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Application of proton mass model to cosmology

Abstract

Historically, a culture's cosmology was an explanation of the origin and a justification for its most significant beliefs. Scientists are actively engaged in understanding new observations regarding our universe. There is agreement that achieving a new level of understanding may require an extension to what has been observed to date about fundamental interactions, matter and energy. This paper is a summary of work by the author building on the best measurements made by physicists, astronomers and cosmologists. Of specific interest are the topics of force unification, gravitational theory, definition of space and time, dark energy and cold dark matter. Of course these are technical matters but the author addresses what this means to life and what it is reasonable to believe regarding philosophy's "enduring questions". The following documents are summarized:

A Top-Down Approach to Fundamental Interactions **[1]**

Starting with data from WMAP [11] that allows an estimate of the number of protons in the universe (exp(180), where exp stands for natural number 2.712^(180) the author explored how this number is used by nature to represent fundamental particles. This reference described models for the neutron and proton mass based on Shannon type information theory. In addition, it proposed a way of unifying the electromagnetic, weak, strong and gravitational forces.

On the Source of the Gravitational Constant at the Low Energy Scale **[18]**

This document summarizes arguments for a low energy gravitational scale and offered an understanding of the weak and long range character of gravitation. Physics has struggled with the reconciliation of general relativity with the other fundamental interactions (strong force, weak force and electromagnetic force). The reason for the difficulty is that general relativity and gravitation is the geometry of space and time and does not appear to originate at a reasonable energy at the quantum level. The accepted gravitational theory had the energy scale far above the energy of a proton. The author proposed a lower energy scale and offered a relationship between the quantum scale and the scale of the universe that appears to resolve this conflict.

On Expansion Energy, Dark Energy and Missing Mass **[2]**

This document summarizes and extends this theoretical groundwork to the field of cosmology. Information from the proton mass model is applied to the beginning, expansion of the universe and observables from the field of astronomy. The fundamentals of space and time are described including the relationships that accurately model expansion, temperature, gravitational history and helium abundance. Results from an expansion model are compared to values reported in WMAP analysis and CMAGIC studies [14]. Three models of expansion are compared and a proposal regarding dark matter is discussed. Reference 2 analyzed the kinetic and potential energy changes during expansion and showed that there is no dark energy (dark energy fraction is 0). Furthermore, information is presented that questions the WMAP conclusion that only 0.046 of the universe is normal protons. Based on this document, it appears that the baryon (proton) fraction is 0.5 and the cold dark matter fraction is 0.5.

***A Simple Model of Atomic Binding Energy* [20]**

The purpose of this document is to support the value 10.15 mev from the proton mass model. This is the value that changes and causes the atomic binding energy curve [9]. The model presented is a probabilistic model that follows the same fundamentals of reference 1.

***Semi-Fundamental Abundance of the Elements* [19]**

This document again is offered as support for the proton mass model and the model of atomic binding energy. It provides a probabilistic model of fusion using barrier energy from the binding energy curve model. It models the abundance of the elements produced during the life cycle of stars [8][10].

***Baryon and Meson Masses Based on Natural Frequency Components* [3]**

The purpose of this document is to extend the approach used to develop the proton mass model to data gathered for the hundreds of mesons and baryons observed at high energy labs [7]. Although the work is somewhat tentative most of the particles have "mirror" particles that allow nature to balance properties to zero (particles with properties can be created from zero only if there is a "mirror" particle). This supports the author's view that one-half of the mass in the universe is protons and the other half is cold dark matter.

***The Effect of He4 Fusion on Primordial Deuterium* [25]**

The baryon mass fraction from reference [2] is 0.5. Literature regarding primordial nucleosynthesis was reviewed that states that measured primordial deuterium is a sensitive test that limits the baryon mass fraction to 0.04. Surprisingly literature does not account for He4 fusion which releases approximately 1.6 mev. When this energy is added to temperature curves for early expansion the temperature increases and deuterium photo-disintegrates. However, as the temperature finally falls due to expansion deuterium production recovers to the measured values. Calculations also show that the photon/baryon number ratio does not restrict the baryon fraction from reaching 0.5.

The proton mass model

Nature uses information operations on the value exp(90) to create components of nature such as electrons, neutrinos and quarks that are inside atoms. The operations are described in detail in reference 1 and are summarized below. Operations divide the natural logarithm 90 into smaller information units called N that always add to 90. Information unit N= - ln P=1/ln P were P is a probability. Where these operations originate is unknown but one way to think about them is as a code that underlies physical existence. The first operation creates the four dimensions of the universe (three distance dimensions and one time dimension). The number 0.0986 = ln(3/e) is associated with electromagnetic charge (3*0.0986=0.295) and the value 10.333 at the bottom of the table becomes an electron with N=10.333-0.295=10.136. The quarks are identifiable with N=15.431, 12.431 and 12.431. The N value 12.431 is a kinetic energy operator.

		Operation 1	Operation 2&3	Operation 4		Operation	Fundamental N values	
Higgs X dimension		22.5	10.167	5.167	15.333	0.0986	15.432	
			12.333		12.333	0.0986	12.432	
Higgs Y dimension		22.5	10.167	3.167	13.333	0.0986	13.432	
			12.333		12.333	0.0986	12.432	
Higgs Z dimension		22.5	10.167	3.167	13.333	0.0986	13.432	
			12.333		12.333	0.0986	12.432	
			0.667		0.667	0.0750	0.075	
Time		22.5	11.500					
			10.333		10.333		10.333	
Total		90	90		90		90	

How do we know the energy associated with N above? Once we recognize the electron N=10.136 we do the following calculation based on the measured energy of the electron, 0.5109989 mev (Data source is the Particle Data Group or PDG [7]).

E=eo*exp(N)
eo=E/exp(N)=0.511 mev/exp(10.136)=2.025e-5 mev.
And we can use the same relationship to find the energy of all the other particles.

How do know that E=2.025e-5 mev*exp(N)? Again the basic relationship is P=1/exp(N). We recognize that e0/E is a probability and this makes e0/E=P=1/exp(N) and E=e0*exp(N). There is also a parallel with thermodynamics and information theory.

Energy data for other particles [6][7][13] is shown below. Firstly we calculate N from N=ln (E/e0), they we look at the series generated and compare it with the code above. We recognize a logarithmic pattern with the quarks separated by N=4 and we recognize the Higgs that was measured as 129000 mev in July 2012. The bosons are variations on N=22.

unifying concepts.xls cell aw48			Proposed	IS Hughes
		Particle Data	Energy	Bergstrom
		Group energy	E=eo*exp	Randall
Identifier	N	(Mev)	(Mev)	energy
			e0=2.02e-	(Mev)
0.0986	0.0986			
e neutrinc	0.197	2.00E-06	2.47E-05	3.00E-06
E/M Field	0.296	0.0000272	2.72E-05	
	(3*.0986=.296)			
ELECTRO	10.136	0.51099891	0.511	
mu neutri	10.408	0.19	0.671	less than 0.2
Graviton*		1.75E-26	2.732	
Up Quark	11.432	1.5 to 3	1.867	1.5 to 4.5
E Op	12.432		5.076	
Down Qua	13.432	3 to 7	13.797	5 to 8.5
Strange q	15.432	95+/-25	101.947	80 to 155
Charmed	17.432	1200+/-90	753.29	1000 to1400
Bottom Qu	19.432	4200+/-70	5566.11	4220
Top Quarl	21.432		41128.30	40000
W+,w- bos	22.099	80399	80106.98	81000
Z	22.235	91188	91787.1	91182
HIGGS	22.575	125300	128992.0	105000
* sum of 3 Ns of 10.431+10.408 (2.73/exp(60)=2.4e-26 mev)				
Mw/Mz	Weinberg radians		sin^2 theta	
0.87275	0.509993	0.48817152	0.23831	

Quantum mechanics uses circles (the time for a wave to travel around the circumference of a circle is t=2pi/C, where C is the speed of light) to describe fundamental energy quanta. The author found that the following “energy interaction” produces the same result.

								Results of the above energy interaction				
									(difference ke)			
									E3+E4-E1-E2		E3 field1	
		mev			mev			E1 mass	ke	E2 ke		E4 field2
		E=e0*exp(N)			E=e0*exp(N)			mev	mev	mev	mev	mev
N1	13.43	13.80	E1 mass	N3	15.43	101.95	E3 field	13.80	83.76	5.08	-101.95	
N2	12.43	5.08	E2 ke	N4	10.43	0.69	E4 field					-0.69
								Sum of energy from above table				
N1,N3,N2,N4 are defined as a Quad								E1+difference ke		102.63	E3+E4	-102.63
								Energy is conserved since 102.634=102.634				

Here, the kinetic energy operator N=12.431 is put into action. The associated energy=2.025e-5*exp(12.431)=5.01 mev. The energy interaction is similar to gauge invariance by giving a particle kinetic energy to travel around the circle. Waves are energy quanta when the square root of probability is psi=exp(+iv dt) and psic=exp(-iv dt) and i is the imaginary number. P=psi*psic is associated with one *complete* circle and frequency v is 1/time to complete the circle.

The time for one cycle of the wave is 2*pi*R/C since the wave moves at C (R is the radius of a circle).						
2*pi*R/C=1/frequency						
2*pi*R/C=H/E		where H=Heisenberg's Constant 4.136e-21 mev-sec.				
Using the same example as detailed in operation 6:						
Field energy E		101.947	mev			
2*pi*R/C	time	4.057E-23	seconds			
H/E	time	4.057E-23	seconds	mev-meters		
R=H*C/(2*pi)/E		1.936E-15	meters	E in the equation to the left can also be:		
				E=(E*E')^.5=(E*m/g)^.5		
convenient constant: HC/(2*pi)=1.973e-13 mev-meters				because in the equation to the left, E'=m/g=13.977/.1353		
			1.973E-13	(E*m/g)^.5=E=(101.947*13.797/.1353)^.5		
Substitute (E*m/g)^.5 for E in the above equation to give an equation for radius involving mass, field energy and gamma						
R=(HC/(2pi)/(E*m/g)^0.5		This equation represents a force balanced orbit with kinetic energy 0.5*field energy.				
		It is also accurate for orbits determined by energy balances as demonstrated below.				
	From operation 6 definitions and the operation 6 example.					
Field energy E		101.947	mev			
mass (m)		13.7970	mev	mass divided by g is equivalent to the field		
ke		88.150	mev	Instead of g=1/exp(2) gamma can be defined from ke		
gamma (g)	g=1/exp(2)	0.13534			g=(m/(m+ke))	0.13534
v/C	v/C=(1-(g)^2)^0.5	0.9908	297034325.2			101.9469
v/c		1.9356E-15	R=(HC/(2pi)/(E*E)^0.5			
R	meters	1.9356E-15	R=(HC/(2pi)/(E*m/g)^0.5			
	The following conversion constant converts mev to kg:				1.783E-30	kg/mev
	Convert mev to newton-meters with the following conversion constant:					
	Check the force balance:					
	Inertial:	F=m/g*C^2/R	8438.623	newtons		Ef=F*R=m+ke=m/g*C
1	Field	F=E/R	8438.623	newtons		
			8438.623	newtons		

Actually, if we didn't know Heisenberg's constant H, we could calculate it from the above circle recognizing that a wave traveling around the circle has energy. That is: H=2pi*R/C*E=4.136e-21 mev-sec. Heisenberg's constant is a fundamental value in quantum mechanics.

The Proton Mass Model

Next assemble the components into a model of the proton. Literature indicates that there are three quarks in the proton but the energies are thought to be lower. To use the above component energies, we guess that the quarks are at higher energy and have transitioned to lower values while preserving mass plus kinetic energy. The values toward the left side of the box, labeled mass and kinetic energy are balanced by fields on the right hand side of the box. Reference 1 N values (13.431, 12.431, 15.431 and 10.431) are shown to the left of the box. These values are the source of the energies inside the box. Four values like the ones described above make one "quad" that describes the quark orbit and its associated field energies. The kinetic energy column has several components. Kinetic energy for each quad =E3+E4-E1-E2-E2, using the nomenclature above labeled Operation 6. The extra E2's are added back to form the column weak kinetic energy (10.15 mev) and gravitational expansion energy (20.3 mev). The bottom quad is for the electron after it has decayed from the neutron. The balancing neutrinos and energies play crucial roles in cosmology.

Unified.xls cell g191										
					Mass, Kinetic Energy and Fields for Neutron					
										Gravitational
N for Neutron Energy Interactions							Residual ke	Expansion		Field
mass	Energy-mev	S field	Energy	Mass	Difference KE			KE	Strong field	
ke		G field	mev	mev	mev		mev	mev	MeV	MeV
15.43	101.95	17.43	753.29	101.95	641.88				-753.29	
12.43	5.08	10.43	0.69							-0.69
13.43	13.80	15.43	101.95	13.80	78.69				-101.95	
12.43	5.08	10.43	0.69							-0.69
13.43	13.80	15.43	101.95	13.80	78.69				-101.95	
12.43	5.08	10.43	0.69							-0.69
							10.15	10.15		
-10.33	-0.62	-10.33	-0.62	0.00	0.00			10.15		-0.67
10.41	0.67	10.41	0.67				0.048			
10.33	0.62	10.33	0.62	0.62	0.00					
0.00	0.00	0.00	0.00							
				130.16	799.25	939.57	**0.048**	20.30	-957.18	-2.73
90.00	sum	90.00				NEUTRON MASS		Total m+k	Total fields	
								Total posi	Total negative	
								959.916	-959.92	
								MeV	MeV	

Add the quarks together:

	Mass and Kinetic Energy			**Field energy**		
	Mass	**ke**		**Strong**	**Gravitational**	
				field ener	**Energy**	
	MeV	**MeV**		**MeV**	**MeV**	
Quark S	**101.947**	**641.880**		**-753.291**	**-0.687**	
Quark U	**13.797**	**78.685**		**-101.947**	**-0.687**	
Quark D	**13.797**	**78.685**		**-101.947**	**-0.687**	
	129.541	**799.251**		**-957.185**	**-2.061**	

Simplify the Neutron Table:

Simple neutron model

r20 uc2

	Mass and Kinetic Energy			Field energy	
	Mass	**KE**	**Strong**	**Strong**	**Gravitational**
	Quarks		**Residual**	**field ener(**	**Energy**
	MeV	**MeV**	**Field**	**MeV**	**MeV**
Strong	**130.16**	**799.25**		**-957.18**	-2.73
Strong Residual KE		**10.15**			
Neutron		**939.57**	**-20.35**		-959.92
neutrinos		0.05			
Gravitational ke		**10.15**			
Gravitational pe		**10.15**			
Total		959.92			

The neutron decays to a proton by emitting a neutrino energy 0.671 and separating the electron quad of value 0.622 Mev. The proton has 957.59 Mev minus 1.293 (0.671+0.622) MeV and has energy 938.272 MeV. The three quark masses total 129.5 mev and together have 799.2 mev plus 10.15 mev of kinetic energy minus one neutrino of energy 0.671 mev. These components give the proton mass (938.27 mev).

