Effect of spin on galaxy rotation curves

Subtitle: Zero Dark Matter and Zero Dark Energy (Revised)

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Flat galaxy rotation curves were observed in the 1930's by Dutch Astronomer Jan Oort. Most cosmologists today attribute the difference between observed flat and calculated declining Keplerian velocity curves to dark matter despite decades of failed efforts to identify it. Recent WMAP [4] and PLANCK mission scientists believe it is 23% of critical density (the total mass and energy in the universe). There are other difficulties:

What is dark matter and why are baryons only 4.6% of critical density?

What is dark energy and why is it 72% of critical density?

What caused the temperature anisotropy measured by WMAP and PLANCK?

Astrophysics literature says "the universe is flat"; what does that mean?

But even more basic:

What is space-time?

Quantum mechanics applies at the small scale but the general theory of relativity is large scale gravitational theory. Are they incompatible?

These are not easy problems to solve. Any claim regarding different percentages of critical density must address baryon/photon ratios that determine observed fractions of Deuterium, Helium3 and Lithium7. Different claims must also address conditions at equality of photon and mass density and the temperature anisotropy observed at decoupling (where the plasma clears and electrons can orbit protons). Understanding space and gravity more thoroughly than Einstein's general theory of relativity requires bridging small and large scale physics.

A neutron→proton mass model and cellular cosmology, both previously reported by the author, were combined into what the author believes is a first principles cosmology model that resolves these questions. In addition, the model exactly predicts temperature anisotropy at decoupling and star formation rates.

Problem 1; What is Dark Matter?

If mass is distributed uniformly within a sphere the mass toward the outside will be in a preferred position. Since Newtonian gravity is based on central mass, the mass toward the outside will move toward the center. This is an unstable universe and gravitational laws are not uniform throughout the sphere. A model with no preferred position places the mass on the surface of a sphere. But it doesn't have to be a large sphere. It can be many small spheres that have the same surface area. The author developed a concept called cellular cosmology that defines space as N=exp(180) spherical cells each with a proton. Furthermore, the proton has initial kinetic energy 9.87 MeV and orbits central gravitational field energy 2.73 MeV. Radius=hC/2.73= 7.22e-14 meters (hC=1.93e-13 MeV-M). These values are derived by a mass model of the proton developed by the author many years ago. As kinetic energy decreases and potential energy increases each cell expands. Kinetic energy inside each of exp(180) cells is related to pressure acting outward on the surface. This expands the universe. Important cell energy values originate in a Schrodinger based mass model of the neutron (that decays to a proton) [Appendix 1 and 2].

Cellular Cosmology

Cells are defined by equating a large surface area with many small surface areas. This allows cellular cosmology to obey the rule "there can be no gravitational preferred position for mass" because all mass is on the equivalent of a large sphere. The number of cells in large R (representing the universe) is exp(180) [Appendix 2].

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)   surface area substitution
M=m*exp(180) mass substitution

For gravitation and large space, we consider velocity V, radius R and mass M as the variables (capital letters for large space and lower case r, v and m for cellular space) that determine the geodesic (the radius with balanced inertial and gravitational force). The mass substitution is M=m*exp(180) and the surface area substitution is R=r*exp(90) for G large space= G cellular space.

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)**

The extremely small value 1/exp(90) is the coupling constant for gravity. When measurements are made at the large scale to measure G, the above derivation indicates that we must multiply cellular scale values (r*v^2/m) by 1/exp(90) for equivalent G. Geometric and mass relationships give the cell "cosmological properties". Velocity V=V for both surfaces. In cellular cosmology an operative word is "equivalent" meaning there is a mathematical relationship. The relationships simply give the pressure that expands the universe.

The neutron mass model (Appendix 2) is the source of space, time and the gravitational field energy -2.73 MeV. The radius of a quantum circle with this field energy is:

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	

Above, 1.92e-13 MeV-meters is hC, where h is Planck's reduced constant (6.58e-22 MeV-sec). The quantum radius 7.22e-14 meters and time 1.514e-21 seconds are fundamental to space and time. These never change. Coupled with these values kinetic energy (10.15→9.87 MeV/proton) from the Proton model are used in the calculations below that determine the gravitational constant.

Calculating the gravitational constant G

> Note: The cellular expansion model (The subject of Problem 3) is referred to in the following calculations. The reader may have to move back and forth in this document to understand the results.

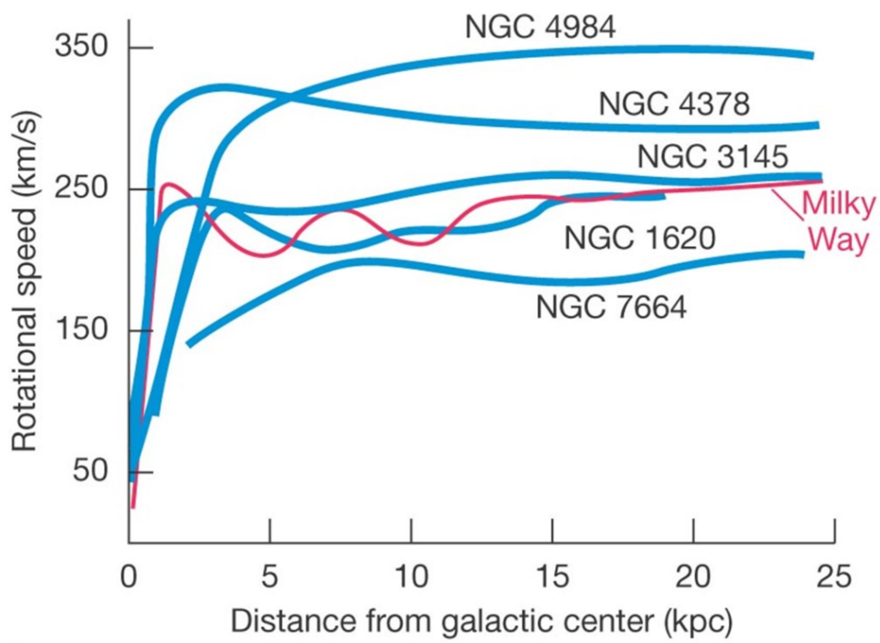
The left column below determines the gravitational constant [9][13][17] with kinetic energy from fundamental values 20.3 MeV from the neutron model. The mass is 1.676e-27 Kg (the mass of a neutron). The gravitational constant is 6.6743e-11 [23]. The value 9.87 MeV is justified in Appendix 5, where it is determined that a neutron falls from potential energy 20.3 MeV to 9.87 MeV. G is almost constant except for small effects related to gamma and expansion rates that are included in the cellular cosmology expansion model.

