribution of Planck constants $h_{eff}/h = n$ dividing the order of the Galois group of the extension of rationals characterizing adeles.

1 Introduction

I have been in FB contact with certain biologist, let us call him Mr X. I cannot say that the contact has been pleasant. Mr X is dangerously near to what is often classified as crackpot (I do not want to use this term). Mr X certainly has encountered this accusation and reacted by introducing the notion of serious scientist. He of course counts himself to this category and those others are idiots, fools, etc... This made discussions impossible although I tried my best ask him to summarize what he thinks I am claiming and represent objections based on contents.

This is a typical defence reaction to keep the illusion about the pyramid having the ego at its top. Mr X uses rather big brush when he paints his vision about other scientists. For instance, all physicists belong to the crackpot category as also all biologists, who are neo-darwinists. Mr X seems to feel empathy towards creationists.

Unfortunately, reactive and defensive attitudes interfere de-constructively with logical thinking. Mr X has been stubbornly claiming that I am touting pure nonsense and that all are laughing to me. Surprisingly, he also claims that I have stolen his ideas! If both claims are correct, also he must be touting nonsense (about this many readers might agree). Mr X also claims that certain person with basic education in biology - the discussion takes place in her FB - has helped me to perform this science crime! Mr X even wrote a posting about his paranoidal delusions (see http://tinyurl.com/jd6euqb): enjoy if you can!

It seems that concerning his attitude to TGD Mr X is in the middle of transition from silence and ridicule to the rage dominated phase during which new vision is passionately denied. After that comes the acceptance and the claims that the new vision has been obvious for decades.

This reactive attitude makes Mr X incapable of listening and I soon realized that I must direct my responses to a general reader. I have seen very many very serious scientists during these 40 years, and learned that this syndrome must be very painful human tragedy, and that communications with a really serious scientist are impossible. Therefore I have adopted the attitude of doctor making the diagnosis and telling the patient what the problem is. Unfortunately, I cannot provide the cure.

Despite the impossibility to communicate with Mr X in civilized manner, I have studied some material at the FB pages of Mr X and agree with Mr X that the importance of metabolism and nutrition in evolution has been under-estimated. There are also many links to material written by other researchers.

1. It is of course known that metabolism is fundamental but the reason why this should be the case is far from clear. Energy and information are closely related but identifying energy with information as Mr X does is of course wrong and due to his understandable ignorance about physics.

2. The standard thermodynamical explanation is that metabolic energy is ordered energy like work so that metabolic energy is basically information or reduction of entropy from its maximal value. The problem is however that thermodynamics provides only a fundamental definition of entropy, not of information. One can speak of entropy currents reducing local entropy but this is not enough to understand living matter. The belief that life is just a thermodynamical fluctuation is non-sense.

3. Energy feed is certainly the prerequisite of having self-organization but the notion of non-equilibrium thermodynamics is only a phenomenological description. Criticality and even quantum criticality seem to be basic aspects of life but again it seems that neither thermodynamics nor the existing quantum theory is enough.

4. My conviction is that one must have a genuine notion of information and the only genuine information is conscious information. Information is always about something, and information is also relative notion. Bit sequence is information only for a conscious entity for which it has a meaning. Shannon entropy based notion of information fails in these respects. One must identify physical correlates of cognition.

   One must extend standard real number based physics describing dead matter but unable to say anything interesting about animate matter. What is required is what I call adelic physics. Number theory would become a new mathematical building brick of physics.

Although these discussions were not pleasant, they led to a little discovery about chemical senses having tastes and smells as qualia. The usual belief shared also by me is that they are strictly chemical senses and they indeed might be so but only partially. Taste and smell might actually be number theoretic senses telling about average value of $h_{eff}/h = n$ serving as kind of number theoretic IQ of a biomolecule. Quite generally, qualities like beauty could correlate with the value of n assignable to sensory input.

In the following I describe the basic building bricks of TGD vision in the hope that it makes easier to read my responses to the vision of X.

2 Zero energy ontology

Zero energy ontology (ZEO) replaces the notion of quantum state with zero energy state. It can be regarded as pair of initial and final states of quantum event. At space-time level these events correspond to 3-surfaces at opposite boundaries of causal diamond $CD \times CP_2 \equiv CD$, where causal diamond CD is the intersection of future and past directed light-cones of 4-D Minkowski space M^4. The conserved quantum numbers of quantum states at opposite boundaries of CD have opposite values.

