Expansion Kinetic and Potential Energy
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Abstract

The Wilkinson Microwave Anisotropy Probe WMAP [3][7] and similar projects led to expansion curves and cosmological parameters that are becoming generally accepted. The author developed expansion equations that agree with WMAP but are thought to be more fundamental. A unique cellular approach is used that allows the kinetic energy and potential energy to be calculated. There are two components of expansion. The second component develops later and according to new calculations requires negligible kinetic energy. The concept of critical density (H= (8/3 pi G rhoC)^.5) incorrectly assumes that density characterizes kinetic energy for this component. Critical density (omega total=1) according to year 9 WMAP parameters [7] is composed of fractions: omega dark=0.718, omega mass=0.235 and omega baryonic mass=0.046. One goal of this paper is to reanalyze mass components with the new understanding that omega dark may be negligible. Based on a model of the proton [1], the author uses 9.8 MeV as the kinetic energy (KE) of expansion and it appears to be adequate to expand one half of the mass to 6.22e25 meters. This is further evidence that mass components might have been misidentified. There is strong support for protons being only a small fraction of omega total. The ratio baryon number/photon number must be about 6e-10 to agree with primordial nucleosynthesis. The photon number is based on CMB temperature 2.725 K and the ratio does not allow a high proton fraction. However, the author believes that there is another energy source that must be considered. Neutrons decay with a half-life of 886 seconds releasing 1.29 MeV of neutrinos and the electron. Based on this the photon plus neutrino kinetic energy gives a photon density 2.7 time higher. This higher density allows higher baryon density while maintaining the important 6e-10 baryon/photon ratio. It is also consistent with 0.5*exp(180) protons/m^3 indicating that one half of the mass is protons.
Other topics addressed are: equality and decoupling, temperature curves for He4 fusion and neutron decay, CMB spot temperature and cold dark matter.

Overview

The author uses a cellular model that defines gravity, space, time, expansion, kinetic and potential energy at the quantum level. The model [1][6] is summarized in Appendix 1 for convenience. Using a small cell of radius r to evaluate big R (literature would call this the radius of the universe) is critical to understanding cosmology. In this model, the universe is filled with the *surface* of many small cells and this is equivalent to the *surface* of one large sphere. This is important conceptually because we can be inside the universe (something we all observe) and each surface can be identical and preserve the concept that there is no preferred location. There is a numerical and geometrical relationship between many small cells and one large sphere that requires the geodesics of cells to be multiplied by the small factor 1/exp(90), a value that the author shows is the gravitational

coupling constant [1][6]. Appendix 1 familiarizes the reader with gravitational theory based on the cellular model. Expansion of each cell involves kinetic energy of a proton like mass on the surface of each cell. Expansion is driven by kinetic energy in the form of temperature (and pressure). The model's geometrical and numerically similarity allows many small cell surfaces to represent the universe. Important values for the model originate in the proton model [1] reviewed in Appendix 1. The model shows protons with about 20 MeV that fall into "orbits" with 9.8 MeV of kinetic energy and 9.8 MeV of potential energy. Initially the mass on the cell surface has high velocity (0.14C) that gives an outward inertial force equivalent to gravity.
Tangential kinetic energy (Appendix 1 contains a diagram) decreases directly with expansion ratio [6] and identifies an orbit that maintains the gravitational constant at G. This "orbit" is again a model since it is temperature and pressure associated with kinetic energy that drives expansion. After expansion, potential energy allows protons to fall (accelerate) toward each other and establish orbits as mass accumulation occurs. Often falling particles have kinetic energy/particle on the order of several MeV. It is this energy that we see when orbits are established around galaxies and planetary systems. It is also this energy that provides pressures and temperatures high enough to initiate fusion.

Derivation of expansion equations

The goal below is to model expansion of a small cell, labeled r that provides values scalable to the universe.

Nomenclature

(all calculations are MKS)
v-velocity (m/sec)
M-mass (kg)
R-radius (meters or m)
G-gravitational constant (nt m^2/kg^2)
c-constant of integration
dt-delta time
t-time
g=dimensionless time=time/alpha time
lower case r is a cell radius
H1 is Hubble's constant for R3
R1 radius is first expansion component
R3 radius is second expansion component
Rt=R1+R3

integral dR has two components
int dR=Rt-R1
Rt=R1+int dR
Rt=R1+R3
R=f(t)=f(g)
first component;
r^3 increases as g^2 (will be g^(2/3) in next step)
R^3=(r)^3*g^2*exp(180)
R=r*g^(2/3)*exp(60)
r=1.93e-13/(2.683*2.683)^.5=7.35e-14
R1=(7.35e-14)*t^(2/3)*exp(60)
second component:
dr=H1*r*dt
dr=H1*alpha*r *dg (dt=alpha dg)
evaluate integral dr
r3=int (7.35e-14)*g^(2/3)*dg*H1*alpha =(7.35e-14)*g^(5/3)*H1*alpha/1.666
r1+r3=(7.35e-14)*g^(2/3)+(7.35e-14)*g^(5/3)*H1*alpha/1.666
R1+R3=r1*exp(60)+r3*exp(60)

Integral dr adds a late stage term that expands with time, after integration, raised to the power (5/3). The author will use time^(2/3) and time^(5/3) for the two terms that characterize expanding cells. Each cell radius is related to bigR by the relationship R=r*exp(60).

Fundamental radius r

The energy 2.683 MeV underlies the quantum mechanics for fundamental radius r and time. This energy is found in the proton mass model [1] associated with gravitation and included in Appendix 2.

Gravitational Action			E	2.6831E+00	mev
			const HC/(2pi	1.97E-13	mev-m
			R=const/E	7.3543E-14	m
			t	1.54135E-21	sec
			Field side	R side E'=m/g	
	E=Hv		H/E	2*pi*R/V	
	t=H/E=2piR/V		1.541E-21	1.541E-21	sec
			1.54135E-21		
1		qm test	m/c^2x^2/t	6.5821E-22	mev-sec
		qm test/h	m/c^2x^2/t/h	1.00	

convenient constant:	HC/(2*pi)		1.973E-13	mev-meters

r=1.973e-13/(2.683*2.683/1)^.5=7.35e-14 meters.