	129.541	**799.251**	**-0.671**	
		10.151		
Proton		**938.272**	**Mev**	

	Mass and Kinetic Energy			Field energy	
	Mass	KE	Strong Residua	Strong field energy	Gravitational Energy
	MeV	MeV		MeV	MeV
Strong	130.16	799.25		-957.18	-2.73
Strong Residua		10.15			
Neutron		939.57	-20.30		-959.92
below, the Neutron decays to a proton, electron and neutrino					
neutrinos		0.05			
Proton		938.27		2.72E-05	
ejected neutrino		0.67		E/M charge splits	
Electron	0.51	0.11		-2.72E-05	
Gravitational k		10.15	10.11		
Gravitational p		10.15	10.19		
Total		959.92			

The proton is thought to be a primary manifestation of the underlying laws and as such contains information that determines many aspects of nature. The proton model above is the source of constants for unification of forces, the subject of reference 1. This table gives the mass, kinetic energy and fields for fundamental constants. Gamma is g=m/(m+Ke) and R=hC/(field energy*mass/g)^.5 (small h sometimes called hbar is H/(2*pi)). The important values for gravity are the mass of the proton with 10.15 mev of kinetic energy imbedded in a field energy of 2.732 mev. The residual strong force (related to the weak interaction) is determined by a mass of 928.792 mev, a kinetic energy of 10.15 and a field energy of 20.3 mev. This field energy is the missing energy required to balance 959.92 mev with balancing field energies totaling 959.92 mev. (Overall the energy is zero by being balanced since there are no negative energies). An orbit is formed by a “bundle of quarks” with kinetic energy 10.15 mev orbiting in field energy 20.3 mev. .

	Mass (m)	Ke	gamma (g	R	Field (E
	(mev)	(mev)		meters	(mev)
Gravity	938.272	10.110	0.9893	7.2238E-14	-2.732
Electromagn	0.511	1.36E-05	0.99997	5.2911E-11	-2.72E-05
Strong	129.541	798.580	0.1396	2.0936E-16	-957.18
Strong residu	928.121	10.151	0.9892	1.4297E-15	-20.303

Before considering gravitation more thoroughly, it is instructive to review other interactions supported by information extracted from the proton mass model. An updated table from [1] is reproduced below:

Unification Table		**cell ax74**		**Strong**		**Electromagn**	**Gravity**
Higgs energy (mev)				**Combined**	**Strong Residual**		**proton**
*****Field coupling to Higgs field Energy**							
	Potential energy of proton falling into gravitational field (mev)						**20.115**
Field Energy E (mev)				**957.18**	**20.303**	**2.72173E-05**	**2.732**
Mass Coupling to Higgs field energy							
Particle Mass (mev)				**130.16**	**928.121**	**0.511**	**938.272**
Mass M (kg)				**2.32E-28**	**1.65E-27**	**9.11E-31**	**1.6726E-27**
Kinetic Energy (mev)				**798.58**	**10.151**	**1.361E-05**	**10.111**
	Rydberg energy from PDG					**1.361E-05**	
Gamma (g)=m/(m+ke)				**0.1401**	**0.9892**	**0.99997**	**0.9893**
Velocity Ratio		**v/C=(1-(g)^2)^.5**		**0.9901**	**0.1467**	**7.298E-03**	**0.1456**
R (meters) =((HC/(2pi)/(E*M/g)^0.5)				**2.0929E-16**	**1.4297E-15**	**5.291E-11**	**7.2238E-14**
Electromagnetic R minus proton R=5.291627e-11-1.4297e-15						**5.291E-11**	
Force	**Newtons**	**F=E/R*1.6022e-13**		**732765.9**	**2275.2**	**8.242E-08**	**3.6556E-38**
						7.250E-09	**7.2238E-14**
Inertial F	**Newtons**	**F=M/g*V^2/R**		**710992.321**	**2262.86246**	**8.241E-08**	**3.6556E-38**
Force=HC/(2pi)/R^2=3.16e-26/Range^2 (n				**721797.0**	**15466.9**	**1.129E-05**	
HC/(2pi)	**3.16E-26**	**(4.13e-21*3e8*6.24e12/(2*pi())**					
	F=(5.907e-39)*hC/R^2 (nt)						**3.5786E-38**
	F=6.67428*m^2/R^2						**3.5782E-38**
Coupling constant derived from this work				**1.0152**	**0.147099**	**137.03047**	**1/exp(90)**
Derived c^2 (E*R) mev m				**2.00E-13**	**2.90E-14**	**1.44E-15**	**1.19E-51**
Derived c^2 joule m				**3.21E-26**	**4.65E-27**	**2.31E-28**	**1.91E-64**
Derived exchange boson (mev)				**942.856**	**138.02**	**0.0037**	**2.732E+00**
***published c^2 mev m**					**1.56E-14**	**1.44E-15**	**1.17E-51**
***published c^2 joule m**					**2.5E-27**	**2.31E-28**	**1.87E-64**
***Range**						**5.29E-11**	**8.82E+25**
***http://www.lbl.gov/abc/wallchart/chapters/04/1.html**						**5.29177E-11**	
Published coupling constant (PDG)				**Rydberg data from PDG**		**137.03599**	

The field energies for three strong (color) interactions and their associated particles are from the proton mass table. They are referenced to the Higgs energy since it is considered by many to be the source of field energies and particle masses. A force coupling constant is calculated to be 1.00 and derived c^2 (E*R) values are presented in MeV-m and joule-m. The author did not find published values for comparison (quarks are not independently observable). The lower hierarchy electromagnetic coupling constant is well known and the author's calculations substantially agree.

The traditional relationship F=hC/R^2 is too simple to characterize gravity since gravity involves defining a radius and a proton with potential energy falling to that radius. Justification for replacing the coupling constant with the value 1/exp(90) is presented below.

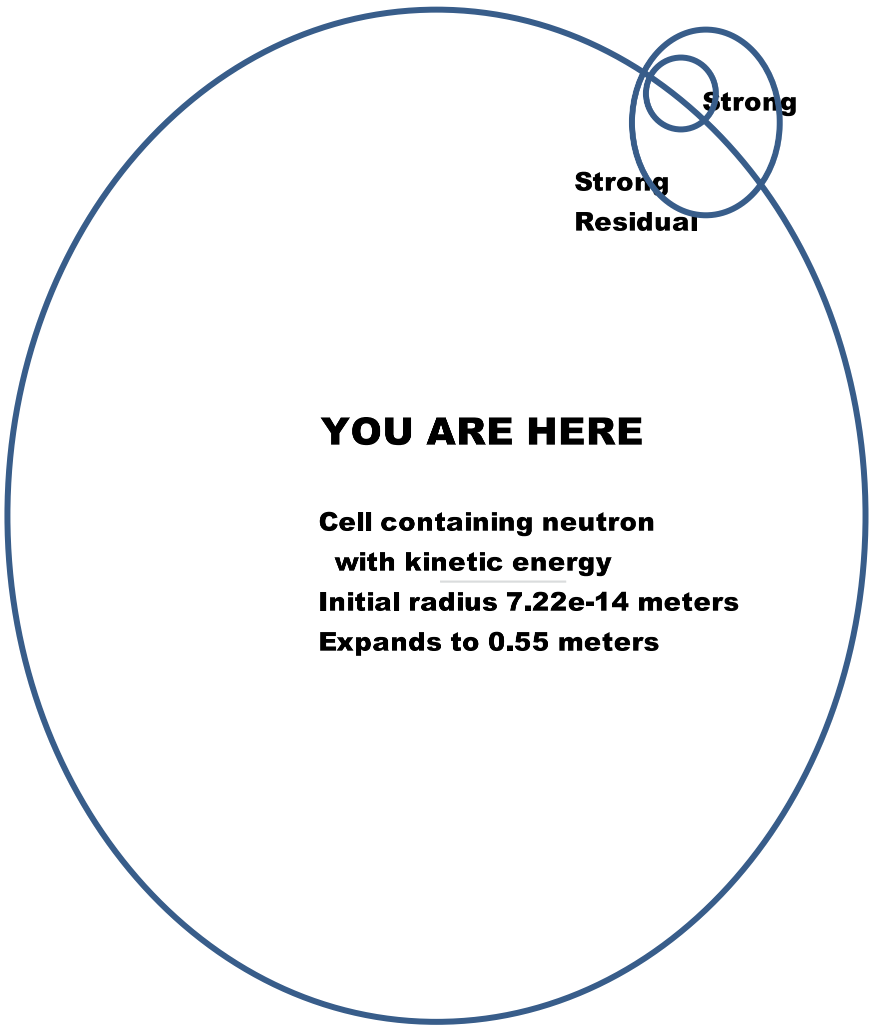
The atomic binding energy curve is considered to be a result of the strong residual interaction. Again, the proton mass model provides information. The key value is the kinetic energy 10.151 MeV associated with the proton. The strong residual force F=hC/R^2= 15467 NT requires the coupling constant 0.147 and the derived c^2= 2.9e-14 MeV m is similar to the published value 1.56e-14 MeV m. Also the radius of the proton appears to be credible. Reference 9 describes a simple model using the value 10.15 MeV as the basis for binding energy. In this model 10.15 MeV is the kinetic energy that changes as atoms fuse. (928.121 MeV+10.151 MeV =938.272 MeV).

Fundamental gravitational radius

Identify the radius and time for the gravitational orbit described above			
Fundamental radius=1.93e-13/(2.732*2.732)^.5=7.224e-14 meters			
Fundamental time=7.224e-14*2*PI()/(3e8)=h/E=4.13e-21/2.732			
Fundamental time	1.514E-21	seconds	

The equations above are basic to quantum mechanics. Of particular interest is the equation R=const/(E*E)^.5. In most cases one of the E's in the equation takes on the value mass/gamma. Gamma=(1-(v/C)^2)^0.5 where v is the velocity of the particle over the speed of light C). The author will refer to this equation as the R equation with the constant HC/(2*pi)=1.973e-13 mev-m. The R equation is central to fundamental forces with different inputs, all derived from the model of the proton above.

The specific R=7.22e-14 meters calculated above is of extreme interest. It is fundamental to space and the starting point for expansion. The author believes that the space we walk around in is expanded from exp(180) cells of radius r=7.22e-14 meters.



Proposed Model for Expansion of the Universe

For gravity and cosmology take into account the large number of particles in the universe. (exp(180) neutrons that decay to protons). For purposes of our discussion on cosmology it is preferable to consider a filled sphere since it what we observation. Rather than the surface of one large sphere, consider the equivalent cumulative volume of exp(180) small spheres each of radius 7.22e-14 meters. The radius of the large sphere R is small r*exp(60) by the following math:

4/3*pi*7.22e-14^3*exp(180)=4/3*pi*R^3
R=r*exp(60)

In general relativity the metric tensor is based on (ds^2). The surface area of a 2-sphere may be broken into many small spheres with an equal surface area. Let r represent the radius of a many small spheres (we will call these cells) and R represent the same surface area of one large sphere containing exp(180) cells. Position a proton on the surface of each cell. The total mass is m*exp(180). The total energy will be that of one protons/cell plus a small amount of kinetic energy.

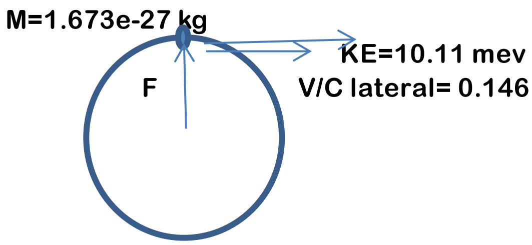
	Area=4 pi R^2	
	Area=4 pi r^2*exp(180)	
	A/A=1=R^2/(r^2*exp(180)	
30)	R^2=r^2*exp(180)	
	R=r*exp(90)	
	M=m*exp(180)	

At any time during expansion		
Large space		**Cellular Space**
		With substitutions:
		R=r*exp(90) and M=m*exp(180)
R*V^2/M=	**G=G**	**r*exp(90)*V^2/(m*exp(180))**
R*V^2/M=	**G=G**	**(r*v^2/m)/exp(90)**

For cells, G=r v^2/m/exp(90).
Reference 1 shows that the value 1/exp(90) is actually the gravitational coupling constant.
Appendix 3 provides an example time dilation calculation for cells using exp(90) to make time dilation equivalent for general relativity and special relativity.