1. ZEO leads to a modification of quantum measurement theory leading to a theory of consciousness [L4]. Self can be seen as a generalized Zeno effect and corresponds to a sequence of state function reductions leaving everything fixed at second boundary of CD. Self dies and re-incarnates as time-reversed self as the first reduction to the opposite boundary takes place. Negentropy Maximization Principle (NMP) was originally postulated as an independent variational principle of consciousness but it seems that adelic physics implies in statistical sense automatically.

2. Remote metabolism is one of the possible implications of ZEO. System could send negative energy radiation to geometric past (this radiation would correspond to time reversed "radiation self"). If there is a system able to receive this radiation - say population inverted laser, remote metabolism as active gain of metabolic energy becomes possible. Also remote metabolism based on positive energy photons is possible but is passive. Remote metabolism could be in central role in living matter.

3. Motor actions could quite generally involve sending of negative energy radiation to past: this would explain Libet's finding that volitional action is preceded by neural activity.

4. Also active remote perception by sending radiation to past or future reflected there as radiation with opposite arrow of time becomes possible and could make control and sensory perception possible in arbitrarily long scale: finite light-velocity would not be a problem. One cannot exclude the possibility that what is regarded as hallucinations caused by some psychoactive drugs are actually remote perceptions of this type.

3 Hierarchy of Planck constants and dark matter

TGD based model relies heavily on the identification of dark matter as a hierarchy of phases labelled by the value of effective Planck constant $h_{eff} = n \times h$.

1. The larger the value of n, the longer the Compton lengths scaling as n. Atomic size scale scales as n^2. The binding energies of hydrogen atom scale as $1/n^2$ so that the phase transition increasing n and making quantum coherence in larger length scale possible requires energy [K8, K10]. Hydrogen atom is simplest atom and proton transfer reactions are indeed very important. They occur also between bases of DNA base pairs (see http://tinyurl.com/jxqvkcb).

   Cyclotron energies are proportional to n and again metabolic energy is required. The phase transitions increasing n take place at quantum criticality: scale up quantum lengths correspond to long range correlations and quantum fluctuations. Living matter would be quantum critical system in which metabolic energy feed makes possible phase transitions increasing the value of n.

2. This picture leads to a model of bio-catalysis in which the temporary reduction of n for atom of catalyst or reactans liberates binding energy kicking reactants over the potential wall so that the reaction can proceed swiftly [K8]. After than the energy could be returned to the catalyst. In ATP $\rightarrow$ ADP the dark atom assignable to high energy phosphate bond would be given to the acceptor molecule. ATP would be created by using ATPsynthase using the energy or protons going through mitochondrial membrane and kicking atom to dark atom state in phosphate attache to ADP. The energy to drive protons through the membrane would basically come from nutrient molecule. The protons would be also dark.

3. There are two quite different ranges of values of n [K8, K9]. Quantum criticality corresponds to a situation in which the perturbative QFT fails. Since em gauge couplings strength is of form $\alpha = Z_1 Z_2 e^2/4\pi\hbar c$, perturbation theory can fail for large charge values $Z_1 Z_2$. The phase transition h to $\hbar_{em} = Z_1 Z_2 e^2/4\pi v_0$, where $v_0 < c$ has dimensions of velocity, makes perturbation theory possible ($\alpha_{eff} = v_0/c$). Nature is theoretician friendly as one might say. Same applies to color interaction and weak interaction and also to gravitation: gravitational coupling strength GMm can be also very large and the phase transition increasing $\hbar$ to $h_{eff} = \hbar_{gr} = GMm/v_0$. Now the values of h_{eff} are extremely large.

4. If one has $h_{eff} = h_{gr}$ at magnetic flux tubes defining the magnetic body (MB) of the system, the dark cyclotron energy does not depend on the mass of the particle and is universal. The mysterious bio-photons can be identified as ordinary photons resulting in phase transition changing $h_{gr} \rightarrow h_{eff}$ for matter visible to us. The energy spectrum would be in visible and UV and this allows to deduce estimate for the value of h_{gr}. Note that the value of h_{eff} for matter visible to us need not be its smallest value corresponding to $n = 1$. The notion of hydrino atom claimed by Randell Mills with scaled up binding energy suggest $n = 6$ [L2].

