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Mathematical theory about the possibility of creation of universe at 1, 2 or 3 dimensions

This paper is a revision of the same paper written by the author on the 29th of September 2010. It exists in French and English.

In this paper, it is taken into account the hypothesis that the total energy of the universe is equal to zero. Consequently, it is determined the possibilities of creation of:

- fictive universes (at 1 or 2 dimensions) (§2 and 3),
- or real universe (at 3 dimensions) (§4.1 to 4.4),
- or "local universes" inside our universe (§4.5).

CONTENT

1. Basic hypothesis

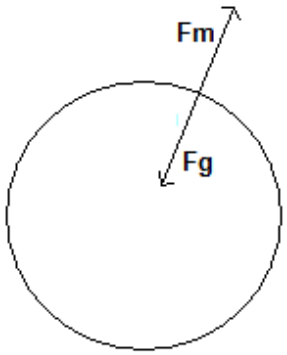
The main hypothesis consists to suppose that the sum of the different energies of the universe is equal to zero ($\Sigma E=0$).
This hypothesis seems logical as an isolated positive or negative energy has no physical meaning, the energy not being able to appear ex nihilo.

Il will be supposed that the thermodynamic characteristics of the created material are the ones which correspond to the absolute zero temperature, consequently the internal energy, the enthalpy and the entropy will be equal to 0. It is not supposed that this universe is moving so its kinetic energy is initially equal to zero.
These hypotheses implicate to assert the equation $Eg+Em=0$ with:

- Eg : gravitational energy of the universe ($Eg<0$, <0 because received by the material)
- Em : material energy of this universe ($Em>0$, >0 because supplied by the material)

In a general way, it is supposed that all the stages of evolution (from the absence of material to any material mass) being balanced (relatively to energy) are possible. It is not described the way to start the universe formation and the kinetics of formation. It is not, either, described the way to initially size the universe (its radius or its density).
Once created, the universe is « released » and submitted to irreversible natural transformations. For example, it is going to be compressed and consequently be heated, a part of the material energy (mc^2) being going to be transformed in internal energy (thermodynamically speaking). So a part of the gravitational potential energy is going to be transformed in kinetic energy, etc...But globally, the sum of energies will remain equal to zero.

The material is considered as spontaneously created. By supposing a 3 dimensions space, the material, thanks to its initial energy (mc^2) pushes towards the exterior and produces a force (Fm on the diagram below) which is necessary to counterbalance the gravitational force (Fg on the diagram below). Fm and Fg are tangent to the sphere in any point of this one (only one point of the sphere is shown on the diagram below, to simplify).
As one starts from the nothingness, there is no material around the created material and, consequently, nothing to prevent to reach any density.



By agreement, the material energy which is supplied by the material is positive (so Fm is positive) and the gravitational energy which is received by the material is negative (so Fg is negative).).
Note : Fg can be different from 0 at the beginning of the material creation.

This system can be compared to a balloon (with rubber skin):

- the energy generated by the pressure in the balloon is equivalent to the material energy (mc^2). It produces a force turned towards the exterior (positive because it is the air which produces the force),
- the energy generated by the distortion of the rubber skin is equal and opposed to the pressure energy. It is equivalent to the gravitational energy. It produces a force (Fm) turned towards the interior (negative because the air receives the force).

As the forces are balanced the system is stable.

2. Creation of a one dimension universe (a line)

2.1 Calculation of the gravitational energy of this universe (Eg)

The force exerted between two masses m1 and m2 is equal to $Fg=-G\ m1\ m2 / R^2$ with:
G : constant of the Newton's law of gravitation (6.67 E-11 IS (International System)),
R : distance between the 2 masses
m1 : mass 1
m2 : mass 2

It is supposed that this universe, being of dimension 1, is distributed on a line of lineic mass σ in kg/m.