Gravitational constant fundamentals for cell size space

A fundamental gravitational radius r= 7.22e-14 meters. This equation and maintaining geodesics that give the gravitational constant G=6.674e-11 nt m^2/kg^2 define the geometry of space time. Mass follows and defines the geodesic by establishing an inertial force F=mV^2/R. For gravity the inputs are the mass of the proton (938.27 mev) and kinetic energy slightly lower than the available 10.15 mev. An "orbit" is established when the above kinetic energy of 10.11 mev imparts a velocity of 0.146 C to the mass 938.27 mev. The gravitational constant is calculated with the inertial force and the radius 7.22e-14 meters. The diagram below shows the fundamentals:



GRAVITY			
		proton	neutron
Neutron Mass (mev)		**938.2720**	**939.565**
Neutron Mass M (kg)		**1.673E-27**	**1.675E-27**
Field Energy E (mev)		**2.732**	**2.732**
Kinetic Energy ke (mev)		**10.111**	**10.140**
Gamma (g)=M/(M+ke)		**0.9893**	**0.9893**
Velocity Ratio v/C=(1-g^2)^0.5		**0.1456**	**0.1457**
R (meters) =(HC/(2pi)/(E*E)^0.5		**7.224E-14**	**7.224E-14**
Inertial Force (F)=(M/g*V^2/R)*1/EXP(90) NT		**3.656E-38**	**3.666E-38**
HC/(2pi)=1.97e-13 mev-m			
Calculation of gravitational constant G			
G=F*R^2/(M/g^2)=NT m^2/kg^2		**6.6739E-11**	**6.6743E-11**
Published by Partical Data Group (PDG)		**6.67E-11**	**6.6743E-11**

Published value of G (PDG)=6.6743e-11 nt m^2/kg^2. More details including examples for gravitation are included in references 1 and 2.

Expansion

Inflation in the author’s models is represented by duplication of one particle by a factor of exp(180). As duplication occurs, the lowest meaningful gravitational radius at the “edge” would be an initial radius of 7.22e-14 multiplied by exp(60)=8.24e12 meter. (exp(60) is exp(180)^.333 for three dimensions).

The following derivation uses the concept that kinetic energy is converted to potential energy during expansion. The reason to show this derivation is to justify the use of time to the power 2/3 as the basis for expansion. Time will be expressed as a ratio, g=time/alpha time.

Nomenclature

(all calculations are MKS)
t-time
g=dimensionless time=time/alpha time
Lower case r is a cell radius
Upper case R=r*exp(60)
R1 radius is first expansion component
R3 radius is second expansion component
H3 is Hubble's constant for R3

First expansion component; R1
(r/r0)^3 increases as (t/alpha)^2 (kinetic energy requirement)
r=r0*g^(2/3)
R=r0*exp(60)*g^(2/3)
r0=1.93e-13/(2.723*2.723)^.5=7.22e-14 m
R1=(7.22e-14*exp(60))*g^(2/3)

Second expansion component: R3
dr/(r*dt)=H3
dr=H3*r*dt
dr=H3*alpha*r *dg (dt=alpha dg)
dr=H3*alpha*r0*g^(2/3) *dg
r=H3*alpha*r0*g^(5/3)/1.6666
R3=H3*alpha*(7.35e-14*exp(60))*g^(5/3)/1.666

r1+r3=(7.22e-14)*g^(2/3)+(7.22e-14)*g^(5/3)*H1*alpha/1.666
R1+R3=r1*exp(60)+r3*exp(60)
t=alpha*(R1/7.22e-14)^(3/2)
(R1/7.22e-14)^(3/2)=g=t/alpha

Integral dr adds a late stage term that expands with time, after integration, raised to the power (5/3). It is included in the derivation and is evaluated with the Hubble constant H. This is similar to the controversial cosmological constant that is now included in documents such as the WMAP analysis [17]. The second component of expansion also depends of time. After integration this component involves a higher power of time and becomes important near the end of the expansion. The author will use time^(2/3) and time^(5/3) but considers each proton's cell as expanding space. The full expansion equations are shown below in the heading "making proton size space into universe size space". Appendix 1 evaluates the constant H1 and alpha.

Lateral kinetic energy during expansion

The following analysis shows what happens to orbital kinetic energy as G=rV^2/M remains constant and r expands to R. Lateral velocity (because we are dealing with surfaces) of the “orbiting” proton V falls to v as r becomes R. Orbiting is in quotes because this is also a model. The beginning involves high temperature associated with this kinetic energy and since a plasma exists, one should not expect a neat orbit.

G remains constant G=rv^2/(M)		
RV^2/(M/g)=rv^2/(M/g0)	RV^2/M=rv^2	10.11 ke
RV^2*g=rv^2*g0	RV^2=rv^2	↓
(v/V)^2=(r/R)*g0/g	(v/V)^2=(r/R)	
(v/V)=(r/R)^.5*(g0/g)^.5		
ke=ke0*(r/R)	Ke decreases with r	

The expansion equations and the above analysis are put into action below to predict expansion and show that the gravitational constant remains almost constant during expansion.

R1+R3 expansion simulation

alpha (initial time in sec		0.0529	Start		
logarithm used to increase time (LN)			45	45.24475	45.4895
time–seconds		EXP(LN)*1.54e-21	0.0528905	0.06756	0.086291
t fundamental		1.51E-21	1.514E-21	1.51E-21	1.51E-21
g time rati	1	time/alpha	1	1.28E+00	1.6315
				2.14E-09	2.74E-09
Cell radius	**7.22E-14**	**R=R1+R3**	**7.22E-14**	**8.50E-14**	**1.00E-13**
1.334E-18		R1	7.22E-14	8.504E-14	1.001E-13
		R3	7.11E-33	1.07E-32	1.61E-32
R universe	6.163E+25	(R1+R3)*exp(60)	8.25E+12	9.71E+12	1.14E+13
			0	3.05E+07	2.81E+07
Proton	938.27	mass mev	938.272	938.272	938.272
0.987	0.9893	gamma (g)	0.9893	0.9909	0.9923
ke orbit	10.111	mev	10.11	8.59	7.28
V/C orbit	0.1456		0.1456	0.1344	0.1239
velocity	3.00E+08	m/sec	4.37E+07	4.03E+07	3.71E+07
Fgravity (nt)		F=M V^2/R/exp(90	3.66E-38	2.64E-38	1.90E-38
G at end		G=F/M^2*R^2	6.67E-11	6.70E-11	6.71E-11
KE+PE			10.111	10.089	10.060
Dark energy PE		FINAL PE Mev	1.1025E-12	1.02E-12	9.37E-13
Pe=Pe+dPE=Pe+Fi dR/2			0.00E+00	1.50E+00	2.78E+00

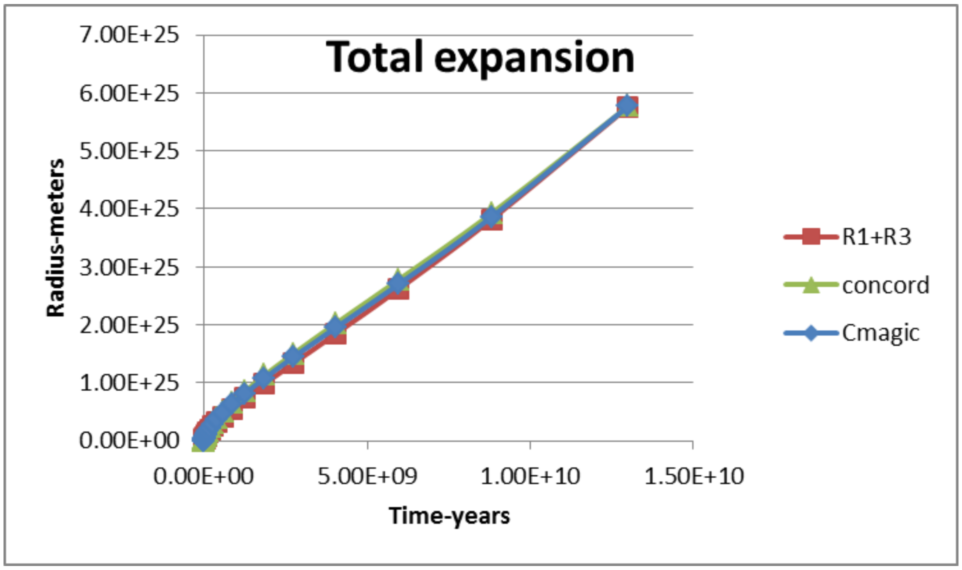
R1+R3 is estimated to be about 6.2e25 meters at 14 billion years. The column labeled NOW is for measured value H= 2.29e-18/sec and H1 and H3 are highlighted to the right.

alpha (initial time in sec		0.0529	Start	Last few ste	NOW	
logarithm used to increase time (LN)			45	88.32075	88.5655	
time–seconds		EXP(LN)*1.54e-21	0.0528905	3.45E+17	4.4E+17	
t fundamental		1.51E-21	1.514E-21	1.51E-21	1.51E-21	
g time rati	1	time/alpha	1	6.52E+18	8.32E+18	2.29E-18
Cell radius	7.22E-14	R=R1+R3	7.22E-14	4.14E-01	5.40E-01	
1.334E-18		R1	7.22E-14	2.520E-01	2.967E-01	1.33E-18
		R3	7.11E-33	1.62E-01	2.43E-01	3.30E-18
R universe	6.163E+25	(R1+R3)*exp(60)	8.25E+12	4.72E+25	6.16E+25	2.29E-18
			0	1.41E+08	1.51E+08	
Proton	938.27	mass mev	938.272	938.272	938.272	
0.987	0.9893	gamma (g)	0.9893	1.0000	1.0000	
ke orbit	10.111	mev	10.11	1.75E-12	1.34E-12	
V/C orbit	0.1456		0.1456	2.87E-12	2.44E-12	
velocity	3.00E+08	m/sec	4.37E+07	18.29	16.01	
Fgravity (nt)		F=M V^2/R/exp(90	3.66E-38	1.11E-63	6.51E-64	
G at end		G=F/M^2*R^2	6.67E-11	6.78E-11	6.78E-11	
KE+PE			10.111	9.985	9.985	
Dark energy PE		FINAL PE Mev	1.1025E-12	9.83E-12	1.13E-11	
Pe=Pe+dPE=Pe+Fi dR/2			0.00E+00	9.98E+00	9.98E+00	

Several things should be noted about the simulation. The column labeled now is consistent with the WMAP Hubble's constant 2.26e-18/sec. The initial kinetic energy of 10.11 mev is diminished by expansion and in the column labeled now is only 1.42e-12 mev but the potential energy (highlighted in gold) increased to 9.86 mev. The velocity of expansion for each cell is about 16 m/sec when the cell radius is 0.54 meters.
This expansion history will be compared with other models in the section entitled "Comparison of Expansion Models" below.

The Concordance Model
Results from WMAP support incremental expansion equations that have become known as the concordance model. There are three parts to the equations, starting with an incremental calculation that updates the radius as a function of the distance increased over a certain velocity and time. The velocity is the second part of the equation and contains parameters such as 0.235 mass fraction and "critical" mass density 9.5e-27 mev/m^3. The third part of the equation is an accelerating velocity addition to accommodate a universe containing an unknown dark energy that appears to be accelerating expansion. The radius "now" (6.2e25 meters) agrees with a measured Hubble constant of 69.7 [21] m/sec/mega parsec (2.26e-18/sec).
A graph of the expansion radius for the author's model (referred to as R1+R3) as a function of time is compared below to the model resulting from WMAP data and the Cmagic model resulting from supernova data. The time scales at the bottom of the graph are the same for all expansion histories.

R1+R3, concordance, and Cmagic expansion history.



Comparison of Expansion Models

The author's cellular model is the only model that does not involve velocities larger than the speed of light but of course as all cells expand they are carried away from each other at superluminal speeds. In three dimensions the cells that fill the volume repeat exp(60) times out to the edge of the overall radius for both the light and dark matter expansion. Each small cell contains one particle on its surface and has a small expansion velocity (currently 2.26e-18 m/sec) determined by the base and expanded states presented above for gravity. The author's proposal is based on the inflation phase being identical to duplication of the particles by exp(180**).** Energy conservation and the source of the cosmic background radiation will be addressed in later sections.

Conventional expansion models create space rather than move particles within space and represent space on a large surface rather than space between particles. Since all particles expand, the additive velocity is quite dramatic at the "edge" of the radius that contains the particles. As a point of reference, studies regarding the distribution of mass throughout observable space document remarkable overall uniformity. A principle called the "cosmological principle" states that the initial condition was uniform. Theories exist regarding uniformity (inflation theories) that attempt to explain the initial uniformity [12]. Each light matter model suggests that "space is expanding and carrying light along with it", especially during an inflation phase and early expansion.

Cosmological parameters determined by the WMAP and Cmagic projects are summarized in Table 3 [11] and Figure 8 Cmagic [14] with rho critical=9.5e-27 kg/M^3. Important parameters updated by 9 year data [21] are Omega total=1, consisting of 0.718 dark mass, 0.235 mass and 0.0464 baryons. Hubble's constant was updated to 2.26e-18/sec. Surprisingly the Cmagic model concludes that the universe is accelerating even more rapidly than the WMAP model. Many have concluded that the source of the acceleration appears to be a cosmological constant that becomes increasingly important as expansion reaches the later stages. Since supernova data is based on luminosity of its "standard candle", the interpretation is mainly based on the final slope of the expansion. Both of these models are partially supported by the "cosmological constant" historical discussions involving Einstein, Friedmann, Mach and others [12].

The table below compares overall characteristics of the four models.