5. The overall conclusion is that the organism-environment duality must be generalized to a trinity including also MB carrying dark matter. MB uses biological body as motor instrument and sensory receptor. MB has a hierarchical structure with a wide spectrum of values of h_{eff}. The purely biological level corresponds to flux tubes and atoms $h_{eff} = h_{em}$ and the more spiritual level to $h_{eff} = h_{gr}$ giving rise to time scales of EEG [K6] and even longer time scales. Even the galactic MB could be involved as the fact that certain biorhythms are naturally expressed in terms of galactic day and year suggests. These would give rise to the analogs of EEG and time scales of human consciousness (say hour or day).

4 Can we smell and taste the value of h_{eff}/h?

$h_{eff}/h = n$ brings in new degrees of freedom associated with the Galois group. If the proposed interpretation makes sense, one can ask whether evolution might have developed sensory perception of h_{eff}/h.

1. The same molecule can have large number of chemically more or less identical variants differing only by the values of n assignable to its atoms and with its MB. I learned long time ago from my chemist friend in sauna discussion that it has not been possible to produce artificially vanilla having the same taste as the natural vanilla. Maybe the explanation derives from these number theoretical degrees of freedom.

   This leads to expect that biomolecules, cells and larger structures can have different distributions of n both in short and long scales. In particular, neurons could be cellular elite in this respect and even differences between individuals of the same species can be imagined and it might be that the life style could affect the distribution of n. This might have rather interesting implications concerning the taste of food. The chef could have a decisive role in determining the taste of food. Also the so called junk food could have very low value of n as a consequence of preparation process.

2. The higher the value of $h_{eff}/h = n$, the higher the complexity of extension of rationals, and the higher the value of maximal entanglement negentropy, and therefore the intelligence of the system. Dark atoms are possible and therefore dark variants of molecules. Also dark variants of nuclei are possible and the numbers for states of dark proton sequences turn out to correspond to those of DNA, RNA, tRNA, and amino-acids [L1]. Furthermore, the numbers of DNA codons coding for given amino-adic in vertebrate genetic code are predicted correctly. The proposal is that dark analogs of basic biomolecules have served as templates for visible molecular biomatter: biochemistry would be dynamics of shadows. Dark matter would be master and biomolecules the slave.

3. If this picture is correct, one can characterize biomolecules and also larger systems by the spectrum of the values of n - value spectrum for the order of Galois group characterizing its algebraic complexity. Best nutrients would have large average value of n. Therefore it would very advantageous to sensorily perceive the value of n. Maybe odors and tastes give idea about the value of n. The better the odor or taste, the higher the value of n!

   This would also explain why excretion products smell bad. It has low value of n since metabolism has removed from excretion produces the dark component as effectively as possible and therefore they are not good as nutrients except possibly for bacteria. Same applies to non-organic matter and therefore it cannot be used as nutrients.

   Also in sexual reproduction it is advantageous to find the best possible partner and high average value of n is desirable. Pheromones giving rise to social odors are central here. Pheromones could carry information about the spectrum of n. They could thus carry not only information about - say - genome but also about number theoretic IQ.

4. One can also understand the emergence of immune systems. Dark atoms - number theoretical complexity - are cognitive currency and living systems are fighting for it. The dirty trick is to eat another living system and use its dark matter for own survival. We indeed eat other animals and plants instead of being happy with sun-light as some spiritual people claim to be. Even cells are autofags "eating" those parts of cell, which are are not functioning properly.

   Immune system would have evolved to prevent dark atom thefts. Both micro- and macro-organisms (in particular in capitalism and market economy!) would do their best to steal negentropy and dark matter. Also viruses could steal dark atoms and thus energy and information from a more advanced system.

5. It is also possible to clone maximal entanglement with density matrix proportional to unit matrix. The conjecture is that number theoretic entanglement for which the p-adic variants of density matrix reduces to unit matrix but not necessarily the one, can be also cloned. Shared joy is doubled joy. This would be alternative but rather rarely used strategy of survival.