GRAVITY		V (m/sec)	
			neutron
Neutron Mass (mev)			**939.5654**
Proton Mass M (kg)			**1.675E-27**
Field Energy E (mev)			**2.732**
Kinetic Energy/neutron ke (mev)			**9.872**
Gamma (g)=939.56/(939.56+ke)			**0.9896**
Velocity Ratio v/C=(1-g^2)^0.5			**0.1438**
Velocity (meters/sec)			**4.323E+07**
R (meters) =(HC/(2pi)/(E*E)^0.5			**7.224E-14**
Inertial Force (f)=(m/g*V^2/R)*1/EXP(90) Nt			**3.588E-38**
Calculation of gravitational constant G			6.536E-11
G=F*R^2/(M/g)^2=NT m^2/kg^2			**6.67447E-11**
Published by Partical Data Group (PDG)			**6.6741E-11**
R (meters) =(HC/(2pi)/(E*E)^0.5=1.97e-13/2.723			**7.224E-14**

In three dimensions the relationships give G for the surface of a sphere (or the equivalent area of many small spheres). If not it violates the "no preferred position" principle.

Flat Velocity Curves for Galaxies

All of these galaxy profiles (search Wiki for velocity curves) are nearly flat:



(b)

Calculating Flat Velocity Curves

The example below is for a galaxy with mass 2e41 Kg. Measurements of observed radius and observed luminosity are available (Wiki but astronomers have published data). The luminosity falls off rapidly with observed radius indicating that there is not much mass toward the outside (luminosity is proportional to mass). Calculations below sum the central mass M (column 1) and calculate the Keplerian orbital velocity with the equation Vk= (GM/R)^.5 M/sec. Unfortunately many have suggested a halo of dark matter to explain the measured flat velocity curve because they do not fully understand the conservation laws involved.

0	5	10	15	20	25.0	Radius (kiloparsec)	
	1.54E+20	3.08E+20	4.62E+20	6.16E+20	7.7E+20	Radius Meters	
	1.19E+39	9.77E+37	8.01972E+36	6.58299E+35	5.4E+34	Luminosity=I0*exp(-2/r)	
	1.309E+41	1.535E+40	1.25974E+39	1.03405E+38	8.5E+36	Kg within each luminosity band	
	1.87E+41	2.023E+41	2.03568E+41	2.03671E+41	2.0E+41	Central mass for each radius	
0	2.38E+05	2.09E+05	1.71E+05	1.49E+05	1.3E+05	Vk=(G M/R)^.5	
	2.15E+04	4.30E+04	6.45E+04	8.60E+04	1.07E+05	Va=R gal/time	
0	2.60E+05	2.52E+05	2.36E+05	2.34E+05	2.40E+05	Vk+Va	

Spin of a cell is scaled to the galactic scale. The radius of the galaxy band is divided by time= 7.17e15 sec to produce the velocity= R/time. This produces the velocity Va above. Adding Va to Vk produces a flat rotation curve matching measurements.

Calculating velocity Va

Understanding that the gravitational constant G can be calculated with ke0= 9.87 MeV/proton of kinetic energy in a cell of radius r= 7.22e-14 meters allows further development of cellular cosmology gravitational relationships (small m below=1.67e-27 Kg).

Orbital R for galaxy= GM/V^2 where M is the central mass			
substitute G=r0 v^2/m*(1/exp(90))			
R= r v^2/m*(1/exp(90))*M/V^2			
v^2/V^2=1 (cell v and large V equal)			
m/M=m/(m*number of cells in galaxy)			
R= r*(1/exp(90))*M/m			
multiply top and bottom by exp(180)			
R=r*exp(90)*M/(m*exp(180))			
m*exp(180)=Muniverse			
R=r*exp(90)*(Mgalaxy/Muniverse)			
r=r0*9.87/ke=7.22e-14*9.87/ke			
R=7.22e-14*9.87/ke*exp(90)*(Mgalaxy/Muniverse)			
R=r0*9.87/ke*(Mgalaxy/1.67e-27)*(1/exp(90))			

The new relationship R=r0*9.87/ke*(Mgalaxy/1.67e-27)*(1/exp(90)) where r0=7.22e-14 is another way of writing R=GM/V^2 but it provides an understanding of the cosmology involved. From a gravitational viewpoint, the central mass is orbited by one proton (1.67e-27 Kg). The quantum scale r=r0*9.87/ke is the cell radius as the universe expands. Maintaining G equivalence between the large scale and cellular scale requires multiplying small scale values by (Mgalaxy/1.67e-27)*(1/exp(90)) (called the scale factor in the table below). Gravitational G equivalence also requires the orbital radii surface area to consist of exp(90) cell surface areas. Radii r for cells with one proton moving at velocity V are the equivalent of a large galactic circle of radius R defined by a large central mass (R=GM/V^2)^.5.

The table below shows fundamental laws for the gravitational constant G, light speed C, and spin. The table is arranged in columns for: conservation laws at the beginning, the same laws for galaxy cells, the scaling factor (2e41/1.67e-27)*(1/exp(90)) between cells and the galaxy and finally the conservation laws within the galaxy.

When the mass of our galaxy of 2e41 Kg falls from the expansion determined radius (R/.4) due to mass accumulation, it all develops a velocity of 2.27e5 M/sec. This associated kinetic energy/proton (kinetic energy 2.7e-4 MeV) is conserved and the velocity profile is flat at 2.27e5 M/sec throughout the galaxy. The problem is; it won't stay there because the force outward and inward are not balanced. Another way of saying this 2.27e5 M/sec is larger than the Keplerian velocity V=(GM/R)^0.5, where M is central mass. The cell radius associated with 2.7e-4 MeV is r=7.22e-14*9.87/2.7e-4= 2.64e-9 meters. The cell diagram is below on the left. In cellular cosmology everything is based on a circle (surface in three dimensions).

Spin

To understand spin, we must understand some fundamentals. Appendix 1 develops a model of the neutron from the solution to a Schrodinger equation. It contains fundamentals of energy, space and time. The zero energy, probability one construct is shown below. The values for the quarks originate in the neutron model.

Quark 1	Energy zero	E1+	(E3+E4-E1-E2)+		E2		-E3-E4=0	Etotal (Me
	(MeV)	101.947	646.955		5.08	-753.29	-0.687	0.000
Quark 2	Energy zero	E1+	(E3+E4-E1-E2)+		E2		-E3-E4=0	
		13.797	83.76		5.08	-101.95	-0.687	0.000
Quark 3	Energy zero	E1+	(E3+E4-E1-E2)+		E2		-E3-E4=0	
		13.797	83.76		5.08	-101.95	-0.687	0.000
	Energy zero	E1+	(E3+E4-E1-E2)+		E2		-E3-E4=0	
Q1+Q2+Q3	Energy zero	129.541	810.02	0.048	20.30	-957.18	-2.73E+00	0.000

Note: The gravitational field is 3*0.687+0.671=2.73 MeV. (Quads 4 and 5 are not shown above).

