Big bang model with surprising results.

Chapter 1, the contraction of matter prior to the big bang

The Friedmann equation: $H^2 = ((dR/dt)/R)^2 = (8/3).\pi.G.\rho - k.c^2.R^{-2}.(E_{mat} - E_{vac})/(E_0)$

I have always thought that quantum mechanics works from the wrong postulate of E = h.f and that came from the idea that a rest mass particle could not be a wave, but produces a wave as soon as the particle starts moving in space (in vacuum energy). The particle then follows the path of the wave as soon as it starts moving. The path of the wave can then be affected by charge.
There is then no: E = h.f but p.c = h.f. There are several arguments for this statement, which I mentioned in another article. This has consequences for the dilution law of relativistic matter and non-relativistic matter with regard to the density.
Here I am going to talk about a big bang model that meets all the objections that apply to the current model (flatness, horizon problem, the big bang would be a point expansion of a finite amount of vacuum energy with an order of magnitude of 10^{68} J).
I start from the Friedmann equation in which the density ρ and the Gaussian curvature k play a major role. The mass density ρ is given a positive sign: positive for matter and also positive for vacuum energy (via $E = m.c^2$). However, the vacuum energy density ensures the expansion and the material density for the contraction. This is expressed by the second term in the Friedmann equation: $-k.(E_{mat} - E_{vac}).(E_0)^{-1}.c^2.R^{-2}$
The Big Bang then starts with the expansion of pure vacuum energy. Only when this expansion reaches the speed of light can matter be formed because vacuum energy can only form matter once the expansion speed has fallen below the speed of light. After all, matter cannot expand/move faster than the speed of light. When this phase is reached, relativistic particles are formed and the density of matter is proportional to R^{-4} where R is the scale factor (relativistic matter, visible matter). The vacuum energy expands with R^{-3} . The total amount of vacuum energy that started the big bang ($E_{vac} = E_0$) then decreases with a value that is equal to the formation of matter.
It should be noted that the relativistic matter density ρ_{rel} is time-dependent during the formation of relativistic matter. As soon as that phase is over ρ_{rel} is time independent. After relativistic matter formation non- relativistic matter takes shape (rest mass matter). This matter formation is proportional to R^{-3} and also time-dependent.
During the conversion of vacuum energy to matter, a transition takes place from expansion to contraction. At one point all vacuum energy is then converted to matter density and a relativistic contraction takes place. The matter density is then proportional to R^{-4}.
Another short comment about matter density. For each piece of rest mass particle applies:

$$E^2 = (m.c^2)^2 = (m_0.c^2)^2 + (p.c)^2.$$

Here the term $m_0.c^2$ is proportional to R^{-3} and the term p.c is proportional to R^{-4} in terms of density. If E = h.f (particle is a wave) then both terms would be proportional to R^{-4} !!
The same applies to photons as to the term p.c : the photon density is proportional to R^{-4} .

In this paper, I actually review the 2 limit values:
1) Relativistic matter (both dark and visible, rest mass negligible, final phase of the cycle)
2) Pure vacuum energy (starting phase, the big bang)
3) I do not treat the transition from relativistic to non- relativistic. The following therefore applies:

$\rho^2_{mat} = \rho^2_{restmass} + \rho^2_{rel} \cong (R^{-3})^2 + (R^{-4})^2$ (but also time-dependant).

I start with the calculation from the Friedmann equation with the relativistic contraction. This is actually the phase that leads to the Big Bang. Almost all vacuum energy is then already converted to matter.
I still have to discuss the Gaussian curvature in the Friedmann equation. In both expansion and relativistic contraction there is a homogeneous and isotropic concentration around the centre of this expansion / contraction and its natural form is the spherical shape around the centre. For a spherical shape, the Gaussian curvature is equal to $+r^{-2}$ where r is the radius of the sphere. The Gaussian curvature still needs to be transferred to the scaling factor and that goes via the formula
$r = r_0.R$ where r_0 is the radius of the big bang ($R_0 = 1$) . The whole is viewed from the centre of the sphere. So there is a preferential radial direction! Within the sphere there is density, not outside the sphere. So outside the sphere there is a real vacuum (space without density)!
I cannot emphasize enough that in this model not the space expands but the vacuum energy. After all, the Friedman equation describes the expansion / contraction of densities!
The following applies: $E_{vac} = 0$, $E_{mat} = E_0$