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       R       dR
---------------|---|
       M       dM
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Let's suppose that this universe has a length R and a mass σ R.
Let's suppose that it has increased by dR and dM.
$dFg = - G\ dM\ M / R^2 = - G\ \sigma\ ((R+dR) – R)\ \sigma\ R / R^2$
➔ $dFg = - G\ \sigma^2\ dR / R$
➔ $Fg = \int(0 \text{ to } R) - G\ \sigma^2\ dR / R = G\ \sigma^2\ Ln(R)$
$dEg = dFg\ R = - G\ \sigma^2\ dR$
➔ $Eg = \int(0 \text{ to } R) - G\ \sigma^2\ dR = G\ R\ \sigma^2$
With $M=\sigma\ R$ and hence $\sigma=M/R$, it will be obtained $Eg = - G\ M^2 / R$

2.2 Calculation of the material energy of this universe (Em)

$Em = M\ C^2 = \sigma\ R\ C^2$
with C : light velocity

2.3 Application of the basic hypothesis (Eg+Em=0)

$Eg + Em = 0$ ➔ $(- G\ M^2 / R) + (M\ C^2) = 0$
➔ $C^2 = G\ M / R$ and $M = C^2\ R / G$

By replacing M in Eg, it will be obtained :
$Eg = - C^4\ R / G$

By replacing σ by M/R then M in Fg, it will be obtained :
$Fg = - C^4\ Ln(R) / G$

2.4 Possibility of creation of this universe, from the nothingness

Ln(R) aims towards $-\infty$ when R aims towards 0. So Fg aims towards $+\infty$ when R aims towards 0. As Fg is positive, it is not possible to create a stable universe.

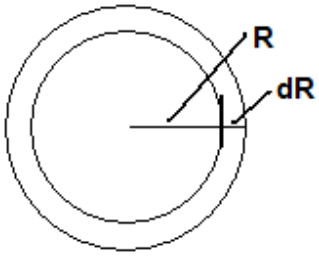
3. Creation of a two dimensions universe (a surface)

3.1 Calculation of the gravitational energy of this universe (Eg)

The force exerted between two masses m1 and m2 is equal to $Fg=-G\ m1\ m2 / R^2$ with :
G : constant of the Newton's law of gravitation (6.67 E-11 IS),
R : distance between the 2 masses
m1 : mass 1
m2 : mass 2

It is supposed that this universe, being of dimension 2, is distributed on a plan of surfacic mass σ in kg/m^2.

Let's suppose that this universe, in circle shape, has a radius R and a mass $\pi\ \sigma\ R^2$.



Let's suppose that it has increased by dR and dM.
$dFg = - G\ dM\ M / R^2 = - G\ \sigma\ \pi\ ((R+dR)^2 - R^2)\ \sigma\ \pi\ R^2 / R^2$
➔ $dFg = - G\ \sigma^2\ \pi^2\ 2\ R\ dR$
➔ $Fg = \int(0 \text{ to } R) - G\ \sigma^2\ \pi^2\ 2\ R\ dR = - G\ \sigma^2\ \pi^2\ R^2$
$dEg = dFg\ R = - G\ \sigma^2\ \pi^2\ 2\ R^2\ dR$
➔ $Eg = \int(0 \text{ to } R) - G\ \sigma^2\ \pi^2\ 2\ R^2\ dR = - G\ \sigma^2\ \pi^2\ 2\ R^3 / 3$
With $M=\sigma\ \pi\ R^2$ and hence $\sigma=M/(\pi\ R^2)$, it will be obtained : $Eg = - 2\ G\ M^2 / (3\ R)$

3.2 Calculation of the material energy of this universe (Em)

$Em = M\ C^2 = \sigma\ \pi\ R^2\ C^2$
with C : light velocity

3.3 Application of the basic hypothesis (Eg+Em=0)

$Eg + Em = 0$ ➔ $(- 2\ G\ M^2 / (3\ R)) + (M\ C^2) = 0$
➔ $C^2 = 2\ G\ M / (3\ R)$ and $M = 3\ C^2\ R / (2\ G)$

By replacing M in Eg, it will be obtained :
$Eg = - 3\ C^4\ R / (2\ G)$
By replacing σ by $M/(\pi\ R^2)$ then M in Fg, it will be obtained :
$Fg = - 9\ C^4 / (4\ G)$

3.4 Possibility of creation of this universe, from the nothingness

The Fg force being a negative constant, it is possible to create a stable universe.