Comparison of Expansion Models

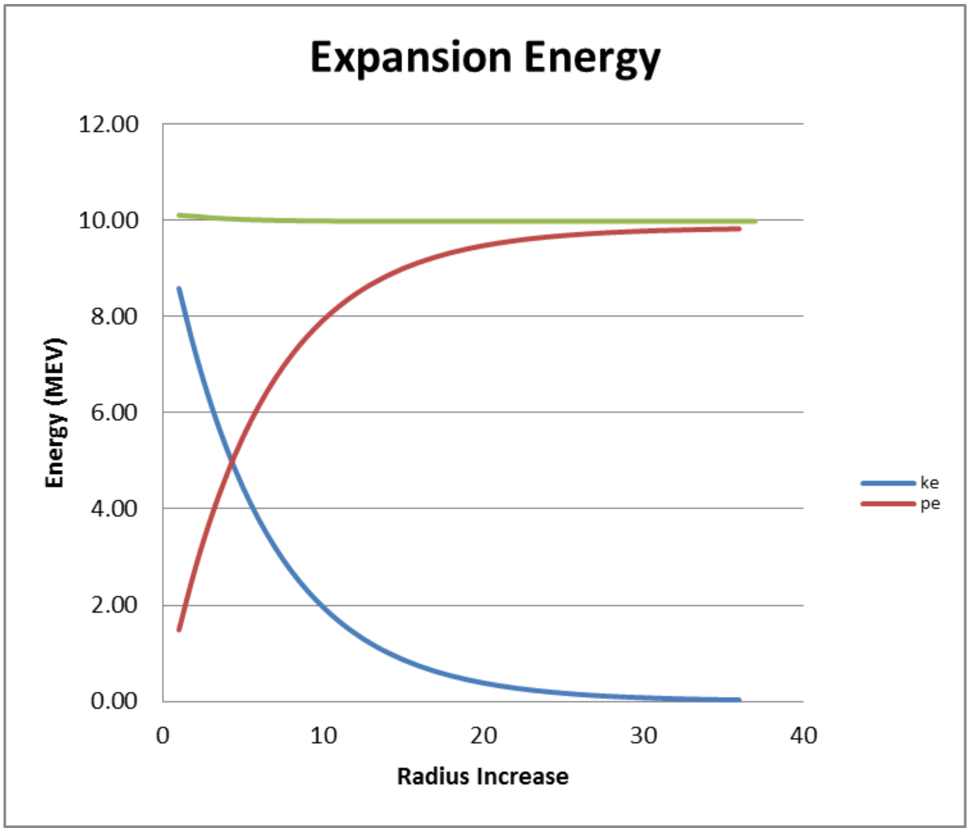
Criteria	**Proposal**	**Concordance**
Expansion history	Same as concordance/Cmagic	Concordance
	fundamentals identified	
	Current radius 6.3e25 meters	Current radius 6.2e25 meters
	Current H=2.2e-18/sec (WMAP)	Current H=2.2e-18/sec (WMAP)
Potential energy now	Identified as 20.3 mev	several hundred mev
	source from ref Proton	source unidentified
Initial expansion kinetic		
equal potential energy	& ke 10.15 MeV	Planck scale
dark energy	no	yes-source growing
Dark matter	50% dark @ 1.67e-27 kg	yes 0.27 of total
	50% proton mirror	.044 baryons
		.73 dark
Inflation	Yes	yes
	identified as particle duplication	several proposals
Final State of Universe	"flat"	Expansion could continue
	about 4e26 meters	
	Time ratio =90	
	Expansion kinetic energy is depleted	
Temperature at beginnin	7.60E+10	>1e10 degrees
	heat due to neutrons decaying	
CMB temperature K	2.73*(z-1)	2.73*(z-1)
	radiation source	
	quantified	
Conservation of energy	yes	no
V/C in early Universe	Subluminal within cells	Superluminal
	(Space is expanded gravity r)	space is being created
Helium formation	Sakharov	Sakharov?
	(fractions of seconds after beginning)	
	He4 Fusion is accounted for	?
Mass Accumulation	accoustically initiated →	→
WMAP interpretation	accoustic variation at decoupling →	→
	power spectrum variations	
	Accumulation of dark matter in	
	cluster augments gravitation redshift	

WMAP

The Wilkinson Microwave Anisotropy Probe (WMAP) [11] [21] was launched into orbit in 2001 and produced data for many years. Its purpose was to map the radiation coming from the entire sky called the cosmic microwave background (CMB). The temperature of this radiation is on average 2.725 degrees K but there are hot and cold areas (on the order of 70 micro degrees K) that are of interest. Theory emanating from Princeton's Peebles [12] and other important papers (Bahall) suggested that the hot and cold spots are the results of acoustic waves that have well defined origins and progress at know speeds. They begin to propagate at a condition called equality of mass and radiation density. As the universe expands and matter density starts to dominate, waves travel in the matter at a speed of C/3^.5=1.73e8 meters/sec. They travel outward from their origin and a temperature spot develops related to compression within the wave. As expansion continues another transition occurs. Electrons initially have too much energy to fall into orbits around protons (a state known as plasma where electrons are ionized and absorb light). As expansion decreased the temperature, plasma cleared and the universe became transparent. Radiation from temperature variations on the surface of last scattering traveled through space and was measured by sensors on WMAP. Temperature decreased in direct proportion to the expansion ratio (Rfinal/R), and knowing the temperature at which ionization falls to approximately 0.5 is was extremely important. This transition is known as the decoupling point. The period between equality and decoupling has been the subject of intense interest. Anisotropy in the radiation is related to mass accumulation and theorists have attempted to develop mechanisms for mass accumulation in the early hot universe. There is a critical period when mass accumulation needs to begin to agree with observations regarding early development of galaxies and stars (this occurs at about 200 million years into expansion according to some sources. Decoupling is predicted by an equation known by the acronym SAHA. At decoupling WMAP measured the temperature anisotropy of a sphere when the light matter plasma cleared and it was possible for radiation to escape (the surface of last scattering). The interpretation of the cool spots is that early gravitational accumulation has red shifted the radiation, somewhat offset by density compression that would also change the temperature slightly. The spot size data (0.0107 radians) and the magnitude of the temperature perturbations (70 microdegrees K) are of extreme interest.

Dark Energy

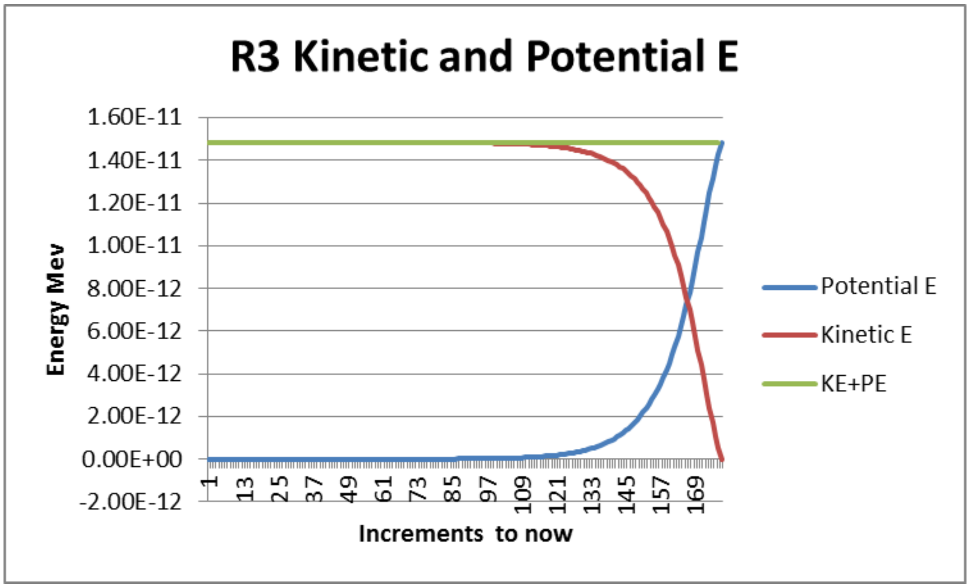
The equation V^2=8 pi RhoC* R^2 is generally accepted as the basis of most cosmological expansion models, where RhoC=9.5e-27 kg/m^3. In the author's view, there are several limitations to the approach and a concern developed that we are looking for missing mass and dark energy that doesn't exist. According to the critical density approach, dark energy is about 72% of the missing energy and conventional baryons only make up 4.4% of the critical mass. But what if the critical mass concept is being misused? Since the expansion history is now known, incremental calculations can be carried out with the cellular model. With 7.22e-14 meters as the initial cell radius, the initial inertial force is calculated to be 2.4e-38 Newtons. As the cell expands (driven by time^(2/3) and time^(5/3), the force changes and an integration of the increasing potential energy can be easily carried out.



Derivations that end with (v/r)^2=8/3 pi G rho start with the assumption that initial kinetic energy will become potential energy as expansion occurs. Calculation of kinetic energy at the beginning can't be done with big R because the velocity is greater than the speed of light; hence the wisdom of carrying this out with the cellular model.

Dark Energy

The second component of expansion R3 is initially only 8.47e-7 meters and expands to about 2.9e25 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 (3.66e-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 1.29e-11 out of 10.11 MeV). The result is shown below:



Very little energy is required because the radius is 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 density 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.

Detailed energy balance for expansion

The detailed energy balance/particle at different times in the expansion is shown below (all values are in mev). Note that the overall energy balance is zero for each time during expansion, even though expansion kinetic energy has been converted to potential energy and kinetic energy inside the atom has been converted to external kinetic energy (temperature) due to fusion. Note also that the original neutron decays to a proton without any external release of energy. The reason is that neutrinos are produced that do not appreciably interact with matter. Note further that the original proton mass table shows that the electron quad produces 27.2e-6 mev of kinetic energy that just balances the negative 27.2e-6 field. As the electron falls into the field, 13.6e-6 mev will be released as light/heat. Likewise as mass accumulation occurs, some gravitational potential energy will be reconverted to kinetic energy. It is observed that a particle falling into the gravitational potential eventually creates lateral kinetic energy that allows an orbit to be established. In this process, the fall positions the orbiting body at one half of its original height if its energy is conserved. It is clear that expansion kinetic energy is not reversed. Entries in the table could be changed slightly to reflect exactly where the kinetic energy is but the total of gravitational and kinetic gravitational will not change as a result of gravitational accumulation. Note that the kinetic energy to expand each cell is on the order of 10.11 mev. Particles that fall into orbits as mass accumulation occurs often have kinetic energy/particle on the order of several mev as shown in the following table for the mass of one proton attracted to a maximum central mass. Particles will fall half way to the center where they establish an orbit with inward and outward forces balanced.

ENERGY BALANCE PER PARTICLE AS EXPANSION OCCURS									
simple cell bk9		Fusion	Fusion		Gravitational	Gravitational	Electron	Total	
begin	Atoms/Strong	ke	Heat	e/m	Kinetic Energy	Potential E	neutrinos	mev	
	131.4566							131.4566	mass
0.000	797.9575	10.15127013	0		**20.303**	**0.00**	4.85E-02	828.4598	ke
-2.732	-957.1847							-959.9164	pot
								0	total
after decay to P & fusion to helium				e/m					
(released as K	129.5409						1.2788	130.8197	mass
	798.5799	8.521270135	1.63	2.720E-05	**10.15**	**10.15**	0.1114	829.1451	ke
-2.7316	-957.1847							-959.9164	pot
					Grav Kinetic E	Grav Pot E	CMB	0	total
Now	6.16E+25								
	129.5409						1.2788	130.8197	mass
	798.5799	8.351270135	1.8	2.720E-05	**1.40E-12**	**20.30**	0.1114	829.1451	ke
-2.7316	-957.1847							-959.9164	pot
								0	total
Near end	2.36E+26								
	129.5409						1.2788	130.8197	mass
	798.5799	8.351270135	1.8	2.720E-05	**0.00**	**20.30**	0.1114	829.1451	ke
-2.7316	-957.1847							-959.9164	pot

Initial temperature of the compressed state

At time zero, no fusion has occurred and the neutron mass table shows a small release related to the neutrino quad and nothing else. The initial density is defined by 0.5*1.67e-27 kg divided by the volume associated with the gravitational radius of 7.22e-14 meters (1e12 kg/m^3). Expansion reduces the density quickly but the early temperatures and densities are very high.

Cosmic background radiation source

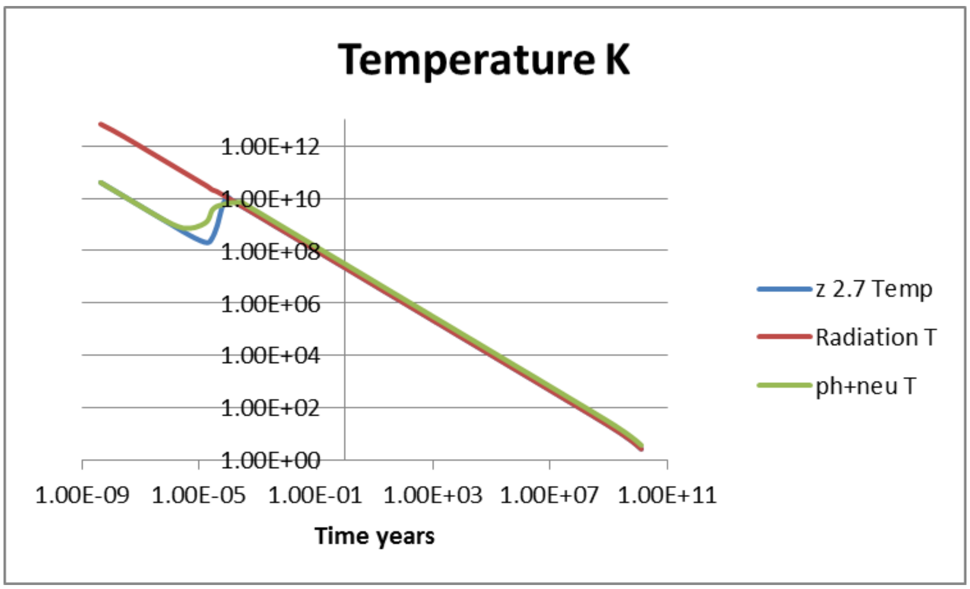
Using the Boltzmann relationship T (K)=ke/(1.5 B), it is possible to assign a temperature to kinetic energy.