Fundamental time

Identify the fundamental unit of time for expansion is the gravitational orbit described above/(time around radius)						
	Fundamental radius=1.93e-13/(2.68*2.68)^.5=7.354e-13					
	Fundamental time=7.354e-14*2*PI()/(3e8)=h/E=4.13e-21/2.68					
	Fundamental time	1.541E-21	seconds			

The author uses a dimensionless ratio, g=time/alpha in expansion equations, i.e. R=r*g^(2/3). Define alpha as initial time. Time=1.54e-21*exp(N) where N→45 to approximately 90.

Identify alpha based on Reference 1 and WMAP best fit				
	dimensionless time			
	1/exp(45)	2.863E-20	sec	
	alpha=fund time/dim time=1.54e-21/2.86e-20			
	alpha	0.0538	sec	

Expansion constant H1:

The expansion model will be called the "R1+R3" expansion model, with components R1 and R3.

R1+R3=7.35e-14*g^(2/3)+7.35e-14*g^(5/3)*H1*alpha/1.66

There are no unknowns in the equation R1=7.35e-14*g^(2/3) but the second part R3=7.35e-14*g^(5/3)*H1*alpha/1.666 contains alpha and unknown, H1. Alpha and H1 are evaluated with WMAP *data*. De-coupling, equality and Hubble's constant match data with alpha=0.0583 seconds and H1=3.1e-18/sec. If these value are used the resulting expansion curve compares favorably with both the WMAP concordance model and the Cmagic model.

R3=7.35e-14*g^(5/3)*3.14e-18*0.053/1.666

R is calculated with increasing g until overall H is 2.26e-18 [7]. The match gives R1+R3= 6.24e25 meters at 4.4e17 seconds (14 billion years). R3 is 0.45 of the total radius but of course expanding faster (power is 5/3).

Expansion Table (first 3 time steps)

The following table puts the derivations above into action. There are many results in tables below for R1+R3 expansion. The simulation starts at the fundamental radius and progresses to the right as time advances. The author uses a natural logarithmic scale with time=exp(45+c)*1.54e-21 seconds. Dimensionless time (g) = time/0.0583 starts with 1. If c above is a small value, the model contains more incremental steps. Rows in the model contain values of interest. Cell radius is R+R3, using the derivation above. Runiverse = (R1+R3)*exp(60). Ke orbit=9.78*7.35e-14/(r1+r3). Gamma=938.27/(938.27+ke). V/C=(1-gamma^2)^.5. Fgravity=M*V^2/(r1+r3)/exp(90), where M=1.67e-27 kg. G=F/M^2*(r1+r3)^2/exp(90) and the calculated gravitation constant G is constant throughout expansion (this does not change gravity since it is fixed at the fundamental cellular level). The highlighted rows are kinetic energy and potential energy. Potential energy=PE+F*(delta R)/2*6.24e12 MeV/(NT-m) with initial F=3.44e-38 NT.

					cells hidden
alpha (initial time in sec)		0.0538	Start	45=LN(0.0538/1.54e-21)	
logarithm used to increase time (LN)			45	45	45.24455
time--seconds		EXP(LN)*1.54e-21		0.053845966	0.069
		1.54E-21	**1.54E-21**	1.54135E-21	1.54E-21
g time ratio	1	time/alpha	1	1	1.28E+00
		2 pi R/C	1.54E-21	1	2
Cell radius	**7.35E-14**	**R=R1+R3**	**7.35E-14**	**7.35E-14**	**8.66E-14**
1.358E-18		R1	7.35E-14	7.35E-14	8.657E-14
		R3	7.35E-14	6.54E-33	9.83E-33
R universe	5.773E+25	(R1+R3)*exp(60)	8.40E+12	8.40E+12	9.89E+12
				0	3.05E+07
	938.27	mass mev	938.272	938.272	938.272
0.987	0.9897	gamma (g)	0.9897	0.9897	0.9912
ke orbit	9.781	mev	9.78	9.78	8.31
V/C orbit	0.1433		0.1433	0.1433	0.1322
velocity	3.00E+08	m/sec	4.30E+07	4.30E+07	3.96E+07
Fgravity (nt)		F=M V^2/R/exp(90)	3.44E-38	3.44E-38	2.49E-38
G at end	6.6743E-11	G=rV^2/M/exp(90)	6.57E-11	6.64E-11	6.66E-11
Fi=MV^2/R/exp(90)		1	3.474E-38	3.438E-38	2.487E-38
Pe=Pe+dPE=Pe+Fi dR/2			0	0.00E+00	1.45E+00

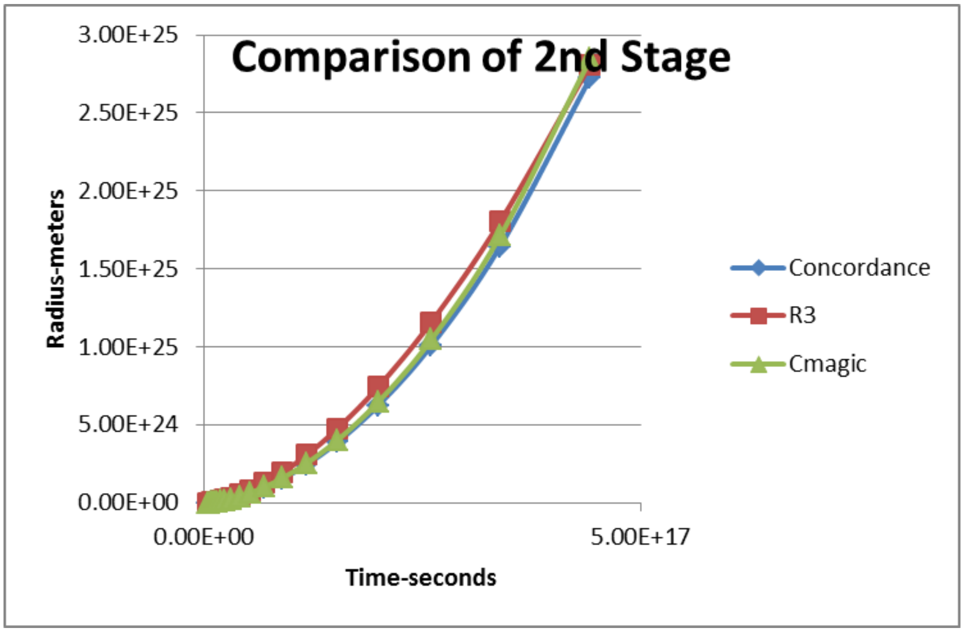
Expansion table (last few time steps)

R universe is estimated to be about 6.25e25 meters at 14 billion years. The two components are labelled R1 and R3 below. The time labelled NOW is measured value H= 2.26e-18/sec [7].