5 Adelic physics and cognition

It took more than 10 years to deduce hierarchy of dark matters as hierarchy of Planck constants from what I call adelic physics.

1. The notion of p-adic physics was introduced by colleagues already around 1990. In lack of any idea about the connection to reality it however remained purely formal exercises such as the construction of p-adic variants of quantum field theories.

   At that time I however realized that p-adic thermodynamics for a system with super-conformal invariance and standard model symmetries predicted by TGD provides extremely elegant description of particle massivation and that the predictions are correct with one per cent accuracy if p-adic length scale hypothesis stating that primes near certain powers of two are physically favored [K7].

   This forced the question about interpretation and about how to integrate real and various p-adic physics to a larger coherent whole

2. Adelic physics is indeed a fusion of real physics for matter and various p-adic physics for cognition, p prime. Various number fields are like pages of a book having common back consisting of rational numbers common to all of them.

   Allowing extensions of rational numbers (by adding roots of N:th order polynomial) one obtain reals and induced extensions of p-adic number fields. Entire hierarchy of books defined by the extensions of rationals. This defines hierarchy of adelic physics identified as evolutionary hierarchy.

3. It became clear already in the beginning that that $h_eff/h = n$ naturally corresponds to the number of sheets of space-time surface representable as a covering space. Galois group of extension act as its automorphisms respecting arithmetics.

   Since cognitive representations correspond to intersections of real and p-adic space-time surfaces having points with coordinates in the extension of rationals as common points, Galois group has a natural action to this cognitive representation and gives rise to n-fold covering space. The identification of $h_eff/h = n$ as the order of Galois group is natural. Cognitive degrees of freedom are discrete degrees of freedom characterized by the Galois group of extensions.

   $n > 0$ measures the complexity of extension and it is bound to increase in quantum jumps like the distance from the origin in random walk at half line. This implies evolution. The Universe becomes algebraically increasingly complex. This also means that its negentropy (negentropic entanglement) increase on the long run. Universe learns and this learning changes it.

   Positive negentropy is made possible - as one might guess - by cognition that is p-adic number fields: for these one can indeed generalize Shannon entropy so that it gets negative values and has interpretation as negentropy [L4]. This implies that NMP - originally postulated as a separate principle - follows from adelic physics and holds true in statistical sense. We do not live in the best possible world since this form of principle allows us to do stupid things.

4. p-Adic differential equations have a very special feature that one can have non-constant functions with zero derivative. Integration constants are piecewise constant functions and differential equations are non-deterministic. This corresponds to the non-determinism of imagination.

   If one has fixed the cognitive representation defined by points with coordinates in extension of rationals one can ask if it can be continued to a preferred extremals of action. In p-adic sectors pseudo-constants make this easy: one can speak of imagination realized as p-adic space-time surface. In real sector continuation need not be possible. In this case the imagination is not realizable.

   For some extensions of rationals there can be very many realizable imaginations. System is not only imaginative but also able to realize its imaginations. These extensions are winners in the fight for number theoretic survival.

Extensions of rationals are characterized by so called ramified primes. The generic rational prime decomposes to a maximal number of primes of extension (order of the polynomial determining it). For ramified primes this number is not maximal. There are good reasons to identify them as preferred p-adic primes for the extension in question. The preferred p-adic primes near to powers of two or small prime could be ramified primes for extensions, which have survived [L3].

6   Comments to the vision of Mr X of top-down and bottom-up causation, immune system, nutrients, and olfaction

With these prerequisites I am ready to comment the claims of X picked rather randomly from his FB pages. I am of course not professional biologists and do not know about the detailed definitions of various notions.

6.1   Comments to the vision about hierarchy of causations

Mr X: The sun's biological energy from top-down causation in microbes to the most recent model of bottom-up gene activation and cell type differentiation in vertebrates.

TGD: Solar photons provide the energy kicking atoms to dark states with larger $h_{eff}/h = n$ and large size scale proportional to n^2. Whether solar photons are dark or transform to dark photons in the biosphere such that frequency is reduced but $E = h_{eff}f$ is not affected, is still unclear. Solar photons would in any case be effectively anti-entropic as Schrödinger conjectured. The maximal entanglement negentropy increases with h_{eff}/h since new number theoretic degrees of freedom making possible cognition emerge.