			Beginning	NOW?
KE temperature relationship				
ke=1.5*B*T			**10.11**	**1.34E-12**
T=ke/(1.5B)			**7.82E+10**	**0.01**
Boltzmann B (MeV/K)	**8.62E-11**			

The temperature 7.6e10 K is more reasonable than the 2e13 K temperatures associated with scaling the current radiation temperature 2.725 K all the way back to a low radius (cosmologists use the expansion ratio z to scale temperatures). 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? Recall that production of electromagnetic waves occurs throughout expansion and accumulate. Incremental calculations were carried out for a cell based on the proton producing radiation energy, passing that radiation energy forward in time but reducing the value by expansion. Accounting for radiation, the temperature still follows a downward sloping line.

Primordial Nucleosynthesis

There appears to be wide acceptance that formation of deuterium/helium occurs in the first few minutes and is called primordial nucleosynthesis. Current literature cites measurements indicating that 25% of primordial matter consists of Helium 4. This element occurs as deuterium is produced and fuses to helium. Early work by Andrei Sakharov suggested that high initial temperatures would fuse elements from primordial nucleons and "freeze" their abundances at the observed levels during expansion and cooling. Most literature gives 23% to 25% as the range of He4 and indicates that it is produced in the first 4 minutes or so. He4 releases 7.07 mev/atom and 0.24*7.07 mev=1.63 mev. This is a significant energy compared to 10.11 mev and adds to temperature. The scale in the graph below is from the beginning to 13 B years. He4 fusion is shown by the discontinuity at 54.68 log time. (Time in seconds below is natural log time and is converted; seconds=exp(54.68)*1.54e-21=880 sec). Note that the blue temperature curve in the graph below is about the same as the red WMAP curve and they both end at 2.72K. This is important because temperature affects the radius at equality and de-coupling but this is well after the temperature rises to the accepted curve.



Neutron Decay

There is another very important event occurring. The neutron is decaying 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 (0.671+0.622=1.293). This energy can also be accounted for by a temperature curve. The green temperature curve shown above is based on neutron decay and also jogs up from the photon only curve. The end of this event is at about 6000 seconds and at the end of expansion, its value is 3.79 K This is very 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 will be further reviewed below, but this small change allows the baryon density to be 0.5 while baryon/photon density is the accepted value 6e-10. These temperature curves are quite meaningful to the question of what kind of mass WMAP is dealing with. Hot matter (protons and electrons) emit radiation, decays from neutrons to protons and partially fuses to He4. The blue temperature would not jump to the accepted curve if it were cold dark matter.

Comparison of proposal with WMAP

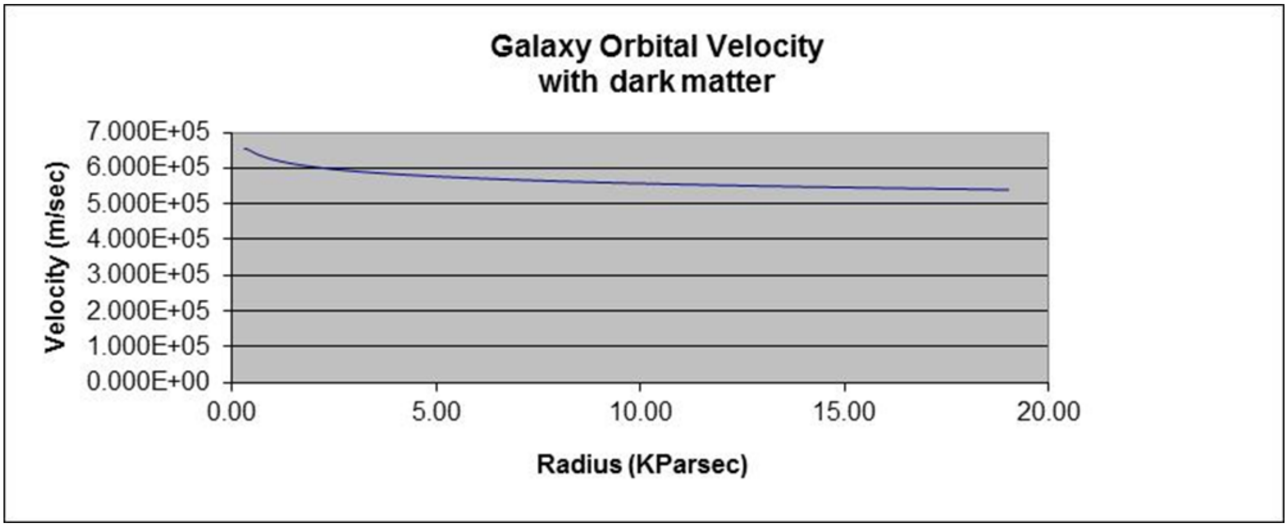
Differences between this proposal and WMAP analysis are summarized below.

WMAP	WMAP [7]				Neutron	Proposal	Now
w/o dark	NOW				Decay	Equality	
					886 sec		
6.207E+25	6.21E+25	Radius			2.62E+16	8.32E+21	6.16E+25
	1.00E+78	Volume (m^3)			7.56E+49	2.41E+66	9.79E+77
	2.82E-01	Baryon number density=.5*exp(180)/v			9.85E+27	3.09E+11	7.61E-01
6.100E-10	6.100E-10	baryons/photon			1.50E-10	1.50E-10	1.50E-10
	5.77E+08	Photon number density			6.55E+37	2.05E+21	5.06E+09
?	0.235	Cold matter fraction				0.5	0.5
		cold matter density in kg/m^3					1.27E-27
0	0.719	Dark Energy				0	0
2.67E-27	9.50E-27	critical density		Final density=1.67e-27*exp(180)/Volu			2.54E-27
?	0.0464	Baryon fraction				0.5	0.5
		baryon matter density in kg/m^3					1.27E-27

Map 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 kg/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. Baryon density is given by 0.5*exp(180)/volume at each of the radius values. The important change in temperature for the now condition gives 5e9 (photons+neutrinos+electrons)/m^3. With baryon density 0.761 baryons/m^3, the baryon/photon ratio is 0.761/5e9=1.5e-10. This is in rough agreement with WMAP and other literature. The argument for a higher baryon fraction is that there are more photons so there can be more baryons. Since the proposed critical density without dark energy is 2.54e-27 kg/m^3, the baryon fraction is 0.5. Again, this calculation is very sensitive to temperature since photon density is a function of temperature cubed.

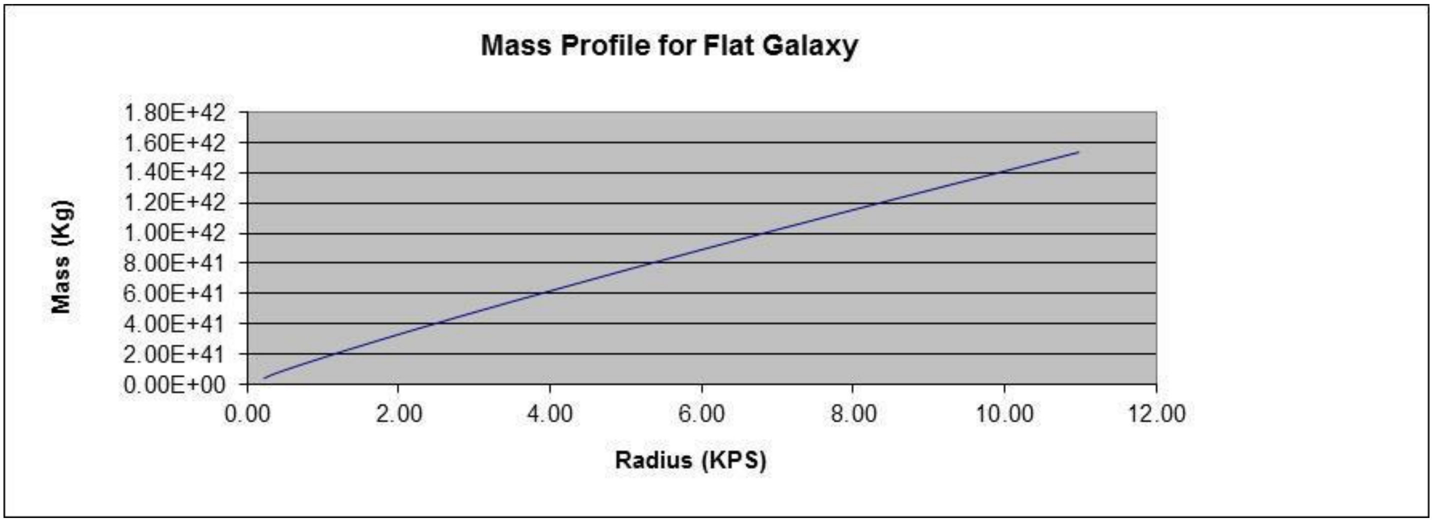
Galaxy velocity and luminosity profiles

An early clue that dark matter indeed exists lies in the observation of the velocity and luminosity across the diameter of observable galaxies. This work is largely credited to astronomers at the University of California Santa Cruz. If a significant amount of dark matter forms a "halo" around observable light matter, the flat velocity profiles and the decreasing light density (mev/m^2) emanating from the edge of the galaxy can be rationalized. Galaxy mass accumulation studies were carried out for a 50% light/50% dark ratio. The galaxy estimated above has significant amounts of dark matter in their outer regions. It seems reasonable that the dark and light particles have no preferred position initially among the exp(180) identical particles but that dark matter particles tend to accumulate outside gravitationally bound objects because they move readily through other particles and have no way of losing kinetic energy. This flattens the velocity profiles as shown in the graph below. Again, these are estimates only.

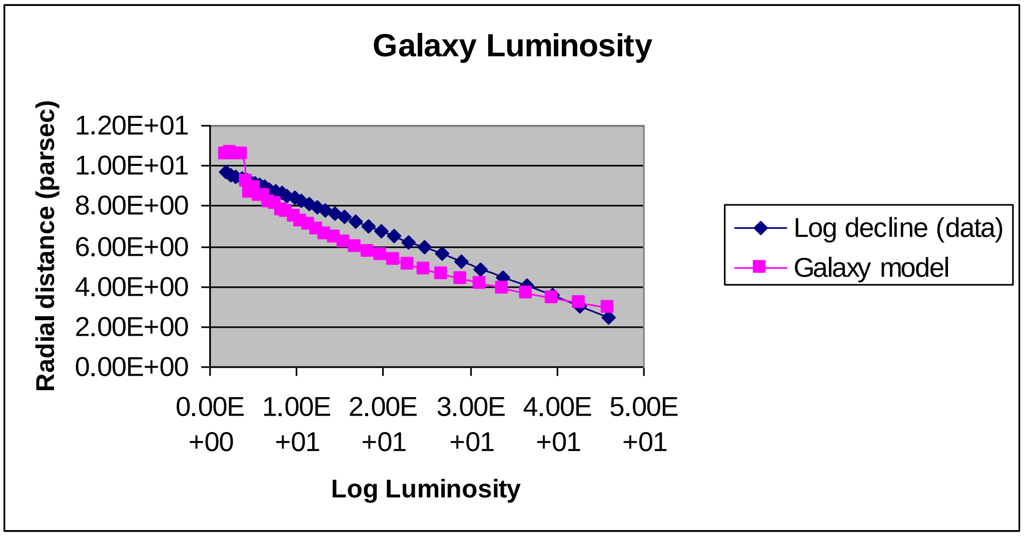


Galaxies with dark matter

Galaxies contain cold dark matter and this "hidden" mass exists in a halo and causes the velocity to be approximately 5.6e5 m/sec from near the center to the edge. This galaxy will be a combination of cold dark matter and hot matter. The normal matter lost considerable kinetic energy by friction as it fell into the galaxy. The only way that the mass distribution for the flat profile could have developed was interaction with another galaxy (see studies of barred spiral galaxies).



The luminosity of a galaxy containing dark matter will decrease exponentially from center to edge although the mass profile increases. This can be simulated assuming that only the normal matter combines into stars that give off light.



The author believes that the current proposal is consistent with the WMAP analysis. Both analyses use a density equivalent to the proton mass for equality. This suggests that half of the exp(180) particles in the universe are dark and the other half are normal proton/neutrons. A "dark" particle could be the same mass as a neutron that does not decay and has zero "cross-section" for absorption. Recall that inflation in the author's proposal is duplication of one particle (based on the proton model) exp(180) times. This duplication was probably balanced in such a way that half of the particles were of one type and half were the other type. There is some theoretical justification for this. Reference 3 is the author's analysis of all the baryons and mesons. Understanding and modeling baryons and mesons requires balancing the properties of particles to zero by including duplicate energy opposites. This balancing would be expected to produce a proton "double" (protons are baryons).

WMAP data analysis using the proposed expansion model

The following simplified model shows the period from equality to decoupling.