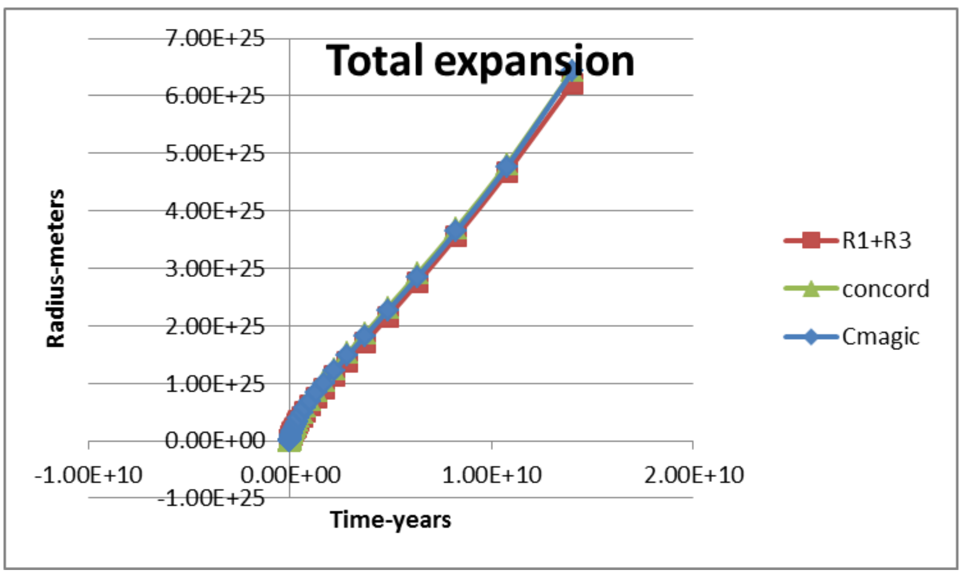
					cells hidden	cells hidde	3.100E-18		
alpha (initial time in sec)		0.0538	Start	45=LN(0.0538/1.54e-21)		Last few st	NOW		
logarithm used to increase time (LN)			45	45	45.24469	88.31013	88.55482	88.79951	
time--seconds		EXP(LN)*1.54e-21		0.053845966	0.06877	3.47E+17	4.43375E+17	5.66E+17	
		1.54E-21	**1.54E-21**	1.54135E-21	1.54E-21	1.54E-21	1.54135E-21	1.54E-21	
g time ratio	1	time/alpha	1	1	1.28E+00	6.45E+18	8.23414E+18	1.05E+19	2.273E-18
Cell radius	**7.35E-14**	**R=R1+R3**	**7.35E-14**	**7.35E-14**	**8.66E-14**	**4.19E-01**	**5.47E-01**	**7.25E-01**	
1.324E-18		R1	7.35E-14	7.35E-14	8.657E-14	2.547E-01	2.999E-01	3.530E-01	1.324E-18
		R3	7.35E-14	7.37E-33	1.11E-32	1.65E-01	2.47E-01	3.72E-01	3.273E-18
R universe	6.250E+25	(R1+R3)*exp(60)	8.40E+12	8.40E+12	9.89E+12	4.79E+25	6.25E+25	8.28E+25	2.273E-18
				0	3.05E+07	1.42E+08	1.52E+08		
	938.27	mass mev	938.272	938.272	938.272	938.272	938.272	938.272	
0.987	0.9897	gamma (g)	0.9897	0.9897	0.9912	1.0000	1.0000	1.0000	
ke orbit	9.781	mev	9.78	9.78	8.31	1.70E-12	1.30E-12	9.82E-13	
V/C orbit	0.1433		0.1433	0.1433	0.1322	2.79E-12	2.37E-12	2.02E-12	
velocity	3.00E+08	m/sec	4.30E+07	4.30E+07	3.96E+07	18.03	15.78	13.71	
G at end	6.6743E-11	G=rV^2/M/exp(90)	6.57E-11	6.64E-11	6.66E-11	6.67E-11	6.67E-11	6.67E-11	
Fi=MV^2/R/exp(90)		1	3.474E-38	3.438E-38	2.487E-38	1.06E-63	6.24E-64	3.55E-64	
Pe=Pe+dPE=Pe+Fi dR/2			0	0.00E+00	1.45E+00	9.66E+00	9.66E+00	9.66E+00	

The radius of each cell is 0.50 meters and the velocity related to the reduced kinetic energy is 15.8 m/sec.

Expansion Comparisons



The R1+R3 model can be compared with the concordance and Cmagic models.



Important Transitions

WMAP used the difference in time between two important transitions to determine the size of the acoustic spots detected by radiometers. Those two transitions were 1) equality of energy and mass when acoustical waves develop and 2) decoupling where the universe became transparent as the plasma clears.

Detailed Equality to Decoupling Simulation

When photon mass density matches and falls below mass density a condition known as equality has occurred. Acoustic oscillations are no longer dampened and wave propagation at velocity 3e8/3^.5 m/sec begins. These waves enlarge and are visible in the cosmic background radiation (CMB) as the plasma clears at decoupling. An attempt was made to duplicate the concordance expansion calculations. Below the white concordance block, the author's R1+R3 results are shown (darker background). Although the expansion curves start at the same radius and end at the same radius, there are small differences. However, the differences do not affect the spot size in radians. Equality and decoupling values are shown in red.

