Hypersphere space-time model

(draft)

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Abstract

The origin of the three spatial dimensions as well as that of time is deduced from fundamental principles (symmetry). The structure resulting from this construction looks like an hypersphere of which each energy particle constitutes a dimension, forming a loop or a string covering the whole universe. This model shall be linked to the existing theories that are in adequation with the experience.

Space

Nothing (*symmetry*) generating something (*energy*) can be expressed by the addition and the multiplication of an energy quantum (a) and its opposite ($\bar{a}$) :

$a + \bar{a} = 0$ (*symmetry*), $a\bar{a} = 1$ (*energy*) → $a = i$ and $\bar{a} = -i$ where $i^2 = -1$.

The quantum (a) is a complex number ($a = a_1+ia_2 \in \mathbb{C}$, $a_1, a_2 \in \mathbb{R}$, $i^2 = -1$) so it behaves like a wave, more precisely like the π/2 phase of a virtual (potential) standing wave. It's the same for the opposite ($\bar{a}$).

The quantum (a) and its opposite ($\bar{a}$) form a pair of complex numbers ($a,\bar{a}$). These two elements on their own dimension are linked together thanks to a new dimension : $(a) \wedge (\bar{a}) = (b)$. The vector (b) exists in a three dimensional space ($a,\bar{a},b$) that can be represented by a quaternion q

$q = s + (b) = s + ix + jy + kz$ where $s, x, y, z \in \mathbb{R}$, $i^2=j^2=k^2=ijk=-1$, $(b) = (x,y,z)$

more precisely by a vectorial quaternion where s = 0. The quaternion is a piece of momentum, a piece of energy. Energy conservation imply that the result of the operation on two pairs of quanta shall not be null, which is in adequation with the quaternionic multiplication. So a fundamental element can be represented by a quaternion, it's the Hamilton's dream.

Considering that the universe is made of such fundamental energy elements, energy conservation implies a constant (finite) number of such elements or else an homogeneity that means that all elements are identical or even both constant number and homogeneity. Homogeneity seems to be a principle and it will be supposed. The easiest way to explain homogeneity is to have only one element that interacts with itself in several ways but this extreme hypothesis will require further study. Homogeneity means that unitary quaternions can be used for all elements : $||q||^2 = q\bar{q} = s^2+x^2+y^2+z^2 = 1$, where $||q||$ is the norm and $\bar{q} = s -ix -jy -kz$ is the conjugate of (q).

Each fundamental energy element has - or "is" because there is no other characteristic - its own three dimensional (3D) space, perfectly in accordance with the special relativity. Independancy of elements means that they are orthogonal. Each element is on its own dimension, forming an hypersphere of 3D spaces, an hypersphere of quaternions.

Orthogonality can be defined by $||q+q'||^2 = ||q||^2+||q'||^2$, so using the bra-ket notation ($\langle q|q'\rangle = q\bar{q}'$) :

$\langle q+q'|q+q'\rangle = \langle q|q\rangle + \langle q|q'\rangle + \langle q'|q\rangle + \langle q'|q'\rangle = \langle q|q\rangle + \langle q'|q'\rangle \rightarrow \langle q|q'\rangle+\langle q'|q\rangle = 0$

Mass

In a first approach, mass existence could be linked to a non negative value of s in the quaternion, the norm forming the Minkowski's formula $s^2+x^2+y^2+z^2 = c^2t^2$. Unfortunately, there is up to now only vectorial quaternions (s = 0). The work of Dirac shows that a biquaternion (s, x, y, z $\in \mathbb{C}$ instead of $\mathbb{R}$) can be a solution of his equations. BEH (Higgs) boson shows that the mass is an external behaviour to the particle. Mass is constant but is spread in three families, according to some fixed relationship by rotation (see CKM and PMNS matrices, but also Weinberg's angle). It's a lot of different things that shall match.

- énergie
  - moment = addition ?, énergie = multiplication
  - conservation du moment (d/dx=0) -> phase varie mais pas amplitude (norme)
- quaternion
  - division de vecteur, bivecteur de Pauli,
  - bra-ket = division, non associatif, indiscernable
  - moment (vecteur)
  - propagation (Minkowski, unitarité A -> $U^{-1}AU$)
  - SU2 -> SU3 via SU2xSU2xSU2=U3 ou SO3
- masse
  - biquaternion (s, iv), sans inverse, i^4 -> 1 (chapeau mexicain)
  - variable en théorie mais constante en pratique(aléatoire ? seule réaction possible ?)
  - brisure de symétrie -> probabilités asymétriques (pas 1/2)
- interaction
  - constante de structure (./. vitesses)
- NB :
  - se baser sur c et h constants
  - imprécision/indétermination augmente avec le temps
  - exclusion de Pauli agrandit univers
  - projecteur $E^2=E$ -> E=0 ou 1
  - double converture SO3 par SU2 -> spin
  - boson virtuel si distance inférieure à fréquence
  - Lagrangien = onde car échange de valeurs cos/sin
  - où est la propriété de quantité de masse (interaction Higgs) ?
  - gravitation = rotation cône de lumière
  - interaction = brisure symétrie, de phase, d'onde stationnaire
  - intrication = pas orthogonal, dépendance linéaire
  - énergie empruntée dexdt à cause onde et déphasage
  - const cosmologique : force croit avec distance
  - temps et probabilité liés (improbable si temps court), temps flou, augmente entropie

Time

Mass and space generate time.

Interaction

Each element has its own 3D space but there is apparently a common 3D space. This common space is a space of interactions. An interaction is a 3D space-time relation between particles, they share the same 3D space-time, they project themselves. We can image different common spaces, a bit like multiple universes, but there is restrictions.

A particle can be seen as a relatively stable 3D relation between a set of fundamental elements, they are at the same position.

Projection -> only eigenvector/eigenvalue. How when ?

Entanglement has an obvious solution here. The entangled particles share the same 3D space but are outside the "common" (our) 3D space. They propagate in their own 3D space but during interaction, their space combines with the common one, which can randomly be done in several different ways.

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 forming a quaternion covering the whole universe. The implications of this hypothesis are vast and go far beyond this short article.

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 three dimensional structure in addition of time, which is far from an evidence ?

Whether the theory is correct or not, it seems increasingly clear that the space-time is not a fundamental structure, it’s the consequence of the interaction between particles. That’s why calculations based on common space-time can become unstable.To explain the universe, the ether is not necessary and perhaps not a common space-time either.