				1.000		t=alpha*G		3.10E-18	"Universe"
				Expanded	R1			R2	R1+R2
		G	G^(4/3)	radius per	Time^2/3	Time (sec)	Time (years	Time^(2)	
				particle (m)	meters			meters	meters
End of inflation		1.00E+00	1	7.2238E-14	8.2497E+12	5.289E-02	1.677E-09	8.2497E+12	1.6499E+13
(progress at 46 years)		1.44626E+12	1.63554E+16	9.2384E-06	1.0550E+21	7.649E+10	2.426E+03	1.5842E+14	1.0550E+21
Equality	1.023E+00	8.55396E+13	3.769E+18	1.4024E-04	1.6016E+22	4.524E+12	1.435E+05	1.3484E+17	1.6016E+22
Decoupling	3.5291E-04	4.32239E+14	3.26813E+19	4.1297E-04	4.7161E+22	2.286E+13	7.249E+05	2.0062E+18	4.7163E+22
Now	2.2016E-18	8.198E+18	1.65314E+25	2.9371E-01	3.3542E+25	4.3362E+17	1.375E+10	2.7064E+25	6.0606E+25
	2.301E-18	8.362E+18	1.69737E+25	2.9761E-01	3.3988E+25	4.423E+17	1.403E+10	2.7972E+25	6.1960E+25
R1&R2 end		1.991E+19	5.39704E+25	5.3069E-01	6.0606E+25	1.053E+18	3.340E+10	1.1877E+26	1.7937E+26

	0.088	8.61952E-11	
	8.375E-28		
Temperatu	Mass	Radiation	Saha
	density	density	
T=Rnow/R*2.725			
	6.630E+10		
1.565E+05	2.5356E-13	3.94E-12	
10311.7	7.2482E-17	7.42E-17	2.1268E-16
3501.7	2.8384E-18	9.86E-19	3.5291E-04
2.73	1.3377E-27	3.62E-31	
2.67	1.2519E-27	3.31E-31	
0.9	5.1596E-29	4.71E-33	

Using information from the simple model above, the size of a thermal spot can be calculated knowing that accumulation starts at equality and is visible at decoupling.

R1+R3 model details:			
Equality		4.52E+12	seconds
Decoupling		2.29E+13	seconds
Radius at decoupling		4.72E+22	meters
Wave travel time (delta t)		1.83E+13	seconds
Radius of spot R=V*delta		3.17E+21	meters
Radius of spot*Rnow/Rs		4.08E+24	meters
angle of spot radians		0.01071	spot now
		(pi*Radius)/2	
Radius of Universe Now		6.06E+25	meters
Now (at matching H0)		2.202E-18	

Spot size (anisotropy in the CMB) is a measurement of decoupling radius. According to literature acoustic waves start at equality and are visible at decoupling. The time between these two transitions allow waves to travel 3.18e21 meters at velocity of 3e8/3^.5=1.73e8 meters/second. This gives the estimated size of the spots when they were visible. Knowing that the temperature ratio is 2970/2.725=1090, the expansion ratio for the spot at decoupling must also be 1090. From the temperature ratio between decoupling and now, it can be inferred that the spots are now 4.3e24 meters.

The highest temperature peak was observed by WMAP against the full sky and the angle the spot subtended was 0.598 degrees or 0.0105 radians. (there are pi radians per 180 degrees). This measurement allowed an estimate of the size of the universe now 6.2e25 meters if the author is interpreting their papers properly.

The above values can be compared with WMAP reported results below:

WMAP Reported and derived values	
3196	z equality
1090	z decoupling
302.4	acoustic scale
14.116	da angular size dia gigapc
6.920E+22	radius at decoupling meters=14.116*3.08e19/pi
146.6	sound horizon mpc (3.08e19 meters/megaparsec)
4.515E+21	sound horizon (spot size) meters=146.6*3.08e19
4.922E+24	Wmap spot size now=1090*4.5e21
0.0104	spot size in radians=4.5e21/(6.9e22*pi())
7.542E+25	Universe radius now=4.9e24/.0104/(2*pi())
2.301E-18	Hubble's constant =71/3.08e19
13.75	Age of Universe Billion years

Mass accumulation

It is clear from WMAP that amplification of light matter acoustic waves is the primary mechanism. Plasma exists until the temperature drops enough to allow electrons to form orbits around protons. Radiation pressure prevents gravitational accumulation until radiation is attenuated by expansion. Eventually gravitational forces become dominant and accumulation of mass into clusters, galaxies and clusters begins. The concentration process later allows stars to "light up" with fusion when they become dense and hot. This is known in the literature as re-ionization. Stars burn up their hydrogen and follow the well documented aging cycle that depends on the kinetics of progressive fusion reactions. Literature cites measurements regarding the abundance of the heavy elements that are produced by these reactions. Once density develops conventional gravitational accumulation continues. The approach below should be considered estimates since it is very difficult to calculate processes that are probabilistic.

Partitioning the volume into clusters

Accumulation of mass obeys conventional kinematics and Newton's law as bodies fall into each others gravitational fields. The final state appears to consist of clusters, galaxies, stars and planets interacting gravitationally in a way that a new semi-stable state is achieved. That state is ideally nested "orbits" in which forces are balanced. Overall movement in the resulting orbital state is neither overall expansion nor contraction. The numbers of spots in the WMAP analysis were probably the seeds of clusters. If the spots represents spheres of early accumulation, the number of spots is (Runiv/Rspot)^.333 and equal to 26913. WMAP results suggest that the dense (cool) spots observed are associated with clusters in the era of decoupling. This would place the mass of clusters in the right range. (1e47 kg).

Number of Galaxies and Stars

The ratio of pi*spot size/Jeans wavelength is approximately 1.7e6 according to the following "estimates". (Estimates (in red) are presented with empirical constants for demonstration purposes). If clusters are approximately 9e46 kg, the galaxies would be about 6e40 according to the following estimates based on the ratio 1.4e6.

At decoupling wave speed drops dramatically as the plasma clears. The Jeans length falls to a fraction of 1e18 meters. This divides the clusters into smaller disturbances that with time form stellar masses due to fractionation of the Jeans length. This divides the 5.45e40 galaxy mass by about 1e11, giving an maximum probability star mass of 5e29 kg.

				Detailed WMAP ratios give mass of						
				clusters & stars based on M universe						
				Universe mass (kg)						
				1.67e-27 kg*exp('	2.5E+51	Kg Universe				
	R1+R2	4.72E+22								
		2.6E+04		((4.8e22)/1.62e21	9.5E+46	Kg Cluster				
	spot (m)	1.59E+21								
	spot*2 (m)	3.17E+21	meters							
		1.7E+06		((3.76e21)/2.67e1	5.6E+40	Kg Galaxy	6.237E+40	avg mass of galaxy from count data		
Jeans lo spee	1.33E+18 →	2.67E+19	meters		4.0E+10	numb galaxy	data http://universe-review.ca/F05-galaxy.htm			
Jeans hi spee	5.00E+22							mass--kg	dn/d log m	
	Jeans lo (n	2.67E+19	meters					2E+29	5.0000E-02	
		1.1E+11		(2.67e19/5.6e15)'	5.2E+29	star mass	~~compare data~~ →	3.17E+29	0.2	References
Jeans fractio	1.33E+18	5.60E+15			4.8E+21	number stars		5.024E+29	0.29	maximum probabilit
				stars/universe=clusters/universe*galaxys/cluster*stars/galaxy				7.962E+29	0.25	

The mass distribution of stars [12] is well estimated by their life cycle data and once again the approach above gives about the right average. As indicated by photography, galaxies and stars are still in the process of development. Mass accumulation at the star level is from material that has been recycled and concentrated from earlier generations. Spiral galaxies are apparently good concentrators and star development is not only cyclical but very incomplete at the present time as evidenced again by photography. Star counts and surveys of matter indicate that only a small fraction is visible. As individual atoms fall toward the central body, most of the material will form orbits. Over time in relatively small accumulations enough kinetic energy is lost to allow "solid" stars to form and "light up" with nuclear fusion.

Primordial Nucleosynthesis

It is well known that approximately 23% to 25% of nucleons found throughout space are in the form of Helium 4 atoms. The distribution uniformity indicates that these atoms were formed in the very early universe. In addition, trace amounts of Deuterium, Lithium 3 and Beryllium 7 are also uniformly distributed. These elements are evidence of a process known as primordial nucleosynthesis that has been well studied and documented by G. Gamow, H. Bethe and A. Sakarov.

The author explored a cosmology expansion curve called R1+R3 based on values found in a model of the proton [5][7]. The expansion curve is similar to the concordance model [4] with WMAP parameters [3]. Temperature histories that include He4 fusion energy all increase to temperatures that photo-disintegrates deuterium leading to potential difficulties explaining measured residual fractions. The first goal of the work below is to determine when residual primordial deuterium originated.

The R1+R3 expansion model starts at a kinetic energy of 10.11 MeV/particle, has omega baryons (protons) =0.5, omega dark matter =0.5 and dark energy =0. The associated temperature history decreases initially but as He4 fusion occurs, the temperature increases before finally decreasing to 2.73 K due to expansion. Surprisingly, literature was found [8][9] that does not account for fusion energy of He4. In addition, there are claims [4][6] that residual deuterium is a sensitive test that rules out cosmologies that contain more than 0.04 baryon fraction. The view that conventional mass is only 4% of the observed universe, with the remainder "missing" is becoming widely accepted. The second goal of this work is to investigate the claim that a low photon/baryon ratio is required to match measured residual deuterium.

Temperature history for expansion models

The simulated temperature curve in red below is the temperature curve for the primordial nucleosynthesis information reproduced in Appendix 2 (call this the Astr222 curve). It does not include energy from He4 fusion. Although it has a lower slope through part of the curve, the temperature decreases to the correct value 2.73 K at the end of expansion. The comparison curve is the author's R1+R3 model [7]. The initial kinetic energy (temperature) is about the same as the Astr222 curve but increases after He4 fusion. The higher slope associated with radius proportional to t^(2/3) after decoupling allows the curve to decrease uniformly to 2.73 K at the end of expansion.