	8809.925		Hidden cells	Hidden cells		3196			
1.58E+22	1.89E+22	2.26E+22	2.76E+22	4.69E+22	5.59E+22	5.86E+22	6.99E+22	Radius at decoupling (meters)	
					2.98E-02	3.90E+02		Saha	
1.07E+04	8.99E+03	7.54E+03	6.16E+03	3.63E+03	3.04E+03	2.55E+03	2.13E+03	T concordance	
3.53E+19	2.07E+19	1.22E+19	6.67E+18	1.36E+18	8.00E+17	4.71E+17	2.77E+17	Photon density	
7.48E-17	4.40E-17	2.59E-17	1.41E-17	2.88E-18	1.70E-18	9.99E-19	5.88E-19	proton mass density	
8.72E-17	4.30E-17	2.12E-17	9.48E-18	1.14E-18	5.61E-19	2.76E-19	1.36E-19	photon mass density	
1.17E+00	9.77E-01	8.19E-01	6.70E-01	3.94E-01	3.30E-01	2.77E-01	2.32E-01	photon/mass density	
0.00E+00	0.00E+00	2.49E+20	6.22E+20	2.38E+21	3.35E+21	4.61E+21	6.26E+21	Wave progression	
0.0000	0.0000	0.0017	0.0035	0.0078	0.0092	0.0107	0.0121	Angle radians	
3.68E+19	2.17E+19	1.27E+19	6.99E+18	1.42E+18	8.37E+17	4.92E+17	2.90E+17	not used	
	77.41	6.40E+12		0.00999		79.00	3.14E+13		
1.39E+22	1.66E+22	1.98E+22	2.42E+22	4.11E+22	4.91E+22	5.86E+22	6.99E+22	R conc	
5.17E+19	3.04E+19	1.79E+19	9.82E+18	2.00E+18	1.18E+18	6.91E+17	4.07E+17	photon density	
					4.28E-04	2.26E+00		Saha	
1.22E+04	1.02E+04	8.56E+03	7.01E+03	4.12E+03	3.45E+03	2.89E+03	2.43E+03	T conc	
1.32E+00	1.10E+00	9.23E-01	7.56E-01	4.45E-01	3.73E-01	3.12E-01	2.62E-01	equality?	
1.11E-16	6.50E-17	3.82E-17	2.10E-17	4.27E-18	2.51E-18	1.48E-18	8.69E-19	proton density	
1.45E-16	**7.16E-17**	**3.53E-17**	**1.59E-17**	**1.90E-18**	**9.36E-19**	**4.61E-19**	**2.27E-19**	photon mass density	
1.73E+08	1.73E+08	1.73E+08	1.73E+08	1.73E+08	1.73E+08	1.73E+08	1.73E+08	Wave velocity	1.73E+08
		2.49E+20	6.22E+20	2.38E+21	3.35E+21	4.61E+21	6.26E+21	Wave progression	
	0.0000	0.0020	0.0041	0.0092	0.0109	0.0125	0.0143	Angle radians	

Photon mass density above is given by the following equation:

Photon mass density=8*PI()/(H*C)^3*(1.5*B*T)^4*1.78e-30				
mev^4 kg		kg/m^3		
(mev^3-m^3	mev			

http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/phodens.html

B is the Boltzmann constant 8.62e-11 MeV/K.

Mass density is:

mass density is = 0.5*1.67e-27*exp(180)/Volume

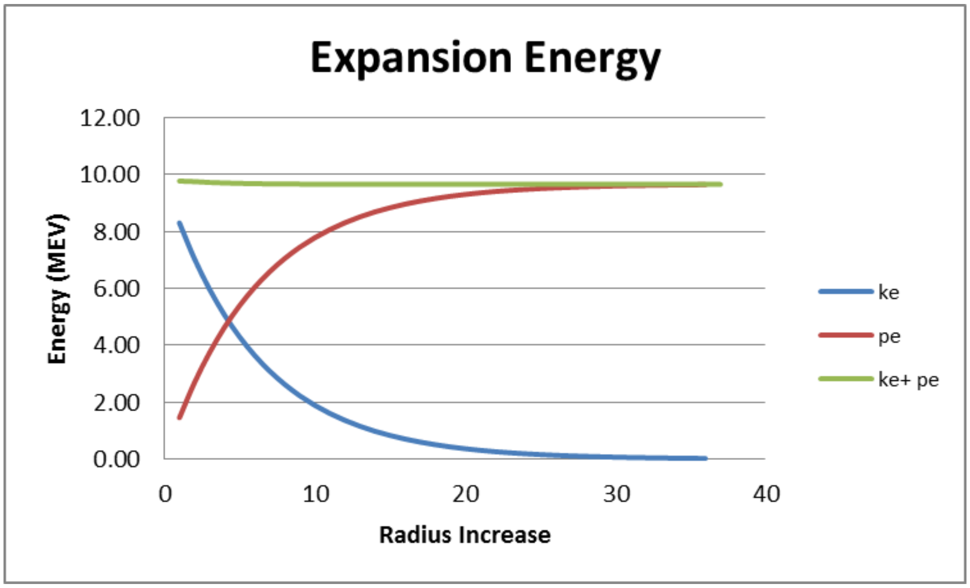
The SAHA equation is used to determine when decoupling of radiation occurs. A SAHA value nearing one indicates that the plasma clears.

```
SAHA Value=4*2^0.5/PI()^0.5*1/3.63e20*1.6e-9*(T/0.511)^(3/2)*EXP(1.36e-5/(8.62e-11*T))
```

Equality of photon mass density and mass density occurs at radius 1.66e22 meters for the R1+R3 model. From this point waves progress until the temperature reaches 2890 K. At this point the SAHA equation indicates that decoupling occurs. The R1+R3 radius is 4.91e22 meters at decoupling. The wave has enlarged to 3.35e21 meters and this value divided by 2*pi*4.91e22=0.0107 radians. This matches the peak WMAP observed CMB spots. The value 0.5*1.67e-27 kg in the above equation for mass density is half the mass of a proton. This is another clue that baryons are more numerous than WMAP analysis indicates but more information is provided below.

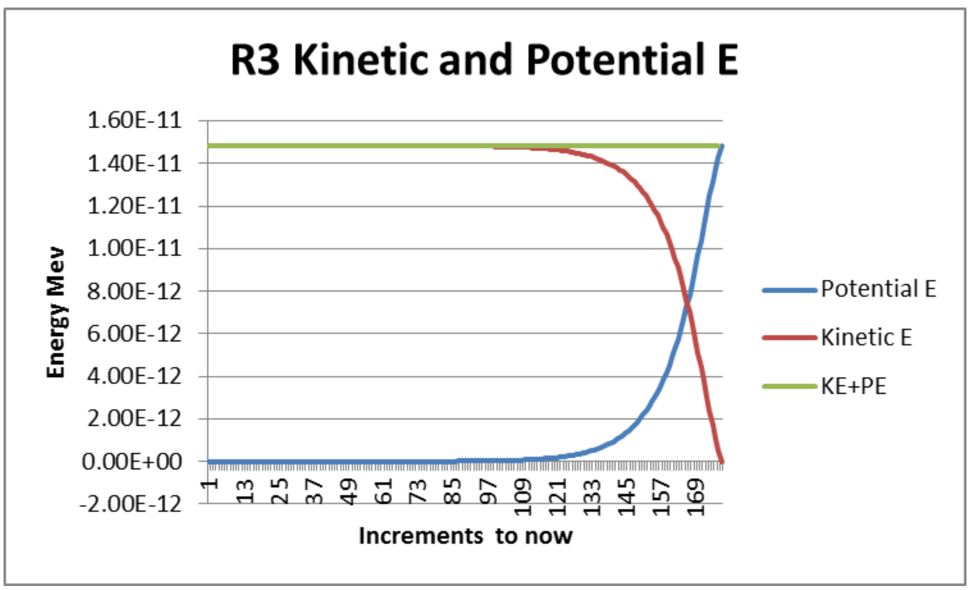
Expansion kinetic energy and potential energy