In TGD inspired quantum biology MB is a new key player. MB is the boss and the causation begins from the level of dark MB and proceeds down to the level of biomatter. One possibility is that the control signals go through genomes, where the counterpart of bottom-up cascade is initiated.

Genomes could form a hierarchy in which the MBs of separate cells would fuse to larger MBs and these in turn to even larger ones [**?**, K3]. One could even have genome or organ, organism, population, or even species. The coding would be as bio-rhythms defined by cyclotron frequencies, which in turn correspond to energies in the universal energy range of visible and UV bio-photons ($E = h_{gr}f$) inducing molecular transitions.

Sensory input would arrive from cell membranes to the MB. EEG and its fractal variants would mediate this input [K1, K5]. Cell membrane would be a generalized Josephson junction generating dark Josephson radiation allowing the communication of the sensory input. Frequency modulation would be the manner to code sensory data represented as nerve pulses to Josephson radiation [K4].

6.2   Comments to the vision of Mr X about immune system

I already described the view about immune system as preventing theft of dark matter.

1. **Mr X**: For comparison, successful reproduction links energy from supercoiled DNA to protection of all organized genomes from virus-driven energy theft and pathology.

   TGD: Dark atoms are cognitive currency and living systems are fighting for it. The dirty trick is to eat another living system. Immune system would have evolved to prevent dark atom thefts. Both micro- and macro-organisms (in particular in capitalism and market economy!) would do their best to steal negentropy and algebraic complexity - that is dark matter. Viruses could steal dark atoms and thus energy and information from more advanced system. Supercoiled DNA mentioned by Mr X as system preventing viral energy theft could provide new dark atoms to compensate the stolen ones or serve as an immune system.

2. **Mr X**: Theorists seem willing to continue to ignore all facts about UV-light induced DNA repair that were presented in the poster that linked femtosecond blasts of UV light to all biophysically constrained energy-dependent RNA-mediated changes in protein folding chemistry and to all differentiated morphological phenotypes and all differentiated behavioral phenotypes.

TGD: This suggests a new mechanism of metabolism or transfer of metabolic energy/increase of $h_{eff}/h = n$. In TGD dark photons with large value of $h_{eff}/h = n$ and low frequency but energy $E = h_{eff}f$ in visible (the original motivation for h_{eff} hypothesis) and UV range provide a mechanism of communications and also of metabolism having two variants based on positive and negative energy photons.

Positive energy photons would allow only passive reception of metabolic energy. Negative energy photons would make possible active gain of metabolic energy (remote metablism): the system needing metabolic energy would send *negative* energy dark photons to a system able to receive them and thus provide the metabolic energy (quantum credit card).

Negative energy photons are analogs of phase conjugate light rays known to dissipate in "wrong" time direction). This is possible in ZEO, which is the basis of TGD inspired theory quantum measurement theory implying in turn theory of consciousness. Fantappie [J1] proposed long time ago that time direction in living matter can vary and introduced the notion of syntropy as time reversed entropy.

Dark photons travelling along flux tubes of a network of magnetic flux tubes would effectively replace sunlight and also the analog of photosynthesis could occur by using "artificial sunlight" rather than nutrient molecules.

3. **Mr X**: Nothing suggests gene expression evolved to depend on any ATP-consuming factor. Gene expression is energy-dependent. It cannot evolve itself to be energy-dependent and that fact is exemplified in the context of my model of virus-driven energy theft and genomic entropy.

   TGD: DNA repair mechanism involving UV light - recall that biophotons are in visible and UV - could kick atoms with reduced $h_{eff}/h = n$ back to states with large value of n - healing. Same applies to energy-dependent RNA-mediated changes in protein folding chemistry, etc...
   .

6.3 TGD inspired comments about nutrients and pheromones

For a background reader can read the article "Human pheromones and food odors: epigenetic influences on the socioaffective nature of evolved behaviors" by Kohl (see `http://tinyurl.com/zammzfe`), which represents a lot of facts serving as constraints on TGD based view about odors and tastes as adelic qualia.

 Pheromones are social odors: Kohl's article "Nutrient-dependent/pheromone-controlled adaptive evolution: a model" (see `http://tinyurl.com/zb7c42y`) is about this aspect. The basic message is that nutritional odors and social odors control the behavior via hormones.