Note 1

$M = 3\ C^2\ R / (2\ G) \rightarrow M/R = 3\ C^2 / (2\ G) = K$ (constant)

Now $M=\pi\ \sigma\ R^2 \rightarrow M/R = (\pi\ \sigma\ R^2)/R = K \rightarrow \pi\ \sigma\ R = K \rightarrow \sigma = K / (\pi\ R)$

So σ and R are directly linked.

Note 2

It is obvious that this universe cannot be created from a dimension 2 universe (it can't "auto-create" itself). It can, however, be created from a universe of superior dimension (3 for example). However, the created universe would not be visible from the generator universe. As said in 1), it is not described how to size this universe (by R or by σ). By supposing to know how to create this universe but without controlling its size, as the probability distribution relative to the size would be uniform (R from 0 and $+\infty$), consequently the probability to, randomly, create a universe which size would be between two finite bounds, would be infinitely weak.

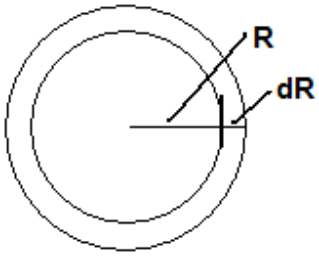
4. Creation of a three dimensions universe (a volume as our universe)

4.1 Calculation of the gravitational energy of this universe (Eg)

The force exerted between two masses m1 and m2 is equal to $Fg=-G\ m1\ m2 / R^2$ with :
G : constant of the Newton's law of gravitation (6.67 E-11 IS),
R : distance between the 2 masses
m1 : mass 1
m2 : mass 2

It is supposed that this universe, being of dimension 3, is distributed on a plan of volumic mass σ in kg/m^3.

Let's suppose that this universe, in ball shape, has a radius R and a mass $(4/3)\ \pi\ \sigma\ R^3$.



Let's suppose that it has increased by dR and dM.
$dFg = - G\ dM\ M / R^2 = - G\ \sigma\ \pi\ (4/3)\ ((R+dR)^3 - R^3)\ (4/3)\ \sigma\ \pi\ R^3 / R^2$
➔ $dFg = - (16/3)\ G\ \sigma^2\ \pi^2\ R^3\ dR$
➔ $Fg = \int(0\ to\ R) - (16/3)\ G\ \sigma^2\ \pi^2\ R^3\ dR = - (4/3)\ G\ \sigma^2\ \pi^2\ R^4$
$dEg = dFg\ R = - (16/3)\ G\ \sigma^2\ \pi^2\ R^4\ dR$
➔ $Eg = \int(0\ to\ R) - (16/3)\ G\ \sigma^2\ \pi^2\ R^4\ dR = - (16/15)\ G\ \sigma^2\ \pi^2\ R^5$
With $M= (4/3)\ \sigma\ \pi\ R^3$ and hence $\sigma=M/((4/3)\ \pi\ R^3)$, it will be obtained:
$Fg = - 3\ G\ M^2 / (4\ R^2)$ and $Eg = - 3\ G\ M^2 / (5\ R)$

4.2 Calculation of the material energy of this universe (Em)

$Em = M\ C^2 = (4/3)\ \sigma\ \pi\ R^3\ C^2$
with C : light velocity

4.3 Application of the basic hypothesis (Eg+Em=0)

$Eg + Em = 0$ ➔ $(- 3\ G\ M^2 / (5\ R)) + (M\ C^2) = 0$
➔ $C^2 = 3\ G\ M / (5\ R)$ and $M = 5\ C^2\ R / (3\ G)$
For example, for a radius of 1 m (diameter of 2 m), the mass would be equal to:
$M=5*(3^E8)^{2}*1/ (3*6.67^E-11)=2.25$ E27 kg, so the density is very big.

By replacing M in Eg, it will be obtained :
$Eg = - 5\ C^4\ R / (3\ G)$

By replacing σ by $M/((4/3)\ \pi\ R^3)$ then M in Fg, it will be obtained :
$Fg = - 25\ C^4 / (12\ G)$) $(=-25*(3^E8)^{4} / (12*6.67^E-11)=2.53$ E44 N)

4.4 Possibility of creation of this universe, from the nothingness

The Fg force being a negative constant, it is possible to create a stable universe.