The Friedmann equation reads:

$$H^2 = (R^{-1}.(dR/dt))^2 = (8/3).\pi.G.\rho - k.c^2.R^{-2}.(E_{mat} - E_{vac})/(E_0) = (8/3).\pi.G.\rho_0.R^{-4} - (r_0.R)^{-2}.c^2.R^{-2}$$

$$= R^{-4}.((8/3).\pi.G.\rho_0 - c^2.r_0^{-2})$$

$$\Rightarrow (dR/dt)^2 = R^{-2}.((8/3).\pi.G.\rho_0 - c^2.r_0^{-2})$$

$$\Rightarrow dR/dt = \pm \surd((8/3).\pi.G.\rho_0 - c^2.r_0^{-2}).R^{-1} \quad (1)$$

This result immediately gives a condition, because the root form has to be positive.
This gives:
$(8/3).\pi.G.\rho_0 - c^2.r_0^{-2} \geq 0 \Rightarrow \rho_0.r_0^2 \geq c^2.G^{-1}.(3/8\pi)$. Further on it will show that $\rho_0.r_0^2$ also has an upper limit, namely $2^* c^2.G^{-1}.(3/8\pi)= c^2.G^{-1}.(3/4\pi)$ This follows from the condition that rest mass particles can not move faster than the speed of light.
If we set $c^2.G^{-1}.(3/8\pi) = a$ then we have the following condition for $\rho_0.r_0^2$:

$$a \leq \rho_0.r_0^2 < 2.a$$

The value $\rho_0.r_0^{-2} = a$ means that the contraction speed for a spherical mass is equal to 0.
The value $\rho_0.r_0^{-2} = 2a$ means that the contraction speed is equal to c (actually almost c). This means that there is no more room for mass to contract and there is a conversion from mass to vacuum energy (very, very high temperature), the big bang. This also indicates that particles have a size and that there can be no contraction of mass to a point. Black holes therefore simply have a radius and a corresponding density.
The fact that there is no Big Bang then has everything to do with the temperature. It is just too low. In the article "evolution of the universe" I will elaborate on that. The Planck length is important in this.

The fact that the contraction speed is equal to 0 means that there is a balance between the particles that make up the mass and internal pressure with an enormously high density (there is almost no question of any intermediate space for particles to move in and a relatively low temperature). This can be checked on the basis of the mass of neutron stars.
a has the numerical value of $0,16 * 10^{27}$ kg/m. A spherical neutron star then has a mass of

$m_0 = 4\pi/3.\ r_0^3.\rho_0$. This yields a formula of: $m_0/r_0 = c^2/2G = 0.67 * 10^{27}$ kg/m.

A typical neutron star has a radius of 10 km and a mass of 1.5 times the sun. This substituted gives: $3*10^{30}/10^4 = 3* 10^{26} = 0,3 * 10^{27}$ kg/m. This is nice!

The DE (1) is easy to integrate: I take the negative solution (contraction)

$R.dR = -\sqrt{((3/8\pi).G.\rho_0 - c^2.r_0^{-2})}.dt \Rightarrow ½.\ R^2 - ½ = \sqrt{((3/8\pi).G.\rho_0 - c^2.r_0^{-2})}.(t_R - t)$ (2)

<u>Control:</u> t_R is the time when R = 1 is reached from the starting point t = 0 for which all particles are relativistic. $t = t_R$ yields R = 1. Formula 2 then provides the scale factor as a function of time.
As a function of the radius r of the universe, viewed from the center of the contraction, the formula becomes:

$½.\ (r^2/r_0^2) - ½ = \sqrt{((3/8\pi).G.\rho_0 - c^2/r_0^2)}.(t_R - t)$

I am now going to look at Hubble's law: V = H.r and thus: $V^2 = H^2.r^2$ where V is the expansion / contraction velocity.
H^2 follows from the Friedmann equation and for V^2 I get:

$V^2 = R^{-4}.((8/3).\pi.G.\rho_0 - c^2.r_0^{-2}).r^2$ with $r = r_0.R$ it becomes: $V^2 = R^{-2}.((8/3).\pi.G.\rho_0.r_0^2 - c^2)$.

This leads to: $V^2.R^2 = (8/3).\pi.G.\rho_0.r_0^2 - c^2$. Now set: $(8/3).\pi.G.\rho_0.r_0^2 - c^2 = a$

I then make the following table:
$R = 1 \Rightarrow V^2 = a$
$R = 2 \Rightarrow V^2 = a/4$
$R = 3 \Rightarrow V^2 = a/9$
As the scale factor becomes smaller, V will become larger. This means that V cannot be larger than c, after all there is matter. If we use this condition, then c^2=a, with a scaling factor of 1 (the radius of the big bang ball, the radius to which the ball can not shrink further) . I then get the next limit for a relativistic mass that is shrinking into a big bang:

$\rho_0.r_0^2 = (3/4\pi).c^2/G$ (3) , one sees that the factor ¾π indicates the spherical shape. Via $(4\pi/3).\rho_0.r_0^3 = m_0$ is to convert formula 3 to: $m_0/r_0 = c^2/G$ (4)

This is a very important result. From the book by Professor Achterberg about Cosmology (ISBN 90-5041-070-7) a total mass of the universe is given as approximately 10^{52} kg. This means that according to formula 4 a radius of the big bang ball will come out of about 1 billion light-years! So there is no question of a point-shaped big bang expansion. This immediately solves the flatness and horizon problem. The universe then begins to be more or less flat anyway.

$r_0 = m_0.G/c^2 \approx 10^{52}.10^{-11}.10^{-16} \approx 10^{25}$ mtr. 1 light year is about 10^{16} mtr, and so r_0 is about 1 billion light years.

For black holes and neutrons stars, however, formula 4 does not apply, but formula 5:
$m_0/r_0 = c^2/2G$ (5). Afterall, there is an equilibrium situation and then V = 0 or a = 0.

A black hole therefore has just a finite size, the radius of which follows from formula 5. For our galaxy, this has to be calculated since it is thought that the black hole in the centre has a mass of about 3

million times the solar mass. This yields a sphere with a radius of approximately $r_0 \approx 10^6.10^{30}.10^{-11}.10^{-16} \approx 10^9$ mtr or on the order of 1 million kilometres (this is also approximately equal to the diameter of the sun) . This would mean that on 'photos' of the galactic centre, a dark disc of about 2 million kilometers in diameter should be seen (apart from foreground stars) . This should be visible as a reduction in the intensity of the radio waves when a star passes behind the disc.
See also the You Tube movie with radio waves the orbits of stars around the black hole of our galaxy can be followed: https://www.youtube.com/watch?v=duoHtJpo4GY
If you see the real video of the movements, you will see changes in intensity. Ofcourse not on the simulations.

Formula 4 also becomes interesting when the Planck length is entered for r_0 . Formula 4 then yields the Planck mass for the mass of the Big Bang! This gives a bit more meaning to the Planck units. In this view, a Planck mass is then defined as a mass that can produce a Big Bang with a Planck sphere whose radius is equal to the Planck length $r_p = (G.h/c^3)^{½} \approx 10^{-35}$ mtr, and a Planck mass of $m_p = (h.c/G)^{½} \approx 10^{-8}$ kg.
I use the Planck constant here instead of Dirac because p.c = h.f and not E = h.f (because that is not correct).
I notice that no meaning can really be attached to this. The Planck length physically relates to vacuum waves and then there is a smallest wavelength that can have a vacuum wave. So there is also a greatest frequency that a vacuum wave can have and therefore also a maximum energy: the Planck energy.
Short derivation: $E_p = h.f_p$ en $c = f_p.l_p$ ➔ $E_p = h.c/l_p = m_p.c^2$ ➔ $m_p = (h.c/G)^{½}$