Since expansion is well characterized by WMAP (and agrees with the author's calculated expansion), one can simply calculate expansion kinetic energy and expansion potential energy as a function of time and determine if initial KE is in fact converted to potential energy. Comparison of expansion kinetic with potential energy in the author's expansion model is included in the table above (the KE line and the PE line are highlighted in gold). The initial kinetic energy is reduced to the current value (labeled NOW) of 1.41e-12 MeV. The initial resisting force is the inertial force F=MV^2/R=3.44e-38 NT where V is the tangential velocity V/C=0.14 that decreases with increasing R. Final potential energy (integral of FdR) is 9.68 MeV in the NOW column. To obtain this result the author reduced the number of protons to one half exp(180). Why one half? The resisting force is based on each of all exp(180) masses. Details presented in reference 3 suggest that protons (baryons) make up one half of the total mass. The R1+R3 final density is based on all exp(180) masses. This is evidence that the other half of the mass is gravitationally active cold dark matter with mass 1.67e-27 kg with its own energy source (a mirror of the proton perhaps). Changes in energy are plotted below (the horizontal axis units are increments of time and they quickly saturate).



Dark Energy

The second component of expansion R3 is initially only 1e-6 meters and expands to about 3e25 meters. WMAP identifies the expansion energy for this component as “dark energy” and assigns a large portion of critical density to it. This expansion is again resisted by gravitational forces (3.44e-38 NT) and potential energy increases as expansion occurs. When the calculation was carried out, it was discovered that this component requires very little kinetic energy (on the order of 1.4e-11 out of 9.8 MeV). The result is shown below:



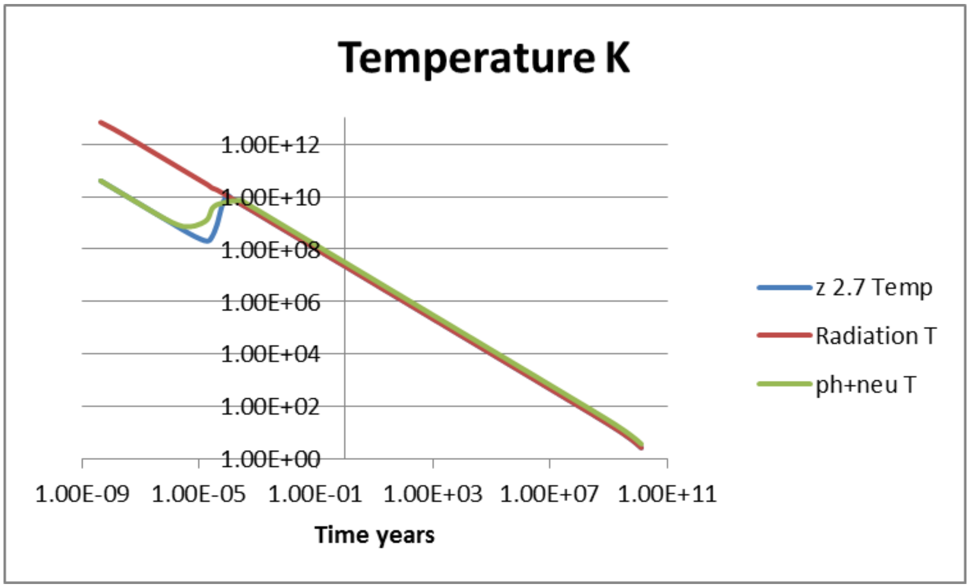
The reason for this is that the radius is very low in the first part of expansion when the resisting force is high. Recall that the WMAP conclusion [7] was the 0.72 of the total energy was missing and a search for "dark energy" was launched. The accepted formula H^2=4/3 pi G rhoC, where rhoC is critical density assumes that the driving force for expansion is kinetic energy characterized by mass density. It is incorrect to calculate a critical from H^2=4/3 pi G rhoC since the second part of expansion requires negligible kinetic energy. To the author this means that omega dark is negligible. I am not questioning expansion of the second component and I do not question that the Hubble constant H is the current expansion rate. What is being questioned is that critical density characterizes the energy required.

Temperature associated with kinetic energy 9.8 MeV

Using the Boltzmann relationship T (K)=ke/(1.5 B), it is possible to assign a temperature to kinetic energy.

KE temperature relationship			Beginning		Current expansion state	
ke=1.5 B T			9.80	mev	1.26E-12	
T=ke/(1.5 B)			7.58E+10	K	0.010	K
Boltzmann B	8.61952E-11	mev/K				
		M=m*exp(0)	2.49E+51		2.18E-08	kg
		R	1.847E+24		1.62E-35	r'
		V (meters/sec)	3.00E+08		3.00E+08	v (meters/sec)
		G	6.68E-11		6.68E-11	

The temperature 7.6e10 K is reasonable although the R1+R3 model's initial density is higher than other models. Cosmologists use the expansion ratio z to scale temperatures i.e. T(K)=z*2.725. However, starting with 7.6e10 K and scaling the other way gives the surprising present temperature of 0.01 K. Isn't the present temperature 2.725 K? It is well known that Helium4 is produced at high temperatures and is the main element formed during primordial nucleosynthesis. Most literature gives 23% to 25% as the range of He4 and indicates that it is produced in the first few minutes. He4 fusion releases 7.07 MeV and 0.24*7.07 MeV=1.63 MeV. This is significant energy compared to 9.8 MeV and must be added to the photon only temperature. When it is added, the blue temperature curve moves up to the accepted 2.725*z red temperature curve. The scale in the graph below is from the beginning to 14 B years. He4 fusion is complete at about 200 seconds (the early discontinuity). The resulting radiation temperature was close to 2.73K at the end of expansion and followed the accepted temperature history. This is important because temperature affects the radius at equality and de-coupling. In this simulation, the important equality point on the natural log scale occurs well after the temperature has risen to the accepted temperatures scaled by expansion from 2.72K. It is also quite meaningful to the question of what kind of mass WMAP is dealing with. Hot matter (protons and electrons) fuse and emit radiation. The temperature would not increase to the accepted curve if it were cold dark matter.



