Hypersphere space-time model

(draft)

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NOTE : This is a draft, so still very superficial and approximate.

Abstract

Following some fundamental principles of physic (symmetry, homogeneity, ...), the article proposes a simple model for the structure of the universe. Time is no more a fundamental dimension, it's the result of the 3 spatial dimensions, in addition to one dimension for mass. Furthermore, there is no 4 fundamental dimensions but as much dimensions as energy particles or energy quanta. The universe is an hypersphere of quanta. Each quantum behaves like a wave. Our 3 dimensional space appearance is the result of interaction between quanta. The article tries to link this model to the existing theories that are in adequation with the experience.

Generation of mass and 3D space

Supposing that nothing (symmetry) generates something (energy), we can formelize an elementary particule or energy quantum ***a*** and its opposite ***a'*** like this :

$a + a' = 0$ (symmetry), $aa' = 1$ (energy), so $a = i$ *and* $a' = -i$ where $i^2 = -1$.

The quantum *a* is a complex number so it behaves like a wave, more precisely like the phase of a standing wave. The quantum ***a*** and its opposite ***a'*** form a pair of complex numbers (*a*,*a'*), commonly referred as a spiner or a quaternion : $a + ja'$ where $j^2 = -1$, $ij = - ji = k$. A quaternion is vectorial space of 4 dimensions : one *scalar* dimension and three *vectorial* dimensions. So each quaternion has its own 3 dimensional reference system. We call quanton this pair of quanta inside one quaternion.

According to homogeneity principle, there is no difference between each quanton, so each quanton is supposed to be an unitary quaternion (norm 1). If quantons are independant (orthogonal) to each others, they form the surface of an hypersphere of radius 1 in a vectorial space of size N, corresponding to the number of quantons, wich is finite or not. This is the universe.

As the quantons are independant on their vectorial dimension, there is no direct interaction between quantons. Their relation takes effect on their projection on a common space. The modification of the projection on the common space gives the impression of change in relations between quantons.

The common space is the product of each elementary space or dimension. It's a 3 dimensional vectorial (3D) space, with additionnal scalar space (mass) because elementary quanta can be seen as quaternions. Addition and multiplication of quaternions remains a quaternion. The 3D space of the universe is the resulting operation between quaternions as explained below.

Propagation is relative to all possible ways. This is a virtual addition of all possible ways, so addition of all quantons and their corresponding waves in 3D. The addition of waves is an inverse Fourier transform that generates space positions. The result is a probability of presence in a 3D space.

An interaction is similar to a multiplication of quantons. The order of the multiplication is important because multiplication of quaternions is not commutative. Order existence means causality existence, as a kind of time notion. On the other hand, the order of multiplication seems to be indeterminated.

Multiplication generates a rotation of a multiple of $\pi/2$ because of orthogonality between quantons. Each event is a rotation.

TODO :

- *interaction explained, entaglement*
- *propagation (3D/2D)*
- *structure of boson (photon) and fermions : symmetry of wave function*

Consequences

All quanton types, except at most one (photon), shall have mass because distinction of quanton types can only be made inside mass dimension. A quanton can be punctual (no spatial dimension) because its existence can be expressed in the 'mass' dimension, orthogonal to spatial dimensions. Photon is not punctual in space but is punctual relative to a massive quanton.

The concept of field is more immediate. It's the quanton's waves envolving the whole universe.

Indeterminacy is explained by multiplication of quantons and is fundamental in the dynamics of the universe.

There is absolutely no fundamental difference between a quantum and its opposite (anti-quantum) in a quanton, anti-quantum forms quantons in the same way as quantum, so there is no antiparticles. *This is a contradiction with the short time antiparticle existence and it shall be further explored, perhaps in relation to the existence of 3 famillies of particles.*

Quantons are orthogonals. Then the corresponding space-time structure is euclidian, so fundamentally flat.

Theory is in accordance with special relativity. The rearranged Minkowski formula ($x^2+y^2+z^2+s^2=c^2t^2$) is a definition of an hypersphere, where the 4th dimension is not time (t) but mass (s), time is only the resulting surface of the hypersphere. Each parameter (x,y,z,s) can also be the surface of a sub-hypersphere.

According to the above special relativity, gravity is generated by the 'mass' dimension (s) that decreases space (x,y,z) for same time (t), which agrees with the slowing down because of the mass in the general relativity. Note that the general relativity is here statistically generated from a lot of quantons.