Chapter 2: Big bang, the vacuum energy expansion

The Big Bang is essentially a conversion of matter to vacuum energy, after which the vacuum energy begins to expand. There is now a completely different situation. The density of the vacuum energy is simply proportional to R^{-3} (there is no question of a 'de Broglie wave') and the sign of the 2nd term in the Friedmann equation has changed from positive to negative. This yields a completely different Friedmann equation. The Gaussian curvature k remains the same; after all there is still a sphere but now of vacuum energy. The expansion speed can now be greater than the speed of light because there is no question of matter. This only happens when the expansion speed has dropped below the speed of light. I first view the speed at which the expansion begins. The big bang sphere has a radius r_0 at t = 0. $E_{vac} = E_0$ and $E_{mat} = 0$
The Friedmann equation reads:

$$H^2 = (R^{-1}.(dR/dt))^2 = (8/3).\pi.G.\rho - k.(-E_{vac}/E_0).c^2.R^{-2} = (8/3).\pi.G.\rho_0.R^{-3} + (r_0.R)^{-2}.c^2.R^{-2}$$

H^2 we then take again from in the Hubble equation and R = 1 at the start of the expansion:

$$(V_{t=0})^2 = H^2.r_0^2 = ((8/3).\pi.G.\rho_0 + r_0^{-2}.c^2).r_0^2 = (8/3).\pi.G.\rho_0.r_0^2 + c^2 \quad (6)$$

it seems that the expansion speed at the start of the big bang is indeed well above c.
The expansion speed as a function of R then becomes:

$$V^2 = H^2.r^2 = H^2.\ r_0^2.R^2 = ((8/3).\pi.G.\rho_0.R^{-3} + (r_0.R)^{-2}.c^2.R^{-2}).\ r_0^2.R^2 = (8/3).\pi.G.\rho_0.r_0^2.R^{-1} + c^2.R^{-2} \quad (7)$$

Then change the density ρ_0 to the mass m_0 of the big bang then we get:

$V^2 = 2.G.m_0/r_0. R^{-1} + c^2.R^{-2}$. For the big bang sphere applies: $m_0/r_0 = c^2/G$,

giving us the following equation: $V^2 = 2c^2/R + c^2/R^2$ (8) and: $V(0)^2 = 3c^2$
and V = ✓3.c However, this is the expansion speed of the outer shell for which R = 1 and r_0 applies .

At t = 0 (the beginning of the big bang, $r=r_0$), the Hubble constant is: $H= v/r_0$ = ✓3. (c/r_0) = 1.73. (c/r_0)

Inside the sphere the following applies at t = 0: v = Hr = ✓3. (cr/r_0).

This means that matter can already be formed inside the sphere for which it holds that v≤c!
Requirement is then v≤c ➔ $r \leq 3^{-½}.r_0 \approx 0{,}58.r_0$
This means that already at the very beginning of the Big Bang, matter can be formed inside a spherical shell of radius $0{,}58.r_0$! This immediately gives a brake on the expansion of the vacuum energy sphere. It is questionable whether matter is actually formed within that sphere shell, because the sphere shell between $0{,}58.r_0$ and r_0 moves faster than the speed of light and compared to the inner shell there would then be a relative speed greater than c! I myself think that matter formation can take place in the inner shell, because the outer shell does not represent rest mass particles.