 The TGD proposal is that these odors give information about the distribution of $h_{eff}/h = n$ distribution of nutrient and another individual and the value of n telling about number theoretic evolutionary level, could be the main factor: the larger the value of n, the more attractive the odor. The article "Honey bees as a model for understanding mechanisms of life history transitions" gives a nice example about how epigenetics determined by the nutrition determines the cast system of beehive.

1. **Mr X**: This atoms-to-ecosystems model of ecological adaptations links nutrient-dependent epigenetic effects on base pairs and amino acid substitutions to pheromone-controlled changes in the microRNA /messenger RNA balance and chromosomal rearrangements.

   TGD: The distribution of values of $h_{eff}/h = n$ for the dark atoms (at least hydrogens) in DNA, amino-adids, and biomolecules in general tells the evolutionary level of DNA, measured also as complexity. It is affected by nutrients if metabolism creates a dark atom in phosphate with same value of $h_{eff}/h = n$ as in nutrient. Complexity of nutrient is transferred to the organism: both its morphology and behaviors (ZEO implies that behaviors correspond to 4-D morphologies for space-time surfaces!). The complexity of the organism's biochemistry correlates with that of its nutrients.

   Two DNAs can be identical chemically but at very different evolutionary level. This is seen in epigenesis and different forms of gene expression and also as large fraction of introns possibly

involved with quantum computational activities made possible by braiding of magnetic flux tubes connecting DNA and lipid layers and/or microtubules and axonal lipid layers [K2].

Nutrients contain dark (not necessarily only hydrogen) atoms characterized by $h_{eff}/h = n$. The higher the average value of n, the more negentropic the nutrient is. We would smell the average value of n! The higher the value of n, the better the smell. Metabolic process picks dark atoms from the nutrient and the end product has a low negentropy: it smells bad. Not a good idea to eat it. This is why olfactory system is so important. This also explains why we do not eat non-organic matter.

Quite generally, various disorders and diseases mean reduction of the average value of n in some parts of organism inducing also the reduction of the complexity of DNA, and therefore that of gene expresion, and makes the system vulnerable to mutations and attacks of micro-organisms. The generic healing mechanism would be simple: increase the value of n.

2. **Mr X**: The *nutrient-dependent pheromone-controlled changes* are required for the thermodynamic regulation of intracellular signaling, which enables biophysically constrained nutrient-dependent protein folding; experience-dependent receptor-mediated behaviors, and organism-level thermoregulation in ever-changing ecological niches and social niches.

   TGD: If the metabolic effect of nutrient depends on $h_{eff}/h = n$, also effects on protein folding are expected. The detailed mechanism could rely on remote metabolism based on dark photon - either active or passive - dark photons would have h_{eff}/h assignable to the nutrient and be involved with protein folding and DNA activities and large n would be optimal: you are what you eat!

   Vegetarians believe that vegetables are better nutrients than meat: could plant molecules have higher average intelligence quotient $h_{eff}/h = n$ than meat? How much the preparation of the food can affect the value of n. Could here be the secret of master chef? Could microwave ovens reduce it?

3. **Mr X**: Nutrient-dependent pheromone-controlled ecological, social, neurogenic and socio-cognitive niche construction are manifested in increasing organismal complexity in species from microbes to man. Species diversity is a biologically-based nutrient-dependent morphological fact and species-specific pheromones control the physiology of reproduction.

   The reciprocal relationships of species-typical nutrient-dependent morphological and behavioral diversity are enabled by pheromone-controlled reproduction. Ecological variations and biophysically constrained natural selection of nutrients cause the behaviors that enable ecological adaptations.

   Species diversity is ecologically validated proof-of-concept. Ideas from population genetics, which exclude ecological factors, are integrated with an experimental evidence-based approach that establishes what is currently known. This is known: olfactory/ pheromonal input links food odors and social odors from the epigenetic landscape to the physical landscape of DNA in the organized genomes of species from microbes to man during their development.

   TGD: This is what is expected. Good nutrients increase the complexity of organisms and its behavioral repertoire. Pheromones tell among other things about genotype. They could also tell about the distribution of n: about complexity, about the level of molecular intelligence. This would give connection with nutrition and complexity of of pheromones and in turn link with success in reproduction.

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