The above diagram is for Et/H=1. If we want to separate E and time, we must combine mass+kinetic energy from fields. This is shown below and note that 959.916-959.916=0.

Energy zero		959.916			-959.916		0
	129.541	810.025	0.05	20.30	-957.18	-2.732	-3E-14

Using the math below, we can calculate t as follows from Et/H. (time t is the time around a quantum circle).

Time 2.73	t*2.73/959.92	1.51E-21			-1.51E-21
t=t/H*H	(sec)	4.31E-24			-4.31E-24
t/H=1/E	(1/MeV)	1.04E-03			-1.04E-03
Energy zero	(MeV)	959.916			-959.916

Constrain Energy to zero

1=exp(itE/H)*exp(-itE/H)

take the natural log and divide boths sides by i

0=itE/H-itE/H

0=t/H*E-t/H*E

take the square root. Since Et/H=1, E=1/(t/H)

0=(E-E)*(t/H-t/H)

0=E1-E1

Example:

a=1/b a=.5 b=2

ab-ba 0

(a-a)*(b-b)=0 (0.5-0.5)*(2-2)=0

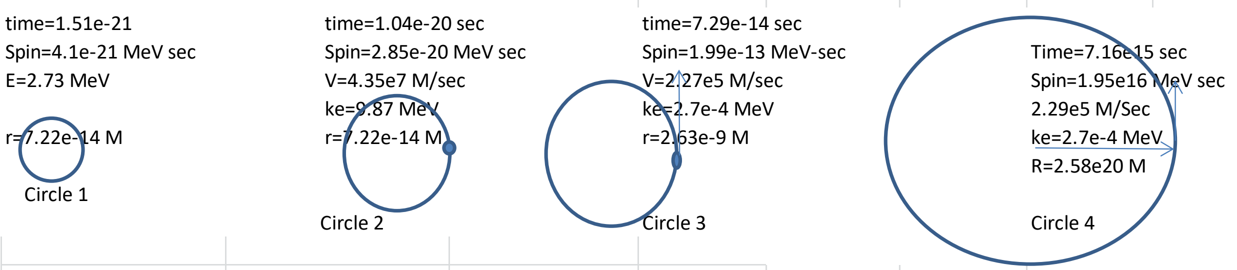
The other way of calculate time 1.51e-21 sec is repeated below:

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**	

Spin (E*t) is calculated below for the gravitational field energy 2.732 MeV.

H*1.6e-13	Nt-M-sec	6.63E-34
t*2.73=H	Mev sec	4.14E-21
Time 2.73	t*2.73/959.92	1.51E-21
t=t/H*H	(sec)	4.31E-24

Using fundamentals we are able to identify time and then calculate fundamental spin. It is equal to H or Planck's constant, although texts use a convention that make spin a quantum value 0.5. Circle 1 below represent the quantum level (based on the calculations above), the fundamental cell is defined in circle 2 with a proton. It defines the gravitational constant G. The third circle represents a cell that expanded and then fell due to mass accumulation, picking up kinetic energy 2.7e-4 MeV. This cell is the basis of the galaxy scale circle on the right. The scale factor is 2e41/1.67e-27*(1/exp(90)).



Scale Factor						2e41/1.67e-27*(1/exp(90	
Kinetic Energy	Ke=0.5*mV^2/1.6e-13	MeV		9.87	2.70E-04		
Cell radius r	r=7.22e-14*10/ke	cell R meters	7.22E-14	7.22E-14	2.64E-09		
Velocity V		M/sec	3.00E+08	4.35E+07	2.27E+05		2.27E+05
Radius (galaxy band)		M					2.58E+20
							2.27E+05
Time	(2*pi()*r)/V	sec	1.51E-21	1.04E-20	7.29E-14	9.81E+28	7.16E+15
Spin	Spin=2.73*t	MeV-sec	4.13E-21	2.85E-20	1.99E-13	9.81E+28	1.95E+16
Velocity space (Va)	Radius galaxy band/Time	M/sec			Va=2.58e20/7.17e15=3.6e4		3.60E+04

The circles are equivalent except circle2 and circle3 contain a proton and circle 4 contains 2e41 Kg of central mass. But what is spinning? The calculated time is the clue. The circle on the left defines light speed C, the ratio of distance around the fundamental radius divided by time around the radius. It also defines space. It is the circle R=hC/E=7.22e-14 M where E is 2.73 MeV and hC=1.9e-13 MeV-M. The four circles are progressions of what I call cells. The radius changes with respect to r0= 7.22e-14 M. At the galactic scale, space is on the radius and like light, the ratio R/Time defines the relationship between space and time. The time value 7.16e15 sec is the key. Its relationship with spin is clearly demonstrated in the calculations above but which of these two statements are correct?

Statement 1 Mass is spinning around the circle that defines space.

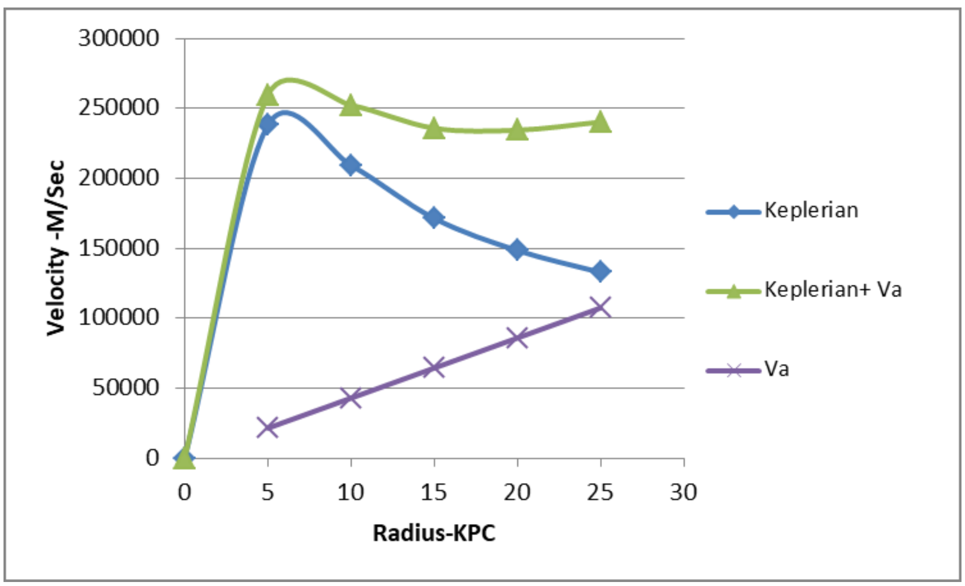
Statement 2 Space is spinning around the circle defined by mass.