I will continue. If I do not take into account the 'contraction' effect of the inner shell, I can calculate the value for R where matter can be formed in the entire vacuum energy sphere. This follows from the requirement: v = c

$v^2 = c^2 = 2c^2/R + c^2/R^2$ ➔ $1 = 2/R + 1/R^2$, this can be redirected to:

$R^2 - 2R - 1 = 0$, with the solution: R = 1 + ½.✓8 = 1 +✓2 ≈ 2,41

The Hubble constant is then at that moment: $H = v/r = c/(2{,}41.r_0) = 0{,}41.(c/r_0)$

I do not know how quickly the conversion takes place. But we see galaxies up to very far distances (very large redshift), which means that matter formation would indeed have started immediately after the big bang in the inner sphere. After all, it takes some time before matter can develop into galaxies.
According to the cosmic background radiation, there is now around 5% visible matter and 26% dark matter. In the first billions of years after the big bang, vacuum energy is the dominant factor in the expansion, only when a significant amount of matter has been formed will there be a visible brake on the vacuum energy expansion. An observer on earth sees this extra delay as an extra acceleration! We are in the present and are therefore subject to that extra delay. Looking back in time, we see the rise of the extra delay as an extra acceleration.

When R ≈ 2.41 has passed (actually less, due to the creation of matter in the inner sphere), everywhere in the space inside the sphere with radius greater than $2.41.r_0$, vacuum energy is converted to relativistic matter (especially in the outer regions of the globe) and non-relativistic matter (inner regions of the globe). A different density will apply and the Friedmann equation changes to a different form. Over a certain period of time (the total lifetime of the universe) the vacuum energy $E_{vac} = E_0$ changes to matter $E_{mat} = E_0$.

What does the Friedmann equation look like when material is being formed? I have now looked at 2 limit cases:

1) A universe with only matter: first term of the Friedmann equation is positive, 2nd negative.
2) A universe with only vacuum energy: first term of the Friedmann equation is positive, 2nd also positive.

So the difference is in the second term. There is a factor that changes the sign. k is the Gaussian curvature and that is always positive because of the spherical shape. As mentioned earlier, the vacuum energy evolves from the big bang to matter. On the way the second term then changes signs: first negative, then 0 and then positive.
I then get the following:

1st term: $\rho = \rho_0 = \rho_{vac} + \rho_{mat}$
2nd term: $-k.(E_{mat} - E_{vac}).(E_0)^{-1}.c^2.R^{-2}$

E_0 is of course equal to the energy with which the Big Bang started . If E_{mat} is equal to E_{vac} then the 2nd term is equal to zero. This then marks the conversion of a universe dominated by vacuum energy to a universe dominated by matter.

Another comment about ρ_0 . With the index 0, I mean the density at the start of the big bang at time t = 0. As soon as the expansion velocity falls below the speed of light, matter can be formed. It happens at the time $t = t_1$ at a scaling factor of $R \approx 2.41$. Then the density at that moment is equal to $\rho_1 = \rho_0.(2{,}41)^{-3}$. $\rho_1 = \rho_{vac} + \rho_{mat}$.
It will now be a complicated situation because ρ_{vac} decreases to the same extent as ρ_{mat} increases ($\rho_{vac} = \rho_1 - \rho_{mat}$) and depends on the scale factor.
I then get the following overview regarding the scaling factor:

$\rho_{vac} \cong R^{-3}$ $\quad \rho^2_{mat} \cong (R^{-3})^2 + (R^{-4})^2$

(first term is related to the rest mass and the second term is the 'kinetic energy' pc. The second term also includes the photons)

I still have to solve the Friedmann equation in case there is only vacuum energy, so until the moment that $t = t_1$ and $R \approx 2.41$.

Solution Friedmann equation for pure vacuum energy.