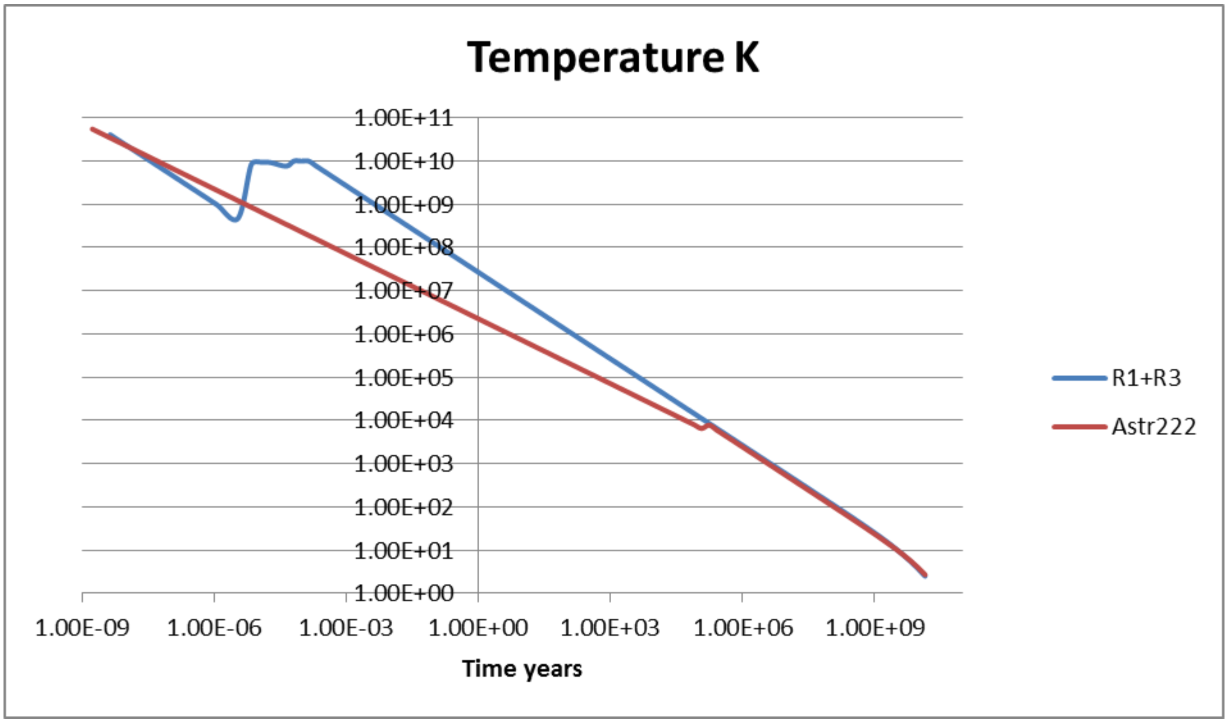


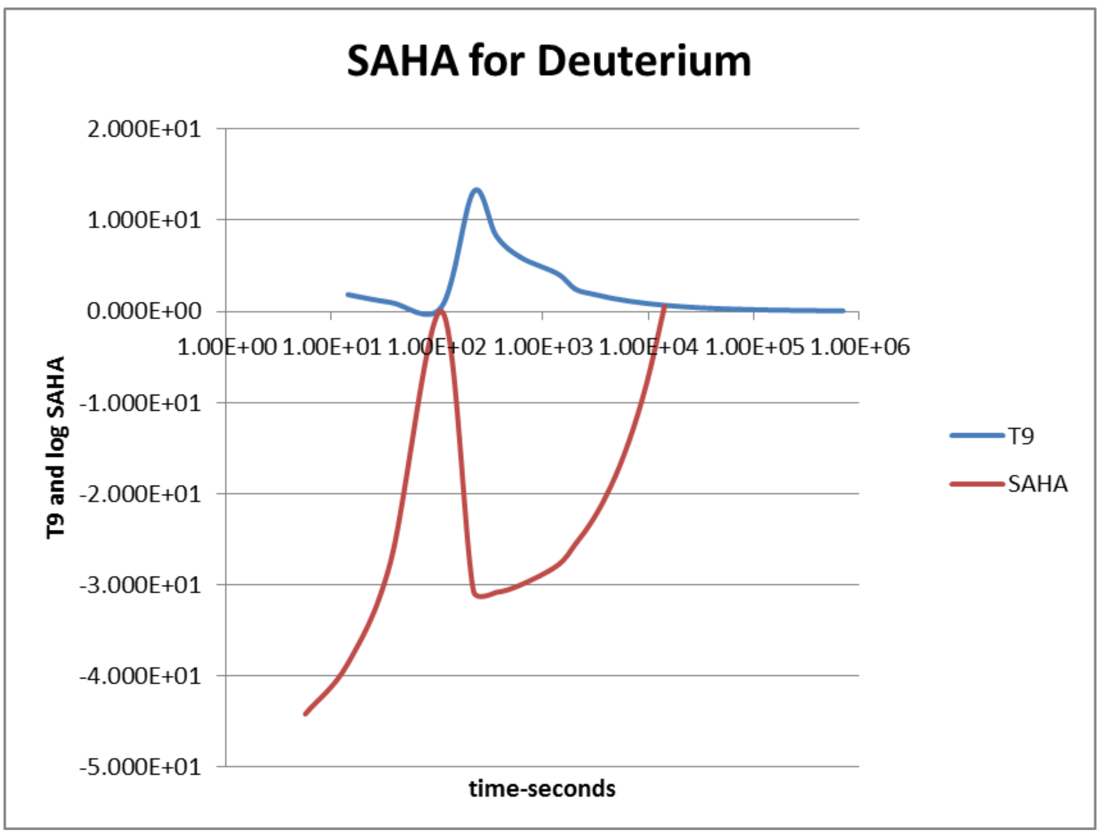
Photo-disintegration of Deuterium

Initial deuterium fraction is limited by photo-disintegration [4][6]. It is well known that deuterium readily fuses to He4 after the temperature falls to approximately 1e9 K. However when He4 fuses energy is released once again the temperature increases to levels that photo-disintegrates the remaining deuterium. This leads to difficulties explaining when the measured residual primordial deuterium originated.

The SAHA equation [4] is utilized to give the early deuterium fraction.

Ln SAHA=(D*N)/(p'*n')=-(25.82-Ln((Ob)*(T/1e10)^(3/2))-2.58/(T/1e10))

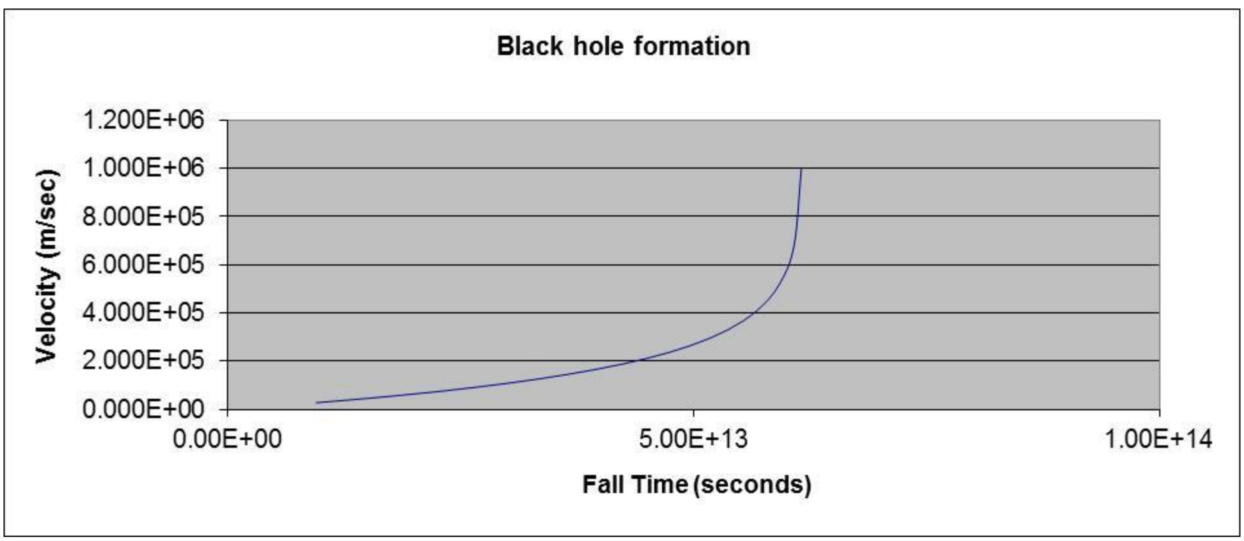
The results below answer the question, "where does the measured residual deuterium originate?" Fusion in stars is from hydrogen. The hydrogen contributes protons that must be converted to neutrons by energetic electrons. This is quite a different situation than exists for the first few minutes following primordial He4 formation. In this environment there were still a large fraction of neutrons that had not decayed. A graph of the SAHA criteria [4] for deuterium formation is shown below. The SAHA criteria used is the natural logarithm of the SAHA value. As the SAHA criteria increased to 0, He4 fused and T9 (the temperature divided by 1e9 K) increased. With the addition of fusion energy, the SAHA criteria became negative again and caused photo-disintegration of deuterium. The temperature finally fell due to expansion and the SAHA criteria rose to 0 where deuterium was again formed. It is this deuterium that we measure uniformly throughout space at an abundance fraction of 1e-5.



Primordial fusion of He4 releases a significant amount of energy and must be included when determining temperature curves associated with expansion. After formation of He4, the temperature rises and photo-disintegrates the deuterium. Subsequently, the temperature decreases and deuterium is once again produced. The author's calculations for the deuterium abundance with the R1+R3 model agree with measured values. Reference 2 concludes that Omega baryons=0.5*exp(180). Simulations of observed primordial nucleosynthesis are substantially consistent with this value and there is no reason to believe that a low baryon/photon number density limits Omega baryons to 0.04 as literature suggests.

Formation of Black Holes

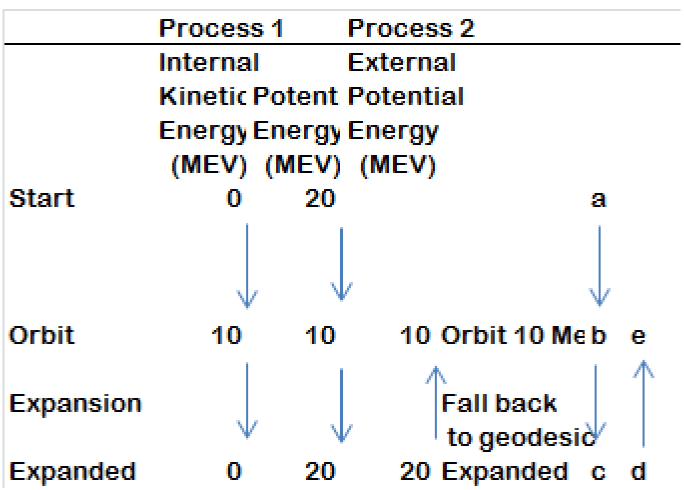
Apparently some black holes formed soon after decoupling of mass and radiation and aided galaxy formation. The excel spreadsheet fallmodel.xls is simply Newtonian kinetics combined with the R1+R3 expansion model. Starting at equality of matter and radiation acoustic waves develop and concentrate mass. WMAP [7] measured the red shift of (spots) that we can now associate with clusters. When the universe was about 1e22 meters in size waves started travelled until they were spots of about 3e21 meters. This dividing matter into approximately 2.6e4 clusters each containing 1e46 kg mass. The Jeans length is a natural wavelength associated with temperature and the state of matter. At decoupling the plasma cleared and the Jeans length transitioned to a much lower value. It went from Jeans high 5e22 meters to Jeans low 3e19 meters. This low Jeans number is listed as “empirical” in reference 12. The low speed Jeans length divided the WMAP spot size of 3e21 meters into about 1e6 smaller spots that we associate with galaxies. The smaller spots contained about 1e42 kg mass. According to the fall model, some mass fell quickly inward and formed a black hole. Some black holes were “seeds” for galaxies. The reason the first masses form black holes is that their fall velocity becomes the speed of light if they are not deflected into orbits. Below the fall velocity as a function of time is shown from fallmodel.xls:



A black hole is an attractor that brings mass into a galaxy. As new mass falls, it falls into orbits around the black hole. The galaxy builds mass from the inside out. As later mass falls, it develops less velocity from the fall.

Gravitational accumulation forms orbits

First review how orbits are formed. The diagram below shows that there was about 20 MeV of potential energy available, the point marked (a) below. The proposed model for expansion is based on an orbiting proton with approximately 10.15 MeV of kinetic energy (b). Since the proton is attracted to and separated from the center of the field, there was also 10 MeV of potential energy when the orbit is established. As expansion occurred (process (b)→(c) below), 10 MeV of kinetic energy was converted to 10 additional MeV of potential energy. At a much later point in expansion (c), although there is motion (temperature) of the proton on the surface of the expanding cell, there is no motion between cells (protons) except for expansion. With the proton velocity nil between cells geodesics will be extremely flat (on the order of 5e38m) compared to 6.2e25m. This causes acceleration of particles toward one another (process 2 below) and external kinetic energy (between protons) increases as protons fall back toward the geodesic (d)→(c). On average the expanded cells do not change their radius. Theoretically, 10 MeV of external potential energy could be reconverted to10 MeV of kinetic energy as particles fall toward one another. Overall, process (b)→(c)→(d)→(e) converts cellular surface kinetic energy to external potential energy between cells.



What actually happened during expansion was a transition occurred and acoustic waves broke the total mass into about 27000 clusters. After equality of photon density and mass density, process (d)→(e) occurred; protons accumulated and eventually fell into orbits that we observe as clusters of galaxies, galaxies, etc. As an engineer one cannot help but be impressed with the approximate energy conservation of combined processes 1 and 2. These processes represent the largest construction project in nature (the universe) and almost no energy is consumed. The "neat trick" seems to be cells that expand, on average don't re-contract and are able to move and fall relative to each other after they are far apart.

During expansion, the kinetic energy of the proton on the cell surface decreased by KE/ke =10.11/ 7.4e12=1.3e-12 Mev and the current velocity on the surface of each cell fell to16 m/sec. The protons could theoretically regain 4.3e7 m/sec by falling but particles usually fall less than this where orbits are established. The expanded cell values can be scaled to large scale space by using the equation R=r*(v/V)^2*(M/m)*1/exp(90) where lower case variable refer to cells and capital letters refer to large scale space. The result yields the range of the gravitational force.

		Scaling a cell to universe sized space at KE=10.11 MEV (V=4.3e7 m/sec)						
R' is the universe size geodesic			R'V^2/M	G=G	r'v^2/m	r' is the cell size geodesic		
							1.6E-13	
			m=1.67e-27 kg					
		M=m*exp(	2.49E+51		1.67E-27	kg		
R'=r*('v/V)^2*(M/m)*1/exp(90)		R	8.840E+25		0.540	r'	6.16E+25	meters
		V (meters	4.37E+07		16.01	v (meters/sec)		
		G	6.77E-11		6.77E-11	nt m^2/kg^2		

The geodesic is universe size when expanded proton positions regain kinetic energy by falling into deep orbits. The range 9e25 meters is larger than R1+R3=6.2e25 meters. The equations for expansion cause this difference and are accurate. Although gravitation is based on the mass of exp(180) protons, this may be a combination of protons and cold dark matter.

Summary

Information that describes nature in a concise way appears to reside inside the neutron and proton mass model. The R equation "displays" this information on several scales that underlie nature's four forces and its cosmology. The big bang could be an expression of this information. An expansion model was offered that simulates conditions consistent with observations to date. Enough energy to support current observations regarding the size and age of the universe is also associated with the model. Overall, the proposals in this document indicate that nature may be somewhat understandable. In particular, the proposal has the following to offer in the field of cosmology:

- Space is created at the quantum level of 7.22e-14 meters [21][22] and expands with time accompanied by changes in kinetic and potential energy. There are exp(180) cells, each now with radius 0.5 meters, simulating a universe radius of 6.3e25 meters.
- Fundamental expansion equations were derived that show two expansion components, one with time to the (2/3) power and the second with time to the (5/3) power. Application of these equations agrees with currently accepted expansion curves.
- The proton mass model is the source of the expansion energy per cell of 10.11 mev. This is enough kinetic energy to expand each cell to 0.5 meters. Calculations show that the second component of expansion requires a negligible amount of kinetic energy. This indicates that there is no "dark" energy. It appears to the author that the standard equation v^2=8/3piGrhoC*r^2 and its associated critical density rhoC=9.5e-27 kg/m^3 is misused because it does not properly characterize the second component of expansion. Simulations show that the correct critical density is 2.54e-27 kg/m^3. Based on the proton mass model, this is just one half the mass of a baryon. From this, it appears that there is no missing mass but one half the mass is cold dark matter. The explanation is that duplication of the proton mass model by exp(180) occurs in two parts. One part is a normal proton but the second (dark) part is the same mass of a proton but without properties that allow detection except through gravitation.

- The baryon number density is 0.5*exp(180)/8e77=0.931/m^3, the photon number density is 1.55e9/m^3 with a ratio of 6.01e-10. This ratio is the accepted value from the field of nucleosynthesis and agrees with WMAP.
- Derived cosmological parameters are consistent with the author's overall theme (code) based on Shannon type information theory and the proton mass model.