The quantons as unitary quaternion are isomorph to SU(2) Lie group. The standard model SU(3) x SU(2) x U(1) can be based on a composition of SU(2) :

- U(3) = SU(2) x SU(2) x SU(2) by replacing Gell-Mann matrix diag(1,1,-2) by diag(1,0,-1) and diag(0,1,-1) from SU(2)
- U(3) = SU(3) x U(1)
- SU(3) x SU(2) x U(1) = SU(2) x SU(2) x SU(2) x SU(2)

There is no other SU(n) group, then no other interaction, from SU(2) composition because :

- dim(U(n)) = n x n
- number of SU(2) for U(n) = dim(U(n)) / dim(SU(2)) = n x n / 3
- number of SU(2) matrices for covering the U(n) matrix ≥ n x (n-1) / 2
- n x n / 3 ≥ n x (n-1) / 2 → n = 3
- [SU(2) x … x SU(2)] = SU(n) x U(1) = U(n) is only valid for **n** = **3**
- SU(n) = [SU(2) x … x SU(2)] / SG is only valid when SG = U(1) because it is the only commutative (S)U subgroup of SU(n).

If the negative electric charge is a phase shift of $-\pi/2$ (charge -1), unit charges could be used for up quark with shift of π (charge +2) and down quark with shift of $\pi/2$ (charge +1) because $4\pi/2 = 0$. By this way, a symmetry could be established between the charge of leptons (electron -1, neutrino -2 or 0) and the one of quarks (down +1, up +2).

Conclusion

Based on the hope that Nature is simple, this article introduces a new representation of space-time structure of the universe : an hypersphere structure on a multi-dimensional space, each dimension is an energy quantum with its opposite.

There is still a long way to envolve the whole physic in one theory but this bottom-up approach, from simple principles to more complex structures, in adequation with the observed reality, is probably a good way to elaborate a simple and comprehensive theory. This intuitive approach tries to answer to a fundamental question : why has the universe an apparent 3 dimensional structure ?

To explain the universe, we didn’t need the ether, maybe we don't need a space-time either.

Puzzle :

- *expliquer*
  - *monde linéaire 3D : Fourier, référentiel commun, ...*
  - *propagation : addition, référentiel commun, paquet d'onde, …*
  - *interaction : multiplication angle pi/2*
  - *expliquer 3 familles : SU3, …*
  - *expansion de l'univers, situation à l'origine : entropie (# pi/2), plus d'intrication (degrés de liberté), ...*
- *masse*
  - *assez d'énergie pour la créer*
  - *constante par particule (s^2, dérivée première)*
  - *permet l'interaction (phase pi/2, absorbeur)*
  - *crée une position et un temps*
  - *construction des fermions et bosons (photon)*
  - *en rapport au changement d'hélicité dans le temps (notion de temps)*
  - *radioactivité implique une notion de temps*
  - *intrication, commutateur non nul, inégalité Cauchy-Schwarz ?*
- *propagation*
  - *addition, perte d'information (mais seulement probabilité)*
  - *monde statique → projection en mouvement (Fourier)*
  - *1/t*
  - *2D (surface 3D)*
  - *unitaire*
- *interaction*
  - *multiplication (de champs), conservation de l'information si nombres premiers*
  - *phénomène de résonance*
  - *valeur minimale ou constante de couplage (pas relatif à masse, ex. électron-muon mais relatif à vitesse / c ?)*
  - *ponctuel*
  - *hermitien*
  - *probabilité combinée (multiplication) → notion de temps (ordre)*
- *Math*
  - rotation par quaternion : q = cos(ɵ) + sin(ɵ).v où le vecteur v = ix + jy + kz => quq' = rotation d'un angle 2ɵ (NB : -q même effet que q)
  - *conservation norme par transformée de Fourier ?*
  - *SU(n) : transformation unimodulaire et transformation de phase*
  - *théorie renormalisable : aucune constante de couplage de dimension puissance négative de la masse*
  - *neutrino : pseudovector (vectorial product)*
  - *quaternion as exponential -> exp(exp(ix)) -> exp($-x^2$) ?*
  - *octonion -> not associative -> time*
  - *modules différents avec phase sans importance équivalent à phases différentes et module = 1 ???*
  - *reflet miroir = rotation dans dimension supplémentaire*
  - *groupe : transpositions = n! générateurs = multiplication, transpositions adjacentes = n-1 générateurs des transpositions = addition*
  - *formule Boltzman : exp(-E/t)*