When confronted with a difficult choice, depend on data. The galaxy velocity profiles are telling us something we didn't know, a combination of statements 1 and 2 is correct. We can calculate the velocity of space around the galaxy. The relationship is simply Va= Rgalaxy/7.17e15 sec. At different radius bands in the galaxy, Va will be Rgalaxy band/7.17e15 M/sec. The Keplerian velocity (Vk) is added to Va, producing the flat velocity profile. I believe this proves that space itself can spin.

Calculations for V space

	Vkepler (m/se	R (meters)	Mass Kg	Time (sec)	Va=R/Time	Vk+Va (M/sec)
	2.85E+05	1.54E+20	1.87E+41	7.17E+15	2.15E+04	3.06E+05
central values	2.27E+05	2.58E+20	2.00E+41	7.17E+15	3.60E+04	2.63E+05
	2.09E+05	3.08E+20	1.53E+40	7.17E+15	4.30E+04	2.52E+05
	1.71E+05	4.62E+20	1.26E+39	7.17E+15	6.45E+04	2.36E+05
	1.49E+05	6.16E+20	1.03E+38	7.17E+15	8.60E+04	2.34E+05
	1.33E+05	7.70E+20	8.49E+36	7.17E+15	1.07E+05	2.40E+05

With Va= R/Time added to Vk, the flat velocity profile matches measurements.



Problem Resolution; What is Dark Matter?

When we look at a galaxy we observe real distances and real velocities. They have flat velocity curves. If all else fails, believe the data (flat rotation curves). Also believe Newtonian gravity and well established principles like spin. A huge central mass does not change fundamental laws; it scales them to a huge radius. The calculations presented are straightforward and allows one to calculate the flat rotation curve. This represents rotation of space but does not change space itself since it is based on radius (r0=7.22e-14 M). Randomness of galaxy spin axis could allow Mach's Principle to be obeyed overall. Those that infer dark matter to explain flat velocity curves are neglecting spin. Keplerian velocity must be added to Va=R/Time. I don't believe dark matter exists but there are other considerations below.

Problem 2; What is the Cosmic Web?

Observations of light bending show streaks between stringy galaxy clusters. This is also attributed to dark matter. The discussion below does not negate the fundamental of space. Ro=hC/E=7.22e-14 meters, where E is 2.73 MeV, the gravitational field energy from the proton model. In cellular cosmology, moving mass changes the cell radius with the relationship r=r0*9.87/ke and kinetic energy is related to expansion. As mass accumulates cells change their size according to the kinetic energy regained from falling from the expansion determined radius. Potential energy + kinetic energy=20.3 MeV.

The gas between the stars is treated with thermodynamics. The protons/atoms obey the relationship P=rho R T where rho=m/volume. The volume of the gas "cells" no longer follow the relationship r=r0*9.87/ke. The gas cell radius in the space between large objects can be as large as 0.3 meters in the fully expanded gas down to 1e-6 meters. Cells in solid objects like planets are about 5e-11 meters in size since the electrons repel each other and limit further contraction. Yet further contraction occurs in black holes. Galaxies and the gas within are gravitationally bound and can't enlarge with time. Space continues to expand elsewhere. One can simulate this situation by placing a piece of cloth on a surface and gathering (pinching together) the cloth in spots. Ridges are formed between the pinch points indicating the distribution of mass.

Problem resolution; What is the cosmic web?

The general theory of relativity gives the deformation of space by mass but according to work above, mass has velocity associated with that probably distorts measurements (see "Cosmology from cosmic shear power spectra from Subaru Hyper Suprime-Cam first year data", 1809.09148). Curved space deflects light. This is being imaged as the cosmic web.

Problem 3; Where is normal matter (only 4% discovered)?

Cosmologists use measurements and models to understand the first few hundred seconds after the big bang. Specifically, when and under what conditions were He4 and residual isotopes formed? WMAP analysis accepted the astrophysics literature [6] value of 4.4e-10 baryons/photons which is associated with the measured He4, He3 and Li7 fractions (measured uniformly throughout the universe and therefore formed with He4). The baryon/photon density equation [1] is below: Radius R and Temperature T are both to power 3. Further as radius expands temperature is reduced in direct proportion to radius. This means that the baryon/photon density ratio is the same now as it was after He4 was formed. At 2.73 K (the current temperature of the cosmic background radiation) the photon density is 5.77e8/m^3 and the mass number density is exp(180)/(4/3*pi()*4.02e25^3).

Baryon/photon=(x*EXP(180)/(4/3*PI()*R^3))/(8*PI()/(4.31e-21*3e8)^3*(1.5*8.62e-11*T)^3)

WMAP analysis [2][4] reduced the baryon content **X***exp(180) of the universe to a very low value (**X**=0.046) because they did not find combinations of R and T that would meet the 4.4e-10 criteria. The present analysis will show a period when temperature and radius values gives a value similar to 4.4e-10 without reducing the baryon content. This required an accurate expansion model.

Expansion Model

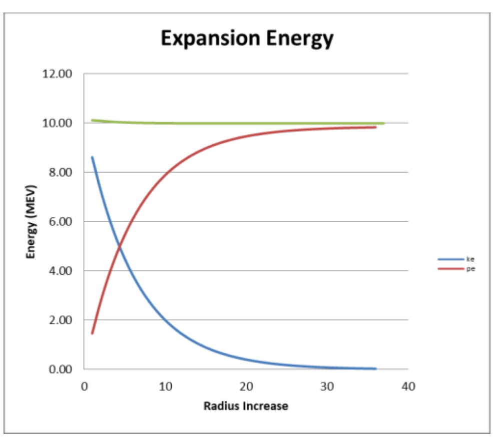
A first principles cellular expansion model based on the proton model was used to predict cosmological parameters. This is important because the laws of physics appear to reside inside the proton, which itself is based on Schrodinger fundamentals. The cosmology model bridges the gap between fundamentals and observations. The proton describes the cell, including the space around it. The model has the following capabilities:

1. Early history of helium formation including Deuterium, Helium3 and Lithium7 residuals.
2. History of the period from equality (matter and photon density) to decoupling (clearing of the plasma and cosmic background radiation pictures).
3. History of energy additions during expansion.
4. Star formation and its effect on expansion.