Note 1
$M = 5\ C^2\ R / (3\ G) \rightarrow M/R = 5\ C^2 / (3\ G) = K$ (constant)
Now $M=(4/3)\ \sigma\ \pi\ R^3 \rightarrow M/R = (4/3)\ (\pi\ \sigma\ R^3)/R = K \rightarrow (4/3)\ \pi\ \sigma\ R^2 = K$
$\rightarrow \sigma = K / ((4/3)\ \pi\ R^2)$
So the smaller is R, the greater is σ.

Hypothesis 1 : let's suppose the mass of the electron (9.11×10-31 kg).
Then R=9.11×10-31/ 2.25 E27=4.05 E-58 m
The density σ is equal to 2.25 E27 / ((4/3) π (4.05 E-58)^2) = 3.27 E141 kg/m^3 (extremely concentrated « material »)

Hypothesis 2 : let's suppose a mass of 1 kg.
Then R=1/2.25 E27=4.44 E-28 m
The density σ is equal to 2.25 E27 / ((4/3) π (4.44 E-28)^2) = 2.72 E81 kg/m^3 (still extremely concentrated « material »)

Hypothesis 3 : let's suppose the mass of the Earth (i.e. 5.97 E24 kg).
Then R=5.97 E24 /2.25 E27=2.65 E-3 m (so a diameter of about 5 mm)
The density σ is equal to 2.25 E27 / ((4/3) π (2.65 E-3)^2) = 7.6 E31 kg/m^3 (still extremely concentrated « material »)

Hypothesis 4 : let's suppose the mass of the Sun (i.e. 2 E30 kg).
Then R=2 E30/2.25 E27=889 m
The density σ is equal to 2.25 E27 / ((4/3) π (889)^2) = 6.8 E20 kg/m^3 (still extremely concentrated « material »)

Hypothesis 5: let's suppose the estimated mass of the universe of 2,8×10^{52} kg.
As K = 5*(3^{E}8) ^{2}/ (3*6.67^E-11)= 2.25 E27, then R=2,8×10^{52}/ 2.25 E27=1.24 E25 m (1.3 billion of light-years).
The initial density before expansion σ was equal to:
2.25 E27 / ((4/3) π 1.24 E25^2) = 3.5 E-24 kg/m^3

Note 2
It is obvious that this universe cannot be created from a dimension 2 universe (it can't "auto-create" itself). It can, however, be created from a universe of superior dimension (4 for example). However, the created universe would not be visible from the generator universe. From a two dimension universe, it is not physically possible to create a universe having more dimensions than the universe of departure.
As said in 1), it is not described how to size this universe (by R or by σ). By supposing to know how to create this universe but without controlling its size, as the probability distribution relative to the size would be uniform (R from 0 and +∞), consequently the

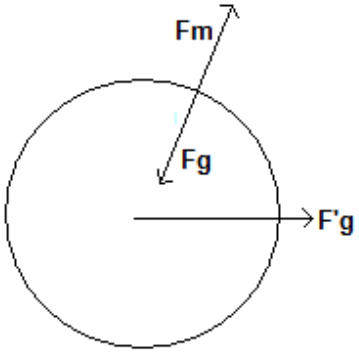
probability to, randomly, create a universe which size would be between two finite bounds, would be infinitely weak.

4.5 Creation of "local universes" inside our universe

Agreement: here the word "universe" used alone refers to our real universe and "local universe" refers to the created material.

It is obvious that it is not possible to create a dimension 3 universe starting from the nothingness, from our universe.
On the other hand, it would be possible to create a given mass of material M (so a sort a "local universe") by supplying an energy Ee (E exterior). As the creation of this material will go along, it will be submitted to its own gravitational force Fg but also to the residual gravitational force Fg' exerted by the universe at this place (positive because supplied by the material) :
$Fg' = G M m / d^2 = K M$, with M the mass of material created and $K = G m / d^2$ which represents a constant relative to the universe attraction at the place where the material M is created. K is the acceleration exerted locally by the universe on all the material created at a given location. The F'g force is supposed to exert in only one direction.
So $Fg' = K (4/3) (\pi \sigma R^3)$), with R the radius of the created mass.