Neutron decay

Literature (Appendix 3) includes many graphs of primordial nucleosynthesis for helium4 and other elements. There is consensus that the baryon/photon number ratio must be about 6e-10 for the measured values of H2, He3, Be7 and Li7 to have been produced in the first few minutes. This value agrees with WMAP.

The neutron decays with a half-life of 886 seconds. The author's neutron mass model changes to the proton mass model [1] with the release of a neutrino with energy 0.671 MeV and an electron (0.551 MeV+.1114 ke) with energy 0.662 MeV (their total is the difference in mass between a neutron and proton). This energy must also be added to the photon density. For demonstration this energy can be converted to temperature and is shown above as the green temperature curve. It also jogs up. The end of this event is at about 6000 seconds and at the end of expansion, its value is 3.79 K This is important because the photon + neutrino + electron "temperature" is 1.39 times the photon only curve. Temperature is to the power 3 in the equation: Photon density=K*T^3 and this means photon density is 2.68 times higher than 2.725 K based photon density. This small change allows the baryon density to be 0.5 while baryon/photon density is the accepted value 6e-10. The argument for a higher baryon fraction is that there are more photons so there can be more baryons.

Summary Comparison

Differences between this proposal and WMAP analysis are summarized below.

WMAP	WMAP [7]		Neutron	Proposal	Now
w/o dark	NOW		Decay	Equality	
			886 sec		
6.434E+25	6.43E+25	Radius	2.5468E+16	1.98E+22	6.22E+25
	1.12E+78	Volume (m^3)	6.9196E+49	3.25E+67	1.01E+78
	3.50E-01	Baryon number density=.5*exp(180)/vol	1.0762E+28	2.29E+10	7.38E-01
6.100E-10	6.100E-10	baryons/photon	baryons/(phot	4.77E-10	4.77E-10
	5.77E+08	Photon number density	1.0158E+37	4.80E+19	1.55E+09
?	0.235	Cold matter fraction		0.5	0.5
		cold matter density in kg/m^3			1.23E-27
0	0.719	Dark Energy		0	0
2.6695E-27	9.50E-27	critical density	1.67e-27*exp(180)/Volume		2.47E-27
?	0.0464	Baryon fraction		0.5	0.5
		baryon matter density in kg/m^3			1.23E-27

WMAP parameters [7] on the left side of the table above give omega total = 9.5e-27 kg/m^3. Omega dark fraction is 0.718, cold dark mass fraction is 0.235 and baryon mass fraction is 0.046. V^2=8/3 pi G rhoC*R^2 is based on initial kinetic energy becoming potential energy and the author's calculations show that the second component of expansion (dark energy) is essentially zero, making omega dark energy=0. This means 0.72*9.5e-27/m^3=6.83e-27 must be subtracted from critical density. The new value is 9.5e-27-6.83e-27=2.67e-27 kg/m^3. The three columns on the right give values from the proposal at neutron decay, equality and now. The total mass/volume is exp(180)*1.67e-27 kg/1e79=2.47e-27 kg/m^3. This compares favorably with the lowered WMAP critical density.

Baryon density is given by 0.5*exp(180)/volume at each of the radius values. The important increase in energy for the now condition gives 1.55e9 (photons+neutrinos+electrons)/m^3. With current baryon density 0.738 baryons/m^3, the baryon/photon ratio is 0.738/1.55e9=5e-10. This is in agreement with WMAP and other literature.

Cold Dark Matter

Reference 8 is an attempt to correlate meson and baryon masses. In many cases it appears that there are "mirror particles" and it is the author's opinion that the cold dark mass fraction 0.5 may be a neutron like mirror particle that interacts only gravitationally. Anomalous galaxy velocity profiles and dark matter lensing strongly indicate that there is a significant amount of cold dark matter in the outer portion of galaxies. This means that cold dark matter expanded. The model shows that 9.8 MeV was adequate to expand protons but did not expand cold dark matter against the combined gravitational resistance force=3.44e-38 NT. Since the model shows the cold dark matter fraction at 6.25e25 it must have its own energy source.

It appears to the author that the proton mass model also models cold dark mass. The current working assumption that cold dark mass only interacts gravitationally is supported by this work.

Red shift of spots

The acoustic mass that accumulated at decoupling caused light released from the higher density spot to be red shifted. The red shift measured by WMAP was 74 micro-degrees for the dominate wave component. The author evaluated the spot temperature utilizing equations from Bennett [3]. The estimates below are for the spot size determined above with cluster mass estimated by density at decoupling times the spot volume.

		Spot Radius	Spot Volume		Volume at Decoupling	
		meters	m^3		m^3	
		4.61294E+21	4.11E+65		8.04E+68	
	Density decoupling=0.5*1.67E-27*EXP(180)/8.04e68				(Kg/m^3)	1.55E-18
		Spot mass = spot density* spot volume			Kg	6.36E+47
f(M/spot)=1+1/(1-(2*6.675e-11*Spot Mass/(spot dia*3e8^2)))^0.5-1						1.06E+00
	T(micro K)=(2.725-2.725/(1+(f(M/spot)-1)/2000))*1e6					75.49

This indicates that the temperature matches WMAP measurement of the peak wavelength when spot mass is similar to a cluster.

Conclusion

Using a cosmological model described as the many small surfaces model, expansion and the size of the universe was estimated to be 6.22e25 meters. This agrees with the “concordance model” used by the WMAP project. However, the authors approach allows one to understand what space is, what time is and the origin of the kinetic energy that drives expansion. Space is created by exp(180) cells of 7.35e-14 meters each expanding to universe size space. Equations were developed based on space expanding with time to the (2/3) power and a second expansion term with time to the (5/3) power. There is one proton like mass/cell and all cells are formed by identical laws. Inflation in this model is duplication by exp(180) supporting the cosmological principle.