An expansion model calculates the radius of the universe as a function of time. But components of each proton are improbable (1/exp(180)) and there are exp(180) protons. In three dimensions, cell radius*exp(60) represents the universe. The model places exp(180) spherical cells into a large sphere. The initial radius of each small sphere is, as explained above, r0=7.22e-14 meters. This means that the initial radius is 7.22e-14*exp(60)= 8.25e12 meters (in three dimension, exp(180)/3=exp(60). This same sphere has a surface area =4 pi*r0^2*exp(180)= 4 pi*R^2. The gravitational constant G remains constant throughout expansion. Kinetic energy follows the relationship below:

G remains constant during expansion		
ke0=9.87 MeV/neutron		
r0*V^2/m =r*v^2/m		
(m v/m V)^2= (r/r0)		
ke/ke0= (r/r0)		
r=r0*9.87/ke		

The proton mass model has initial kinetic energy= 9.87 MeV/neutron associated with the measured value G=6.674e-11 Nt M^2/Kg^2. Expansion converts kinetic energy to potential energy (9.87 MeV total energy/proton is constant). This calculation is made possible by the use of the simple equation f= (mV^2/r)*1/exp(90) and potential energy = integral F*dR, dR is the increase in gravitational radius of each cell.



For convenience cosmologists use ke'=ke*(time/time')^(2/3). (Primed values mean the next value in incremental calculations across time). The universe expands because kinetic energy is being converted to potential energy. Cell radius increases as kinetic energy decreases r'=r*ke/ke'. Combining the relationships above, r'=r*(time'/time)^(2/3). The gravitation constant G=Fr^2/(m/g)^2 is maintained throughout expansion where lower case g= gamma= 938.27/(938.27+ke).
Potential energy (PE)= 0.5*F*(delta R)/(1.6e-13 Nt-m/MeV).

Note: See Appendix 6 for derivation of force and pressure relationships for cells. Force f (inertial force on the cell surface) can also be converted to pressure by the equation p=f/(4pi*r^2), where r is the cell radius. Pressure drives expansion but conversion of decreasing kinetic energy to increasing potential energy is used for convenience.

Constructing the expansion radius

There is uncertainty in current literature regarding the initial radius of the universe. Some say it was a point and an exponential expansion known as inflation quickly increased the radius. The WMAP [4] expansion model (called the concordance model or Lambda Cold Dark Matter model) calculates expansion with R'=R*(time'/time)^2/3 plus a second component based on a constant called lambda suggested by Einstein.

Expansion model based cellular cosmology

An expansion model can be constructed with a few facts (results of huge efforts throughout history):

Facts from WMAP and Planck [21]: The current temperature called Cosmic Background Radiation (CBR) temperature =2.73 K. The current Hubble constant =2.26e-18/sec. The Hubble constant is strongly associated with the current density 9.14e-27 Kg/M^2 in a flat universe. This is also considered critical density. The current age of the universe =13.8 billion years.

Facts from Proton model: Values in the neutron mass model determine the starting radius ro=7.22e-14 M. The gravitational field energy E=2.732 MeV determines r0. R0=7.22e-14*exp(60)=8.25e12 meters. The Proton model provides the initial kinetic energy=10.15 and slightly later value 9.87 MeV/proton.

Based on probabilities for the neutron components the number of protons= exp(180) and the mass of the universe= exp(180)*1.673e-27=2.49e51 Kg. [Appendix 2 topic entitled "The number of neutrons in nature"]. Cellular cosmology places N cells in a large sphere. For this calculation we will assume that the critical density is neutrons but this will be checked several ways. This means that one cell of radius r represents the universe with R=r*exp(60). Initially all exp(180) cells are identical and one cell provides a great deal of information if we know the properties of the cell.

	Radius calculation	
7.22E-14	Initial radius	
1.68E-27	Mass per cell (one neutron)	
9.16E-27	Density of cell kg/m^3 (Omega	
1.83E-01	Volume=density/mass	
0.352	r=((3/4)*volume/pi())^(1/3)	
	For exp(60) cells	
8.25E+12	Initial radius	
4.0211E+25	Radius M	

At the current time the universe density is 9.14e-27 kg/m^3. The volume that would contain exp(180)*1.67e-27 Kg=2.48e51 Kg is 2.48e51/9.14e-27=2.72e77 m^3. Assuming a sphere, the current radius is 4.02e25 meters. This includes both expansion components.

Facts from Astrophysics: During expansion the temperature falls to 8e8 K and the SAHA equilibrium value approaches unity where He4 is readily formed [1][5][6][7]. The measured fraction of He4 is in the range 0.23 to 0.27.

Radius and temperature history from beginning to He4 fusion

First we construct a time scale based on the age of the universe (13.8 billion years =4.33e17 sec). Fundamental time 7.22e-14*2*pi/3e8=1.5e-21 seconds (nature counts forward as this time repeats). Logarithms will be used to decrease the number of computational iterations. Natural log(4.33e17/1/5e-21)=88.6 will be the current time. Natural log 45 is a good starting point (exp(45)*1.5e-21=0.059 sec). Time in seconds for the x axis will be exp(45+increment)*1.5e-21 seconds. The increment is the number of calculation columns from 45 to 88.6.

Next we will calculate the cell radius (r) as a function of time. The force f on the cell surface is calculated two ways and is equal: f=(m/g)*V^2/r*(1/exp(90))= G(m/g)^2/r^2 where m=1.673e-27 Kg. Gamma g=938.27/(938.27+ke) and velocity=C*(1-gamma^2)^.5 in meters/sec. Each cell is an expanding orbit with ke'=ke*(time/time')^0.5 and r=r0*9.87/ke (primed values mean the next value in an incremental calculation over time) Velocity is calculated from V=C*(1-g^2)^0.5 or V=((2*ke/m)/1.6e-13)^0.5 when g becomes very close to 1.0. G was slightly different at the beginning but calculations near the end of expansion G= 6.6743e-11 Nt M^2/Kg^2.

Initial temperature=9.87/(1.5B)=7.6e10 K, where B=Boltzmann's constant 8.6e-11 Mev/K and T'=T*(R/R'). The calculations below are the first few steps. Lower case letters will be used to represent cellular values and upper case letters will be used for the large sphere (the universe). The equations are shown. If you are following this with an Excel® spreadsheet, copy these equations to 809 seconds. The information in green exists in each proton. The proton provides further cosmology properties as subsequent events occur.

> Note: The reader may have to move back and forth in the document. For example, the finding that this is the proton is discussed further in the section entitled "Conclusions".