As done in the §4.1, let's suppose that the created material has increased by dR and dM. The increment of gravitational force dFg' exerted by the universe on the created material is equal to :
$dFg' = K (4/3) (\pi \sigma) ((R+dR)^3 - R^3) = K (4/3) (\pi \sigma) 3 R^2 dR = K 4 (\pi \sigma) R^2 dR$
The increment of own gravitational force dFg of the created material is equal to :
$dFg = - (16/3) G \sigma^2 \pi^2 R^3 dR$ (refer to §4.1)



The increment of gravitational energy supplied by the created material is equal to:
dEg = dFg R
But this initial dEg is decreased by the energy supplied to the universe by the new mass of material.
So the modified dEg (dEgm) is worth:
dEgm = (dFg-dFg') R = dFg . R - dFg' . R = dEg – dEg'

$Eg = \int(0 \text{ to } R)\, dFg \,.\, R = -(16/15)\, G\, \sigma^2\, \pi^2\, R^5 = -3\, G\, M^2 / (5\, R)$ (refer to §4.1)
$-Eg' = \int(0 \text{ to } R)\, dFg' \,.\, R = \int(0 \text{ to } R)\, K\, 4\, (\pi\, \sigma)\, R^3\, dR = K\, (\pi\, \sigma)\, R^4\, dR$
$= K\, (\pi\, \sigma)\, M\, R^4 / (4/3\, \pi\, \sigma\, R^3) = (3\, K\, R\, M) / 4 = K'\, R\, M$ with $K'=3K/4$
➔ $Egm = Eg - Eg' = -3\, G\, M^2 / (5\, R) + K'\, R\, M$

The $-Eg'=K'\, R\, M$ part represents the factor of influence of the universe on the mass M of radius R at the selected place. This term is positive because the universe attracts the created mass towards the exterior of this one.

The energy supplied (>0) by the created material will be Em-Eg'
And the energy received (<0) by the material will be Eg+Ee.
So, the equilibrium equation will be :
Em+Eg-Eg'+Ee=0
$M\, C^2 - 3\, G\, M^2 / (5\, R) + K'\, R\, M + Ee = 0$
By definition Em+Eg=0, so -Eg'+Ee=0 or Ee=Eg'
➔ Ee=-K' R M, so $M\, R = -Ee / K'$ with –Ee which is positive.

The quantity of mass created multiplied by the sphere radius will depend of the factor K' which will be the weakest possible (with K'=3K/4 and K the local acceleration of the universe on the created material).

Note: on our planet, in the present conditions of material creation, it can be considered that the term Eg can be neglected because once created a bit of material, the density of this material is going to balance with the one of the environment, as it is not possible to keep it extremely concentrated (as the one obtained starting from the nothingness). The term Eg' will be also negligible in front of Em so : Em+Ee=0
So it is necessary that $Ee = -M\, C^2$. To create material, it must be supplied the entire energy necessary to the formation of this material. It is the maximum energy.
It is reminded that starting from the nothingness, Ee=0 (by hypothesis Em+Eg=0, with no Eg' term).

Let's suppose that in the future, it can be possible to concentrate a given quantity of material (let's say 1 kg) isolated in a field (magnetic or other) to such a density that Em+Eg=0, so σ = 2.72 E81 kg/m3 (from §4.4).
So we have at our disposal a small local universe. From this equilibrium state, to make grow this universe, it will be enough to supply a given quantity of energy Ee = - K' R M. The created mass M will be much more important that if it would be necessary to supply $Ee = -M\, C^2$

This means that to create a mass M (of radius R), it will be needed much less energy because $|-K'\, R\, M| << |-M\, C^2|$ or in other words if $K'\, R << C^2$
So it is a sort of controlled amplification of material generation.

In conclusion, it would be possible to create "local universes", in a controlled way, with relatively few energy (but without any possibility to create a new universe from the nothingness).

Example

On Earth, it can be considered that the universe influence can be sum up by the sole influence of the Earth gravity, so K=9.81 m/s^2 and K'=7.36 m/s^2. R=4.44 E-28 m so Ee=K' R M = 3 .26 E-27 (Joules) to compare to Ee = M C^2 = 9 E16 Joules.