Dark energy (Appendix 7)

For many experts, the more universe is less dense and more a repulsive gravity of dark energy, outweighs the gravity has the attractive gravitational energy; all the contributions of dark energy because contraction super clusters of galaxies in the observable universe is greater than gravitational energy of the observable Universe, this report (for the observable Universe) has already been calculated in my article:

darkenergy2.htm (Appendix 1),

This report was worth N where N is the ratio of the radius of the observable Universe to that of the radius of a super cluster of galaxies means:

$N = r / (XR)$ (equation 1),

must be considered a super clusters of contracts means that $r = XR$,

XR is the radius at the beginning of the contraction of the super galaxy clusters and R is the radius after a final contraction super clusters of galaxies.

(Dark energy overall) / [(GM) / r] = N, (Equation 2),

(Dark energy overall) = [(GM) / r] N, (Equation 3),

$r / (XR) = N$, (Equation 1),

r for the radius of the observable Universe,

XR for the average radius of a super cluster of galaxies, R for the mean radius possessed by the super clusters of galaxies, after the

contraction of the super clusters of galaxies will be complete. M for the mass of the observable Universe.

According to Equation 1 and Equation 3, we have:

(GM) / (XR) = (total dark energy), (Equation 4),

We can consider dark energy per unit length overall and unit mass by dividing by the radius r of the observable universe, it gives:

[(GM) / [r (XR)] = (total dark energy per unit mass and per unit length), (Eq. 5),

I added last expression per unit mass for convenience.

If the rate of increase of the radius r of the observable universe increases as the rate of decrease of the radius XR using a super clusters galaxies decreases, while under these conditions, the dark energy by global unit mass and per unit length is constant and can be associate with the cosmological constant, which gives us:

[(GM) / [r (XR)] = (cosmological constant),

X can be eliminated in the following way:

r_m is the mean radius of a super cluster of galaxies, then:

$X = (r_m) / R$, where R is the mean radius contraction after the end of a super clusters of galaxies through, then the equation of the cosmological constant becomes:

$[(GM) / [r (r_m)] = $ (cosmological constant), (eq. 6),

(If the rate of increase r increases as the rate of decrease r_m

decreases), (eq.6) is for the observable Universe, of course.

In fact, even if the average radius of r_m super clusters of galaxies seem not decrease much, are rates of decline may be very low, in fact it may be as low as the rate of growth of the radius of the observable universe is about (a light year) / (13.7 billion light years) per year, including:

(Growth rate) $= 1 / [(13.7)(10)^9]$ a year,

(About for the radius of the observable Universe), (eq.7),

which is very low, then the rate of decrease of a mean radius a super cluster of galaxies, can be as low, so that the cosmological constant remains constant or dark energy (dark) Global observable universe per unit mass and per unit length remains constant under these conditions.

However for the observable universe for the universe overall, it is change the total mass M and radius r of the observable Universe, write M_u for total mass of the universe and overall r_u for the radius of the universe, the equation of the cosmological constant becomes:

$[(GM_u) / [(r_u)(r_m)] = $ (cosmological constant of the Universe), (Eq.8)

constant if and only if (r_u) does not increase faster than decreased (R_m).

I notice that this equation has the form of an acceleration, in fact either:

$N\_u = (r\_u) / (r\_m)$, then:

$r\_m = (r\_u) / (N\_u)$ and the equation of the cosmological constant in the universe becomes:

$(N_u) [(GM_u)]/[(r_u)(r_u)] = $ (cosmological constant of the Universe)

$(N_u) [(GM_u) / (r_u)^2] = $ (cosmological constant of the Universe) (equation 9a),

$(N_o) [(GM_o) / (r_o)^2] = $ (cosmological constant of the observable Universe) (equation 9b)

(N_o), (M_o), (r_o) are detailed a little further;

We can compare the gravitational acceleration of repulsion and contraction, it

is consistent with the law of action and reaction of Newton, proceed in the following way:

r_o to be the radius of the observable Universe and N_o for the report $(r\_o) / (r\_m)$

A_r is the gravitational acceleration of repulsion of the observable Universe,

A_c is gravitational acceleration of contraction of the observable Universe,

M_o be for the mass of the observable Universe,

then the sum of gravitational acceleration of repulsion of the observable Universe compared to the gravitational acceleration of contraction of the observable Universe is: (There is an easier demonstration a step further, after equation 10b)

$A\_r = [(N\_o)^3] [G (M\_o) / (N\_o)^3]/[(r\_o)^2 / (N\_o)^2]$,

$A\_r = [G (M\_o) / (r\_o)^2] (N\_o)^2$,

$A\_r = [A\_c] \{(N\_o)^2\}$, (Equation 10a),

$(A\_r) / (A\_c) = \{(N\_o)^2\} = [(r\_o) / (r\_m)]^2$, (Equation 10b)

this proof is easier if we consider that:

A_C = GM / $[(r\_o)^2]$ = {4 (pi) L / 3} d (r_o) (equation 10c)

$A\_r = [(N\_o)^3]$ [4 {(pi) G / d {3} (r_o) / (N_o)}]

$A\_r = [(N\_o)^2]$ (A_c), which leads to Equation 10b,

A_ur to be repulsive gravitational acceleration of the Universe and gravitational acceleration A_uc to contraction of the universe, then:

$[(A\_ur) / (A\_uc)] = (N\_u)^2 = [(r\_u) / (r\_m)]^2$, (Equation 11),

Here is the gravitational repulsion compared to the gravitational contraction,

finally we can verify this equation for the observable Universe, since according to equation 11 for the observable universe, we have:

the square ratio of the radius of the observable Universe to that of the radius of a super cluster medium is equal the ratio to the repulsive gravitational acceleration of the acceleration gravitational contraction, we know this report, as the radius of the observable universe r is about 13.7 billion light years and approximately that of a super cluster of galaxies is approximately .5 billion light years, then:

$[(13.7) / (.5)]^2$ = 750.76 or about 751.

As A_C = {4 (pi)G / 3} d (r_o), where d is the density of the observable universe, let the density of baryonic matter given by Wikipedia (December 26, 2011) estimated a 4.5% density is critical (9.24) $(10)^{-27}$, it gives d = (4,158) $(10)^{-28}$ kg per cubic meter, we have:

A_r = 751 [{4 (pi) G / 3} d (r_o)]

A_r = 751 [(1.50613) $(10)^{-11}$] meter per second squared,

A_r = [(1,131) $(10)^{-8}$] meter per second squared,

but here I have considered that the baryonic matter, but there is material that has not been detected, even considering that galaxies are composed primarily of baryonic matter, there may be a significant amount of material which was not detected between the galaxies and between clusters of galaxies and between super clusters of galaxies, some call it dark matter, this matter has not been still detect, the true density is very difficult to estimate, it will likely revise the estimate of the true density of matter, as it will likely also revise the estimated average radius of a super cluster of galaxies, so this is an example here.