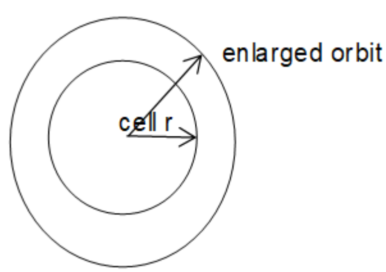
Potential energy + kinetic energy (MeV)	20.30	20.30	20.30	20.31
Potential energy (MeV)=.5FdR/1.6e-13	10.43	12.16	13.59	14.77
r0=7.22e-14*9.872/ke	7.22E-14	8.76E-14	1.06E-13	1.29E-13
ke=9.87*(time/time')^0.5	9.872	8.14E+00	6.71E+00	5.54E+00
g=938.27/(938.27+ke)	**9.8959E-01**	**9.9140E-01**	**9.9289E-01**	**9.9413E-01**
V=(1-(g)^2)^0.5*C	**4.3148E+07**	**3.9238E+07**	**3.5674E+07**	**3.2427E+07**
fgrav=(1.673E-27*V^2/(r0*EXP(90))	3.5702E-38	2.4305E-38	1.6543E-38	1.1259E-38
time (seconds)	5.29E-02	7.77E-02	1.14E-01	1.68E-01
G=fgrav*r^2/(m/g)^2	6.503E-11	6.533E-11	6.558E-11	6.578E-11

Facts from Appendix 5:

Increased radius dR=de/fcell*exp(60) where de is the energy available for expansion/proton. Force resisting expansion is fcell = f grav*exp(90). Pressure inside the cell p=fcell/(4pi*r^2). Temperature (T)= p/(nB) where p is pressure, n is the number density of neutrons and B is the Boltzmann constant.

The He4 transition

The calculations for the cellular base with decreasing kinetic energy continue across the time axis until the period below is reached. The calculation column for the He4 transition at 1190 seconds is shown in yellow below. When the temperature decreases to slightly lower than 8e8 K, He4 fuses (due to free neutrons and reduced Deuterium photodisintegration [15]). The He4 fusion energy causes an enlarged orbit without changing the cellular base (the column of calculations below at time 1749 seconds). This is similar to a satellite being launched with kinetic energy increasing the radius.



The equal force increased radius orbit is calculated by increasing potential energy and decreasing kinetic energy.

	Potential Energy (MeV)	0.017
	Kinetic Energy (MeV)	0.017
	Venlarged orbit=(fgrav*R*EXP(30)/1.67E-27	1.28E+06
	Fenlarg=1.67e-27*V^2/(R/exp(60)*(1/exp(90	2.73E-44

Temp=p/(n*B)/1.6e-13 (K)		3.37E+10
Baryon/Photon ratio for T=5.27e10 K and R=5.77e15 M		4.0533E-10
R=R+dR=1.02e15+dE/(2.3e-42*exp(90)*exp(60)*1.6e-13=4.85e15 (M		9.30E+15
		↑
	MeV addition from Fusion	1.3
p/n=fcell/(4*PI()*rcell^2)/(exp(180)/(4/3*pi*R^3))		4.64E-13
F enlarged=1.67e-27*V^2/R		2.80E-44
	R=rcell*exp(60) (M)	1.02E+15
Temperature (K)	T=ke/(1.5*8.6e-11)	6.19E+08
r radius cell (M)	r0=7.22e-14*9.872/ke	8.93E-12
kinetic energy (MeV)	ke=9.87*(time/time')^0.5	7.98E-02
gamma	**g=938.27/(938.27+ke)**	**9.9991E-01**
Velocity (M/sec)	**V=(1-(g)^2)^0.5*C or V=(2*ke/1.67e-27*1.6e-13)^.**	**3.9096E+06**
fgrav=mV^2/(r*exp(90)) (	fgrav=(1.673E-27*V^2/(r0*EXP(90))	2.3460E-42
	time (seconds)	809.10
Grav const (Nt M^2/Kg^2)	G=fgrav*r^2/(m/g)^2	6.67E-11

The radius is cell radius plus the increase in energy related to fusion R= 8.93e-12*exp(60)+ 1.3*exp(60)/(2.79e-44*exp(90))*1.6e-13=9.32e15 M. (Each proton released 7.07 MeV binding energy= 0.23*7.07= 1.62 MeV available).

Pressure= fcell/(4pi*r^2)=2.05e17 Nt/M^2 and n=exp(180)/(4/3*pi*R^3). At this point in expansion, we know P and n and can calculate T=P/(nB). T= 2.05e17/(4.42e29*8.6e-11)= 6.32e10 K.

The Baryon/Photon ratio is calculated with T=3.37e10 K and R=9.32e15 M.

Baryon/photon=(EXP(180)/(4/3*PI()*9.32e15^3))/(8*PI()/(4.31e-21*3e8)^3*(1.5*8.62e-11*3.37e10e10)^3)=4.02e-10

The WMAP criterion (4.4e-10) is satisfied. We will return to consequences of this calculation but focus on the expansion model. After He4 fusion the radius R is a function of kinetic energy.

After the He4 transition

Refer to the columns of calculation (colored blue above) immediately following the He4 transition. The He4 transition is an explosion (0.25 of all matter releases fusion energy) and the initial result is an increase in radius but conditions stabilize at 1190 seconds. The value T=p/nB/1.6e-13 is constant before, during and after the transition but p/n is decreased because the radius has increased.

The equation is simply R=7.22e-14*9.87/(ke/6)*exp(60). The value 6 reduces the kinetic because this applies to the outer orbit in the diagram above. (Recall that potential energy increased and kinetic energy increased). The temperature is calculated from T=(p/nB). The radius increases from this point with R'=7.91e15*(time'/time)^(2/3). Temperature reduces directly with radius; i.e. T'=1.71e10*(R/R').

Time (sec)		1189.59	1749.00	2571.48	3780.75
n=1/(4/3*PI()*r^3)					
Temp=p/(n*B)/1.6e-13 (K)		1.71E+10	1.32E+10	1.02E+10	7.92E+09
Baryon/Photon ratio for T=5.27e10 K and R=5.77e15 M					
R=7.22e-14*9.87/(ke/6)*EXP(60)		7.91E+15	1.02E+16	1.32E+16	1.71E+16
p/n=fcell/(4*PI()*rcell^2)/(exp(180)/(4/3*pi*R^3))		2.36E-13	1.82E-13	1.41E-13	1.09E-13
F enlarged=1.67e-27*V^2/R		3.88E-44	2.32E-44	1.39E-44	8.29E-45
	R=rcell*exp(60) (M)	1.32E+15	1.71E+15	2.21E+15	2.85E+15
	time (seconds)				
Temperature (K)	T=ke/(1.5*8.6e-11)	4.78E+08	3.69E+08	2.86E+08	2.21E+08
r radius cell (M)	r0=7.22e-14*9.872/ke	1.15E-11	1.49E-11	1.93E-11	2.50E-11
kinetic energy (MeV)	ke=9.87*(time/time')^0.5	0.062	0.048	0.037	0.029
gamma	g=938.27/(938.27+ke)	9.9993E-01	9.9995E-01	9.9996E-01	9.9997E-01
Velocity (M/sec)	V=(1-(g)^2)^0.5*C	3.4383E+06	3.0238E+06	2.6592E+06	2.3386E+06
fgrav=mV^2/(r*exp(90)) (N	fgrav=(1.673E-27*V^2/(r0*EXP(90))	1.4033E-42	8.3890E-43	5.0179E-43	3.0014E-43
Grav const (Nt M^2/Kg^2)	G=fgrav*r^2/(m/g)^2	6.671E-11	6.691E-11	6.691E-11	6.691E-11

At 4.3e17 seconds, the universe reaches the radius 3.53e25 meters and temperature 2.55 K. This radius will increase to 4.02e25 meters and the temperature will increase to 2.73 K after the second component of expansion is added. This is the subject of Problem 4 below.