The proposal has the following to offer in the field of unification:

- Information in the proton model provides an understanding of gravity at the cellular level. The numerical and geometrical similarity provides a coupling constant for gravity that is the small value 1/exp(90). Properly utilized, it was shown that time dilation (dt from Schwarzschild's equation) for general relativity agrees with special relativity dt.
- The weak interaction (called the strong residual interaction) is responsible for atomic binding energy. The kinetic energy 10.15 mev from the proton model is proven to be the value that changes and produces the binding energy curve.
- The strong and electromagnetic coupling constants are properly predicted by values in the proton mass model, supporting the concept of unification.

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Appendix 1

Find expansion constant H1:

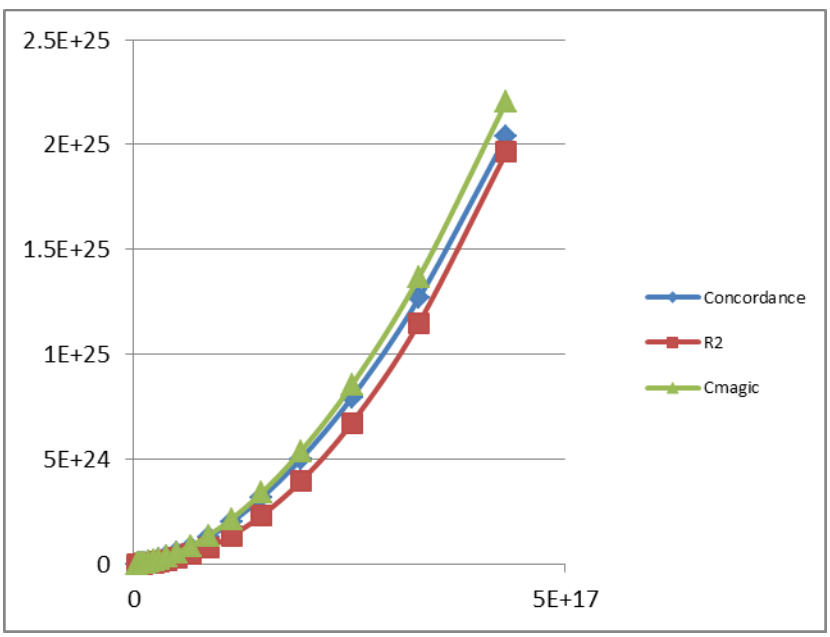
Rf=7.22e-14*g^(2/3)+7.22e-14*g^(5/3)*H1*alpha/1.66

Call the first component of Rf, R1 and second part R3. Note in the equation above that there are no unknowns in the equation R1=7.22e-14*g^(2/3) but the second part R3=7.22e-14*g^(5/3)*H1*alpha/1.666 contains alpha and one unknown, H1. Alpha is known but H1 must be evaluated from data. Time of expansion is alpha*G and in the range of 13 billion years, we look at H1. "Hubble's constant" H1= 2e-18/sec matches WMAP data and maintains a geodesic that yields the proper gravitational constant. If this value is used as the unknown H1 the resulting expansion curve compares favorably with both the concordance model and the Cmagic model as shown below [1],[3]. Using these values the equation for R3 is: R3=7.22e-14*g^(5/3)*2e-18*0.053/1.66.

R is calculated with increasing G until overall H is 2.3e-18. The match gives R= 5.2e25 meters at 4.2e17 seconds (13.35 billion years). R3 is 0.37 of the total radius but of course expanding faster (power is 5/3).

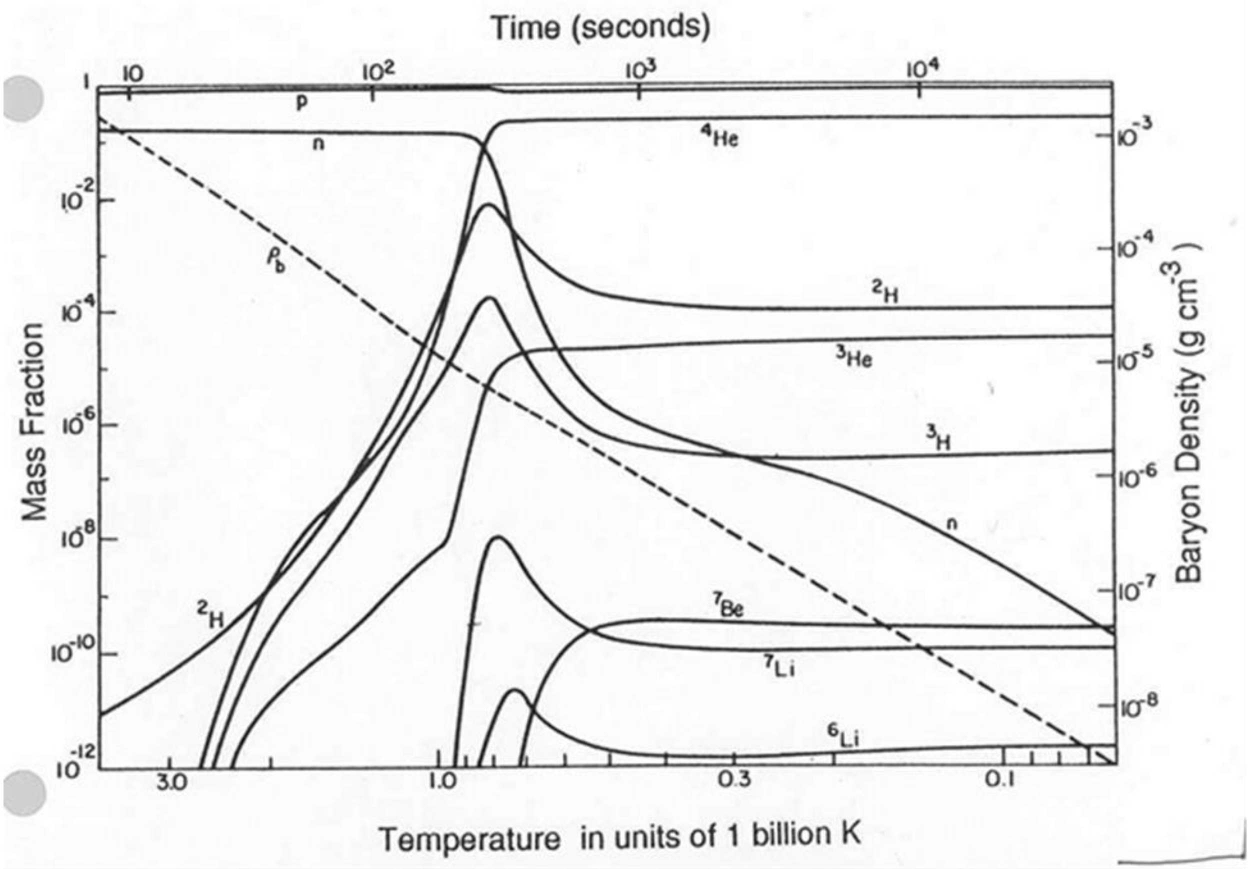
Identify the fundamental unit of time for expansion is the gravitational orbit described above/(time around radius)							
	Fundamental radius=1.93e-13/(2.68*2.68)^.5=7.354e-13						
	Fundamental time=7.354e-14*2*PI()/(3e8)=h/E=4.13e-21/2.68						
	Fundamental time		1.541E-21	seconds			
The end of the expansion phase occurs when its initial kinetic energy (15.23 mev) is depleted.							
	This time is identified as fundamental time*exp(90). Define this time as omega.						
	Omega =Fund t*exp(90)		1.881E+18	seconds	5.96E+10	years	
					1.37E+10	years	
	a resisting force of 3.456e-38 newtons.				22.97%	of final ?	
	The radius of the universe at this point is						
			Gravity				1
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				

Alpha was determined from WMAP data. The following reference 2 table shows a search for alpha that matches WMAP spot size angle=0.0105 radians. The best match is at alpha=0.053 seconds. The following graph compares the "cosmological constant" (R3) expansion components using the constants evaluated above.



Alpha is associated with the Reference 1 logarithm exp(45). What is omega, exp(90)?

Appendix 2



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

The temperature in the graph above is about 3e9 K at 12 seconds. The kinetic energy associated with this temperature is 1.5*B*T=0.39 MeV, where B is Boltzmann's constant 8.62e-11 MeV/K. One can see from the smoothly decreasing temperature in the horizontal axis that as Helium 4 fuses, there is no increase in temperature. The energy associated with He4 fusion is 7.07*0.23=1.61 MeV. This amount of energy should increase the temperature to about 1.55e10 about 300 seconds into expansion. Appendix 1 contains a similar graph from a different source [9]. Again, the temperature does not increase with He4 fusion.

Appendix 3

Light is the energy released when an electron jumps between orbitals. Quantum mechanics describes the allowable orbits. Absorbed light is characterized by a discrete wavelength associated with the electron oscillating between the second orbital and the third orbital (quantum number 2 to quantum number 3).

N	Binding Energy	Quantum no	Quantum no	Delta Energy	Wavelength
		E2=BE/2^2	E3=BE/3^2	E2-E3	E2-E3
	(mev)	(mev)	(mev)	(mev)	(nanometers)
		2	3		
0.296	1.361E-05	3.40E-06	1.51E-06	1.89E-06	655.9

The equation of interest is a wave function for a system that has an internal freedom that varies back and forth between two frequency (f) values.

Psi=muE0/h (1-exp i (f-F) t/ (f-F))

The solution to this quantum mechanical equation is found in The Feynman Lectures on Physics, Volume III page 9-13 [3]. The basic equation for a probability pf is divided by pF to form a ratio normalized to make the peak response equal to one at the peak frequency, F. This equation will be called the absorption equation.

pf/pF=(sin((f-F)t/2))^2/((f-F)t/2))^2
Where f=frequency and t=time interval.

The absorption equation can also be written in terms of distance (D=C t), instead of time. With MC=f-F=C (1/wl-1/WL) and t/2=2D/C=1/(1/dwl-1/wl) where dwl is the width of the response curve, wl is the incoming wavelength and WL is the peak wavelength. The same equation in terms of D and M follows with (f-F) t/2= M*C/C *(2D) = 2DM. (C, the speed of light, cancels).

pf/pF= (SIN (2MD)) ^2/ ((2MD) ^2

Example calculations for red light at 400 nanometers: M=1/400-1/594.3=8.17e5 meters^-1 and D= 1e-9/ (1/55.8-1/594.3)=5.73e-6 meters (573 nanometers) when the peak wavelength for red light is 594.3 nanometers and the width of the curve is 55.81 nanometers.

	COLOR CALCULATIONS					
dwl	55.8116	meters^-1	meters		pf/PF	
WL	594.334188		D=1e-9/(1/(WL-dwl)-1/WL)			
		M=1e9*(1/wl-1/WL)		2*D*M	(SIN(2*D*M))^2/(2D*M)^2	
wl	400	8.17E+05	5.7347E-06	9.38	2.7501E-05	
	405	7.87E+05	5.7347E-06	9.02	0.00189134	

As wavelength increases to the peak, the quantity (1/wl-1/WL) becomes zero for an instant and probability builds to one. On both sides of WL, the absorption equation gives the response of the eye to that color. pf/pF peaks at one through the sin^2 function.

The width of eye's sensitivity to a particular color is specified in another way by N=0.0986. Note in the table below that difference in energy (D Energy below) between each level can be converted to the delta wavelength series 61,51,50,45, etc. These give the width of the pf/pF response curves.

	N Series	Energy (Mev)		Probabilty	D Energy	WIDTH (nm)	PEAK	D	Color
Electron	-0.10454	1.8237E-05		& natural wavelength					
Electron	-0.00593	2.0127E-05	base		1.89009E-06	**61.60**	**655.93**	**6.33E-06**	
Electron	0.09268	2.2213E-05	0.0986	0.906	2.08597E-06	**55.81**	**594.33**	**5.73E-06**	Red
Electron	0.19129	2.4516E-05	0.0986	0.821	2.30216E-06	**50.57**	**538.52**	**5.20E-06**	Green
Electron	0.28991	2.7056E-05	0.0986	0.744	2.54075E-06	**45.82**	**487.95**	**4.71E-06**	Scotopic
Electron	0.38852	2.9860E-05	0.0986	0.674	2.80407E-06	**41.52**	**442.13**	**4.27E-06**	Blue

The eyes measured response to light from Stiles and Burch compare favorably with the Feynman equation for absorption of light using the N series 0.0986. The graph below plots the Feynman equation pf/pF for the three color peaks 594, 538 and 442 nanometers. The associated width series was 61, 55 and 41 respectively for red, green and blue responses. These are tentatively called fundamental since they appear to follow the information series.

Appendix 3

Time Dilation

Schwarzschild equations are known to be solutions in general relativity. The following equation is for time dilation. Time dilation is a measure of space time curvature. Here is an example of dt for a cell at its current expansion. Note that the large factor exp(90) has been introduced into the Schwarzschild equation.

	dt=1/(1-2GM/(C^2*R)^.5		
	dt=1/((1-EXP(90)*2*6.67e-11*1.67e-27/(3e8^2*0.563)))^0.5		
		dt=(1-expression above)/2	
	1.000	1.554E-15	sec

Time dilation dt can also be calculated for cells based on special relativity.

G=rV^2/M		
G=rC^2(V/C)^2/M		
(V/C)^2+(g)^2=1		
(V/C)^2=1-(g)^2		
G=r/M*C^2(1-g^2)		
approximation for (1-g^2)		
dt=(1-g^2)/2		
1.554E-15		
G=rC^2/(M)*2*dt		
r now (meters)		0.505
ke now (mev)		1.41E-12
V now (m/sec)		16.42
low v equation for g		
(ke/938.27)	dt=1-g	1.501E-15
G=rC^2/(M)*2*dt		6.6779E-11
0.5*C^2/1.67e-27/EXP(90)*1.501e-15*2=6.67e-11		

The following plot gives dt for General Relativity and dt for Special Relativity during expansion. Note that they are identical.