$H^2 = R^{-2}.(dR/dt)^2 = (8/3).\pi.G.\rho + k.c^2.R^{-2}$ with $k = +(r_0)^{-2}.R^{-2}$ en $\rho = \rho_0.R^{-3}$

$R^{-2}.(dR/dt)^2 = (8/3).\pi.G.\rho_0.R^{-3} + (r_0)^{-2}.R^{-4}.c^2$

$(dR/dt)^2 = (8/3).\pi.G.\rho_0.R^{-1} + (r_0)^{-2}.R^{-2}.c^2$. For the big bang applies: $\rho_0.r_0^2 = (\frac{3}{4}\pi).c^2/G$ (formule 3)

$(dR/dt)^2 = 2.c^2.(r_0)^{-2}.R^{-1} + c^2.(r_0)^{-2}.R^{-2}$ ➔ $(dR/dt)^2 = c^2.(r_0)^{-2}.(2R+1).R^{-2}$

$dR/dt = \pm\, c.(r_0)^{-1}.R^{-1}.\sqrt{(2R+1)}$ ➔ $+(r_0/c).R.\sqrt{(2R+1)}^{-1}.dR = dt$ ➔ $2^{-½}.\,(r_0/c).(R/(R+½)).dR = dt$

This DE is a standard integral. I take the positive solution (expansion) and t is the age of the universe and integration limits for R between 1 and R :

$t = 2^{½}.3^{-1}.(r_0/c).\,[(R+1)(R+½)^{½} - 2.(3/2)^{½}] = \sqrt{(2)}/3.\,(r_0/c).\,[(R+1)(R+½)^{½} - 2.(3/2)^{½}]$

For R = 2.41 one finds the age of the universe when matter could be formed:

$t = r_0.c^{-1}. 2^{½}.3^{-1}. [(2,41 +1)(2,41 + ½)^{½} - 2.(3/2)^{½}] = 1,587.r_0/c \approx 1,587$ billion lightyears
(r_0 is about 1 billion lightyears).

My calculation is from the centre of a sphere that has a finite dimension. Relativistic calculations can then be performed. So there is a preferred direction! This can be found in the residual rate that remains when measuring the 3 K background radiation and amounts to approximately 600 km / sec for the local group of galaxies to which our galaxy belongs.
According to current views this should then be the expansion speed. opposite to that speed direction, the direction of the Big Bang should be located. (note: that the local group is no longer subject to a further gravitational interaction of one or another cluster).
See: https://apod.nasa.gov/apod/ap140615.html

Finally, a comment on matter:

Matter consists of particles that have rest mass (only these particles can be accelerated) and particles that move with the speed of light. However, these particles do not have a rest mass and therefore cannot be accelerated.
Particles that only have rest mass I call dark matter. The particles known so far are the 3 lepton neutrinos.
Particles that have rest mass and charge (colour / electric or both) I call visible matter.
If I look at an electron, then there is an electron neutrino. The same applies to a muon and tau particle. It is obvious to name an electron-neutrino an electron without a charge: the bald electron, consisting of just rest mass. If nature adds charge to the electron neutrino, then an electron forms, which is heavier because charge creates potential energy.
If we continue this line of thinking, there would have to be 6 quark neutrinos next to the existing 6 quarks (with charge and colour): the bare quarks consisting of just rest mass.
Visible matter then is matter that was formed at the time of relativistic matter formation. Only then is the temperature high enough. As soon as the temperature drops during the expansion, at a given moment no matter can be formed with charge and from that moment on only dark matter is formed. These chargeless rest mass particles are then known as dark matter. The formation of dark matter from vacuum energy is therefore still going on at the moment (otherwise you would not have any material contraction leading to a Big Bang)!
Due to their very small rest mass, these particles can therefore still be formed from the vacuum energy despite the low temperature of the contemporary universe.
Depending on the model used, the percentages of dark matter, visible matter and vacuum energy are calculated. An oscillating model that I describe here is therefore different from the currently accepted model, based on fixed percentages (26%, 5% and 69% respectively). If these percentages are correct then 19% vacuum energy still needs to be converted to matter before there can be a contraction, again according to my model.
However, strong evidence for my model is the observed accelerated expansion at around 6 billion light-years away. Current theories provide no explanation for this.