Consequences of Baryon/Photon ratio

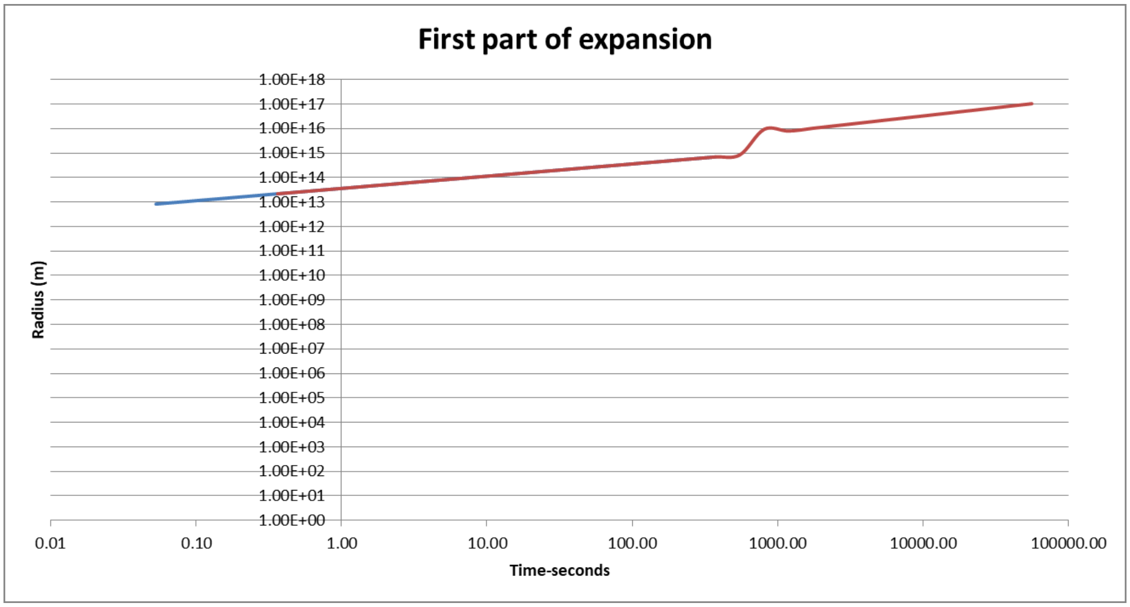
The calculation above at the He4 transition gave a baryon/photon ratio= 4.0e-10. This meets the astrophysical requirement with exp(180) neutrons. This means there is no missing matter. The residuals are formed in proportion to the He4 fraction and are relative fixed (see the discussion on the point in Peebles [1]). The values below under the heading "Calculated" agree with the measured values.

	Time seconds			810	1190
	Radius (meters)			9.32E+15	7.91E+15
	Temperature (K)		7.50E+08	3.37E+10	1.71E+10
	baryon/photon ratio			4.02E-10	5.00E-09
Measured	Formulas for D, He3 and LI7			Calculated	
2.37E-05	D=4.6e-4*(B/P*1e10)^(-1.67)*1/exp(SAHA)			4.51E-05	6.68E-07
6.65E-05	He3=3e-5*(B/P*1e10)^-0.5		3.3e-5 to 1e-4	1.50E-05	4.24E-06
6.00E-09	Li7=5.2e-10*(B/P*1e10)^-2.43+6.3e-12*(B/P*1e10)^2.43			2.03E-10	8.48E-08
http://cds.cern.ch/record/262880/files/9405010.pdf			-2.65E+00	3.67E+01	
			SAHA	SAHA	

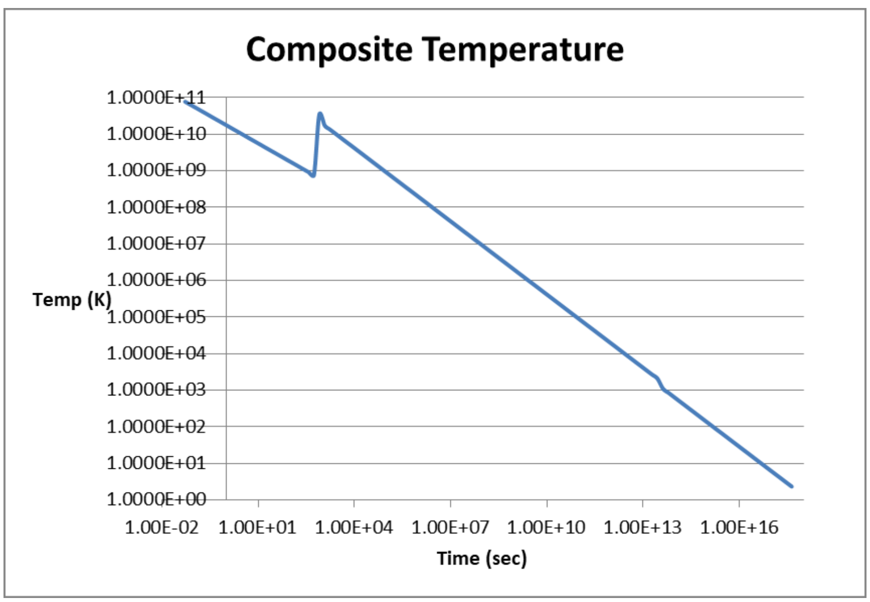
SAHA value=LN(4/3*((1*0.8)/((4.3E+67)/(0.5*EXP(180))))^(3/2))+LN((0.697^2)*(8.16e8/10000000000)^(3/2))-(2.58/(8.16e8/10000000000))

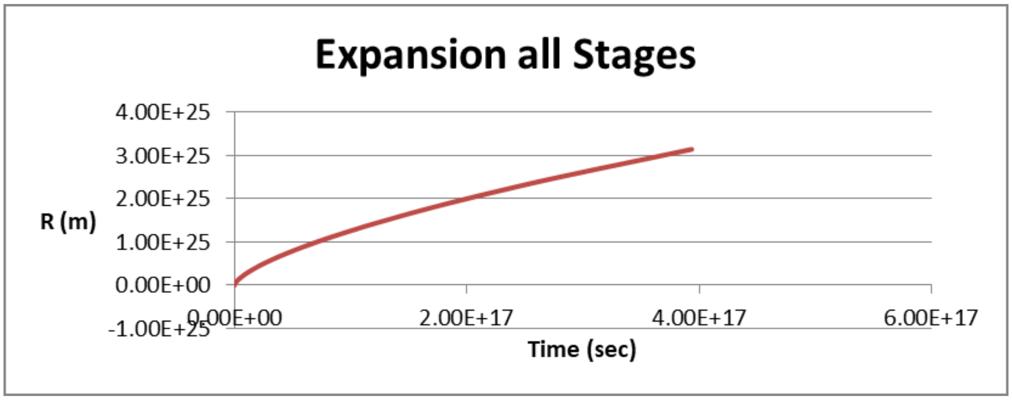
Summary of expansion and temperature history

Overall, the expansion radius and temperature is represented by the following graphs.



