This document proposes a mechanism describing the expansion of the universe.

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Chapter III

The first chapter has analyzed the dispersion relation of light in vacuum with the binoculars of the theory of deformed cross products. The second one has discovered a mathematical link between the solutions of the (E) question and the Bowen-York solutions for the initial data problem. This third part justifies a new cosmology in harmony with the current visualizations of our universe.

1.1 The Hubble law.

1.1.1 Context.

Nowaday:

1. the exact nature of the seemingly empty regions of the universe remains a mystery (nothing, perfect fluid, bosonic fluid, etc.);

2. perhaps as consequence of former point, the energy contained in these regions is unknown and its estimation is the center of a dispute;

3. the universe is supposed to have no extern frontier;

4. the value of the Hubble constant is currently giving rise to a deep discussion about the diverse methods measuring the distances between the Earth and diverse galactical objects;

5. nobody knows why the structural background of the universe is expanding;
1.1.2 The Hubble law.

In cosmology, galaxies give the sensation to escape at a speed which is proportional to the distance separating them from the observer:

\[ (3) v = H \cdot (3) x \]

The coefficient of proportionality is known as the Hubble constant, $H$.

1.1.3 Metaphysics.

Since we can accept the intuitive idea that any reality occurs in a three-dimensional space at a given instant of some chronology, we can also imagine that all objects in the universe -(i) connected or not by some rule of causality and (ii) inclusively myself (or yourself)- always are living, propagating, moving, whatever they are doing ... at the most recent given instant $t$ of my (or of your) chronology. With different words, nothing is living in the past or in the future. Everything is living here and now. *Before* does no more exist and *after* does not yet exist.

Accepting for a while the Big-Bang theory, it is impossible to stay outside of the universe (there is only one and there is no outside); but, because of point 5, we may imagine that the supposedly unique event at the origin of our cosmology has generated a wave and that its front, a surface $\Lambda$, is expanding in following, more or less, a Hubble-like law. Following the metaphysical consideration of prior paragraph, we stay somewhere on this surface. We may sometimes rebuild the chain of causalities going from the birth of the universe until here and now. We can at best guess what happens next.

Let now recall the considerations which have been developed in the first chapter. If the initial event is presumably a kind of light, the coefficients of degree one of the surface which can be associated with its dispersion must be such that:

\[ d^* = -3 |A| \cdot \alpha \cdot s = 6i \cdot |A| \cdot \alpha \cdot \frac{E}{E_0} \cdot \frac{H}{c^2} \cdot x \]
With different words, the singular vector of the polynomial is also proportional to the position.

\[ s = -2i \cdot \frac{E}{E_0} \cdot \frac{H}{c^2} \cdot \mathbf{x} \]

1.1.4 Two technical problems.

This approach gives rise to at least two technical problems:

- We ignore if a (and which) real physical situation can be associated with a relation like:
  \[ s \sim x \]

- A pure imaginary energy appears in that speculative discussion.

1.1.5 Their solutions.

- Concerning the first problem, let consider my demonstration proving the link between the Bowen-York solution for the initial data problem and the non-trivial decomposition of any classical cross product. Recall that that demonstration starts with a coincidence between the \( d^* \) vector and a classical gravitational field (Newton):
  \[ d^* = -\frac{G \cdot M}{r^3} \cdot \mathbf{x} \]

  Accepting that hypothesis is equivalent to say that the coefficients of degree one of the surface \( \Lambda \) always coincide with the local spatial newtonian gravitational field. With this hypothesis, we get exactly:
  \[ s = x \]

  and the confrontation with the consequence resulting from the analysis of the dispersion relation imposes:
  \[ 1 = -2i \cdot \frac{E}{E_0} \cdot \frac{H}{c^2} \]
Concerning the second problem, let recall that the concept of imaginary energies appears within the quantum theory when provisory (synonym: unstable) energetic states are envisaged (e.g.: Lamb-Rutherford effects [Cohen-Tanoudji]). We shall suppose that any effective energy $E$ is an unstable representation of the photon with proper energy $E_0$ and write:

$$E = -i \cdot \kappa \cdot E_0, \quad \kappa = \frac{c^2}{2} \cdot \frac{1}{H}$$

The comparaison between both expressions for $d^*$ imposes:

$$-\frac{G \cdot M}{r^3} = 6 \cdot |A| \cdot \alpha \cdot \kappa \cdot \frac{H}{c^2}$$

Since the discussion concerns only what happens at the border of the universe (here and now), we shall consider the effect of the source $M$ as equivalent to the one of an averaged volumetric density of matter roughly occupying a sphere (with radius $r$) and write:

$$-\frac{4 \cdot \pi \cdot G \cdot \rho}{3} = 6 \cdot |A| \cdot \alpha \cdot \kappa \cdot \frac{H}{c^2}$$

Since very classical calculations should bring:

$$H = \frac{8 \cdot \pi \cdot G \cdot \rho}{3 \cdot c^2}$$

We have:

$$-\frac{4 \cdot \pi \cdot G \cdot \rho}{3} = 6 \cdot |A| \cdot \alpha \cdot \kappa \cdot \frac{1}{c^2} \cdot \frac{8 \cdot \pi \cdot G \cdot \rho}{3 \cdot c^2}$$

Up to a minus sign, the coefficient $\alpha$ is (i) entirely determined and (ii) proportional to the actual value of Hubble constant:

$$\alpha = -|A| \cdot \frac{c^2}{6} \cdot H, \quad |A| = \pm 1$$

In our classical Euclidean geometry $|A| = -1$:

$$\alpha = \frac{4 \cdot \pi \cdot G}{9} \cdot \rho = (\eta^0)^2 - 1 \Rightarrow (\eta^0)^2 = 1 + \frac{4 \cdot \pi \cdot G}{9} \cdot \rho$$
The first chapter could convince us that this situation is related to (i) a Euler’s parametrization and (ii) a deformed cross product $[a, ...][A]$:

$$|[a, ...][A]| >$$

$$= |A|.\{-\} \cdot \{\alpha . |Id_3 + \frac{1}{1 + \alpha} . T_2(\otimes)(x, x) + [J]\Phi(x)\}.|... > + ...$$

In our vicinity, this cross product seems to be a classical one ($[A] = [J], |A| = -1$):

$$a \wedge ...$$

$$= \{\alpha . |Id_3 + \frac{1}{1 + \alpha} . T_2(\otimes)(x, x) + [J]\Phi(x)\}.|... >$$

As explained in chapter II, this result is coherent with the existence of a deformed angular momentum $[a = x, p][A]$ the argument $p$ of which being related to a Bowen-York solution for the initial data problem.

1.1.6 **New cosmological proposition.**

*As logical consequence, we suspect that the giant voids which have been observed in the universe are huge black holes at the surface of which the matter is emergent.*
1.2 Bibliography

1.2.1 Personal works