The kinetic energy of expansion and the conversion to potential energy was examined with the cellular approach. The source of constants for gravitation and expansion kinetic energy was the proton mass model [1]. The R1+R3 expansion model initial kinetic energy was 9.8 MeV; enough to expand one half the cells to the present radius 0.50 meters against gravitational resisting force in a way that kinetic energy was converted to potential energy.

The second expansion component developed late when resisting forces were low. The calculated energy (known as dark energy) was negligible and the author believes that critical density estimates from the equation containing H^2=8/3 pi G rhoC must be revised downward to 2.47e-27 kg/m^3. Based on the author’s WMAP reanalysis, equality of matter and energy density occurs with 0.5*exp(180) normal protons/m^3. The finding that half the total mass was associated with hot baryonic matter was based on its contribution to the temperature curve. WMAP identifies components of the universe as dark energy (0.718), cold dark matter (0.235) and baryons (0.046). Reanalysis in this document make these values 0, 0.5 and 0.5 respectively.

The temperature curves initially differ from literature but two energy additions were identified that make the temperature curves match current observations. The important 6e-10 baryon/photon number ratio agrees with literature when photon density is based on photons+neutrinos+electrons.

Analysis of the spot angle in radians gives the accepted value of 0.0107 as does the spot temperature.

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1. Barbee, Gene. H., *A top down approach to fundamental interactions*, FQXi essay June 2012, revised Feb 2014, viXra:1307.0082. Reference Microsoft ® spreadsheet entitled Unifying concepts.xls, Barbee.
2. Barbee, Gene. H., *Application of information in the proton mass model to cosmology*, viXra:1307.0090 . revised Nov 2013. Reference Microsoft ® spreadsheet entitled simple1c.xls, Barbee.
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4. Peebles, P.J.E., *Principles of Physical Cosmology*, Princeton University Press, 1993.
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Appendix 1: Relationship between Quantum Scale Gravitational Fundamentals and Universe Size Space

Consider large mass M broken into exp(180) cells, each with the mass of a proton. Fill a large spherical volume with exp(180) small spheres. In general relativity the metric tensor is based on (ds^2). The surface area of a 2-sphere would be broken into many small spheres with an equal surface area. Let r represent the radius of each small cell and R represent the same surface area of one large sphere containing exp(180) cells. Position a proton on the surface of each cell (and one in the center?). The total energy will be that of 1 (or 2) protons/cell plus a small amount of kinetic energy. *At a particular time in expansion,* we may either consider the energy density of the whole or the energy density of the many cells. We will evaluate the energy density of large sphere and compare it with the energy density of many small cells.

Area=4 pi R^2
Area=4 pi r^2*exp(180)
A/A=1=R^2/(r^2*exp(180)
R^2=r^2*exp(180)
r=R/exp(90)
M=m*exp(180)

For gravitation, we consider velocity V, radius R and mass M as the variables that determine the geodesic. With G constant, M=m*exp(180) and R=r*exp(90) the gravitational constant would be calculated for large space and proton size space as follows:

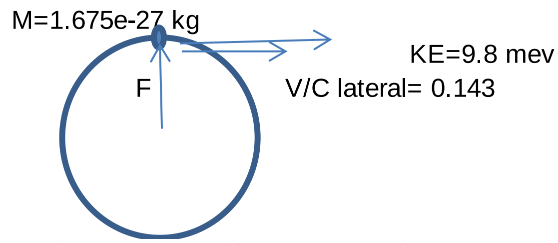
At any particular time in expansion

Large space		Cell size space
		With substitutions
RV^2/M=	G=G	r*exp(90) *v^2/(m*exp(180))
		(rv^2/m)/exp(90)

Note the value 1/exp(90). When measurements are made at the large scale as must be done to determine G, the above derivation indicates that we should apply the value 1/exp(90) to the quantum scale if we expect the same G. This may be surprising. It is generally accepted that the source of the gravitational constant (G) is the Planck scale. The fundamental relationship gives the Compton wavelength (for gravity the Planck length L), L= (\h*G/C^3)^.5 as a function of the reduced Planck or Heisenberg constant (\h pronounced hbar), G and C the speed of light. The Compton wavelength is 1.61e-35 meters and this is associated with the Planck energy 1.2e22 MeV. This energy scale is far above the energy of a proton and the space surrounding each proton after inflation is much above the Compton wavelength. However, gravity is known to be the geometry of space time. It is reasonable that there might be a simple explanation at a small scale that scales through geometry. One should note that this would allow gravity to be defined at a low radius, low energy scale and solve many problems with "quantum gravity".

Cell size space

The following diagram is the initial radius of one cell. The orbital kinetic energy (9.8 MeV) causes tangential velocity V/C=0.147. (Velocity is tangential because we are dealing with surfaces).



The values in the following table are believed to be the source of gravitation [1][6] at the cellular level:

Gravitational Constant

In large space the Newtonian equation F=GMM/r^2 gives the force between objects. For example two particles of mass 938.27 MeV (1.67e-27 kg) gives F=6.67e-11*(1.67e-27)^2/(7.35e-14)^2=3.46e-38 NT. Gravitation at the cellular level is described in reference 1 and 6. Note the equation below for the same force involves the small value 1/exp(90). Reference 1 indicates that this is the coupling constant for gravity.

			GRAVITY
			proton
Proton Mass (mev)			938.272
Proton Mass M (kg)			1.673E-27
Field Energy E (mev)			2.683
Kinetic Energy ke (mev)			9.720
Gamma (g)=M/(M+ke)			0.9897
Velocity Ratio	v/C=(1-(g)^2)^.5		0.1428
R=HC/(2pi)*(E*E)^.5			**7.3543E-14**
Inertial Force=(M/g*C^2/R)*1/EXP(90) NT			3.4524E-38
HC/(2pi)=1.97e-13 mev-m			
Calculation of gravitational constant G			
Inertial Force=(M/g*C^2/R)*1/EXP(90) NT			3.4524E-38
Radius R (Meters)			7.3543E-14
Mass M (kg)			1.673E-27
Gravitational Constant (G=F*R^2/M^2=NT m			6.67428E-11
			6.67428E-11
PE fall			19.34
KE orbit			9.720
F (NT) =PE/R=19.34*1.603e-13/7.3543e-14			3.4524E-38

The author believes that the radius 7.35e-14 meters is the fundamental radius of exp(180) cells that define the beginning radius of a large volume associated with the universe. As these cells expand to about 0.5 meters each they define a large radius of about 6.24e25 meters. The author also believes that the value 1.54e-21 sec defines fundamental time. As this value repeats, time increases.

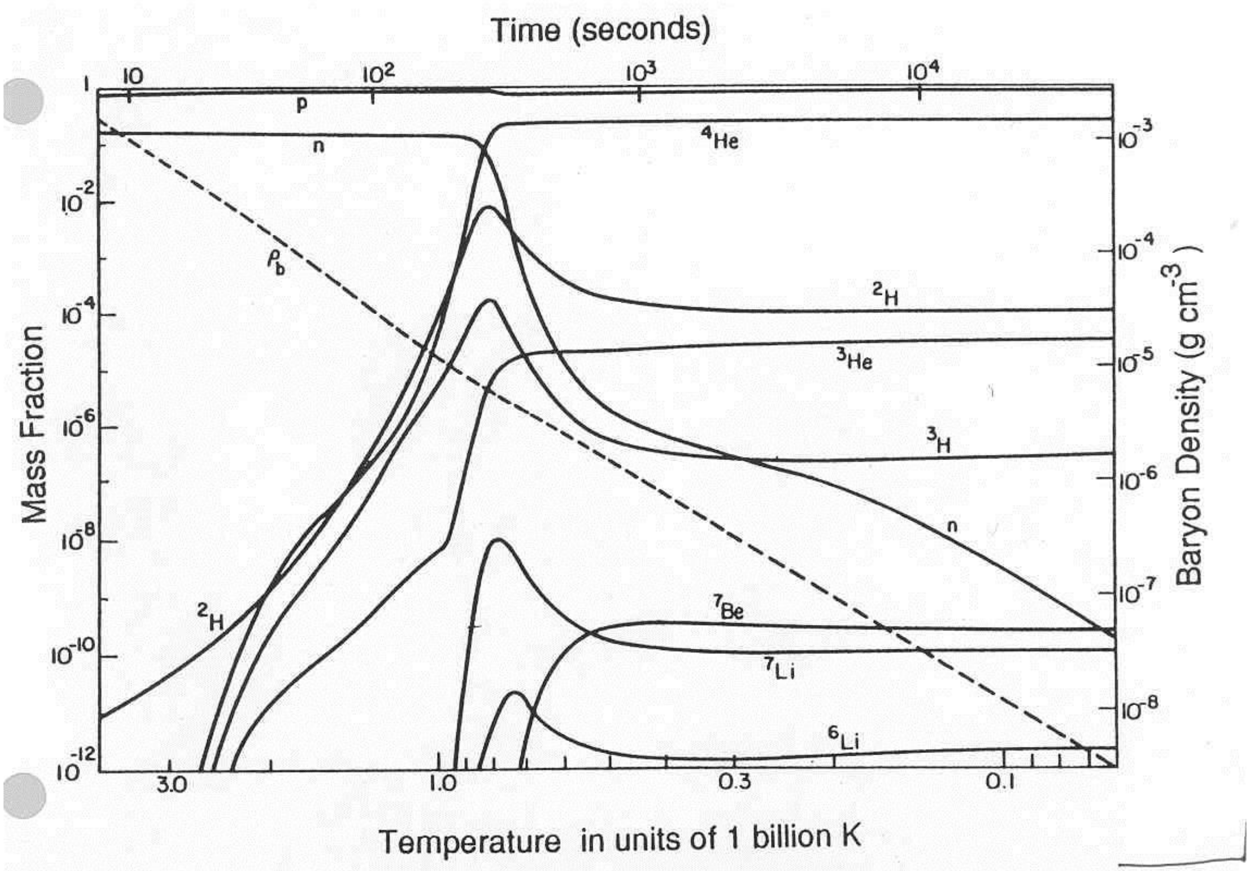
Appendix 2: Proton mass model

ell g228			Mass and Kinetic Energy					Field Energies	
mass	strong field	Energy-mev	Mass	Difference ke	Strong residual ke	Neutrinos	Expansion ke	Strong & E/M	Gravitation
ke	grav field		mev	mev	mev	mev	mev	field energy	Energy
15.432	17.432	753.291	101.947	641.880				-753.29	
12.432	10.432	0.687							-0.69
13.432	15.432	101.947	13.797	78.685				-101.95	
12.432	10.432	0.687							-0.69
13.432	15.432	101.947	13.797	78.685				-101.95	
12.432	10.432	0.687							-0.69
	-0.296	-2.72E-05			10.151		20.303	expansion pe	
charge	equal and opposite charge						0.000	expansion ke	
10.408	0.075		0.000	0.000	-0.671	0.671	v neutrino		
-10.333									
rates here to form proton and electron			129.541	799.251	**938.272013**	**PROTON MASS**			
10.136	10.333	0.62	**0.511**	0.111				5.44E-05	-0.622
0.197	0.296	2.72E-05	**ELECTRON**			2.47E-05	e neutrino		
			130.052	0.111		0.671	20.303	-957.185	-2.683
90.000	90.000				1.673E-27		Total m+ke	Total fields	
							Total positive	Total negative	
							959.868	-959.868	0.00E+00

For this paper, one important value above is 20.3 of expansion potential energy that forms an orbit with about 10 MeV of kinetic energy and 10 MeV of potential energy. Another value above is the difference between the neutron and proton mass, 1.293 that is made up of a neutrino of energy 0.671 and an electron with kinetic energy of 0.662 MeV. These are the missing energies that allow baryon fraction to be 0.5. The gravitational field energy 2.683 MeV is the basis of the fundamental radius 7.35e-14 meters.

Appendix 3: Literature time and temperature

The following graph is reproduced from literature showing primordial nucleosynthesis as a function of time and temperature. The temperature of about 1e9 K is the temperature in the graph agrees with the author's expansion temperature calculation of 1e9 K. Literature cites neutron decay and helium4 as temperature decreases and calculates the fraction 0.23 as an event related to "freeze-out", where the fusion reaction is quenched by lower temperature.



http://burro.astr.cwru.edu/Academics/Astr222/Cosmo/Early/nucleosynth_fig.jpg