The temperature after the He4 transition is due to heat addition from He4 primordial fusion. As expansion occurs the temperature falls as Rh/R and yields 2.73K as the current value. Orbital KE (MeV) determines the temperature (T=KE/(1.5*8.6e-11) K. The slope following the spike is (time/time')^(2/3)





Energy history summary

Energy is available at the beginning and added at two additional places in the expansion curve. The original kinetic energy of 9.87 MeV/proton comes from the proton mass model [1] [10](Appendix 2). Secondly He4 fusion releases 1.3 MeV/proton when He4 forms (called primordial nucleosynthesis in the literature). Finally, stars light up and release radiation energy. The arrows labelled reduced show the change in the energy value/proton due to expansion. The kinetic energy can be calculated from the Boltzmann relationship; ke=1.5*B*T, where B is 8.62e-11 MeV/K.

	Summary of energy releases during expansion					
	Initial Energy	He4 fusion	r=r*t^(2/3)	Star energy start	Expanded now (MeV/proton)	
R meters	8.25E+12	4.80E+15		1.80E+24	3.53E+25	no stars
		reduced →		reduced		
MeV/proton	9.87	1.70E-02	⟶		1.77E-11	
MeV/proton		1.3	(increases temperature)			
MeV/proton				star addition →	3.63E-11	
R delta (meters)					4.94E+24	
R now					4.02E+25	stars

Problem Resolution; Where is all of the normal matter (only 4% discovered)? What conditions existed when residual D, He3 and Li7 formed?

WMAP starts at a different radius and, as far as I can tell, does not add energy to account for primordial He4 formation (1.7 MeV). WMAP analysis used the astrophysics literature value of 4.4e-10 baryons/photons because it explains the measured residual isotopes. But they reduced the baryon content of the universe to a very low value (0.046) to meet the criteria. They didn't have the radius and temperature histories associated with cellular cosmology. Using cellular cosmology, the temperature and radius calculations at this transition combine in a way that yield a baryon/photon density ratio of 4.4e-10 with exp(180) baryons. X is 1.0 in the following calculation, not 0.046. The critical density is exp(180)*1.67e-27 Kg/(4/3*pi*4.02e25^3)=9.14e-27 Kg/M^3.

Baryon/photon=(x*EXP(180)/(4/3*PI()*R^3))/(8*PI()/(4.31e-21*3e8)^3*(1.5*8.62e-11*T)^3)

Overall, the baryon/photon ratio does not cause baryons to be severely limited like WMAP [4] and other documents suggest. (X=1.0)

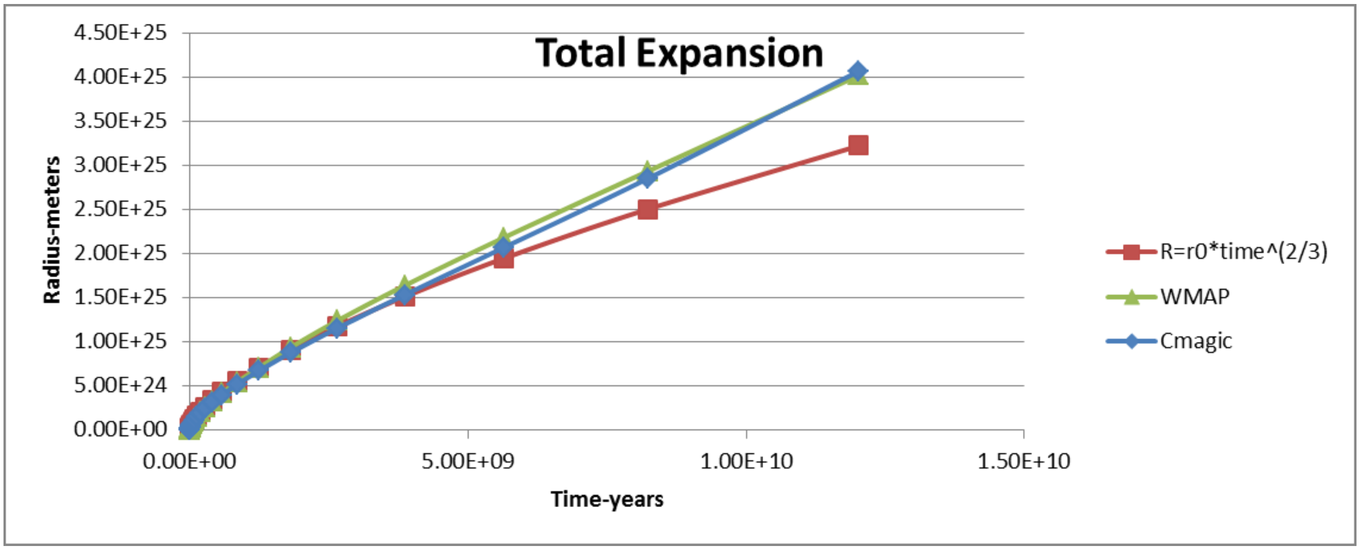
Problem 4; What is Dark Energy?

Observations of the universe's expansion created discussion regarding dark energy. There is consensus that late stage expansion currently is more linear than the equation R'=R*(time'/time)^(2/3). Since this equation represents conversion of kinetic energy to potential energy and is a curve, data [3] showing that late stage expansion is linear or expanding appears to violate energy conservation and require a dark (unknown) energy source. Two literature proposals (cosmological constant Lambda and quintessence) attempt to account for this unknown energy source.

This paper presents calculations indicating that energy produced by stars causes the linear expansion curve. The analysis draws on the rate of star formation and the energy they release. A calculation procedure for expansion was developed that allows one to add energy and predict its effect on late stage expansion. It was surprising that a small amount of energy has a large effect on expansion. In fact, it will be shown that the energy addition is required to match the current temperature (2.73K) since the above models ended at 2.45 K. Energy produced by stars is fusion energy and provides a physical alternative to dark energy. Concordance models use Lambda as the second expansion component but WMAP analysis concluded that there was dark energy and it was a large fraction (0.719) of critical density. The expansion curve, energy release points and associated temperature curve is presented. Analysis shows that although the density is 9.14e-27 kg/m^3, the mass fractions should be all normal matter.

Background

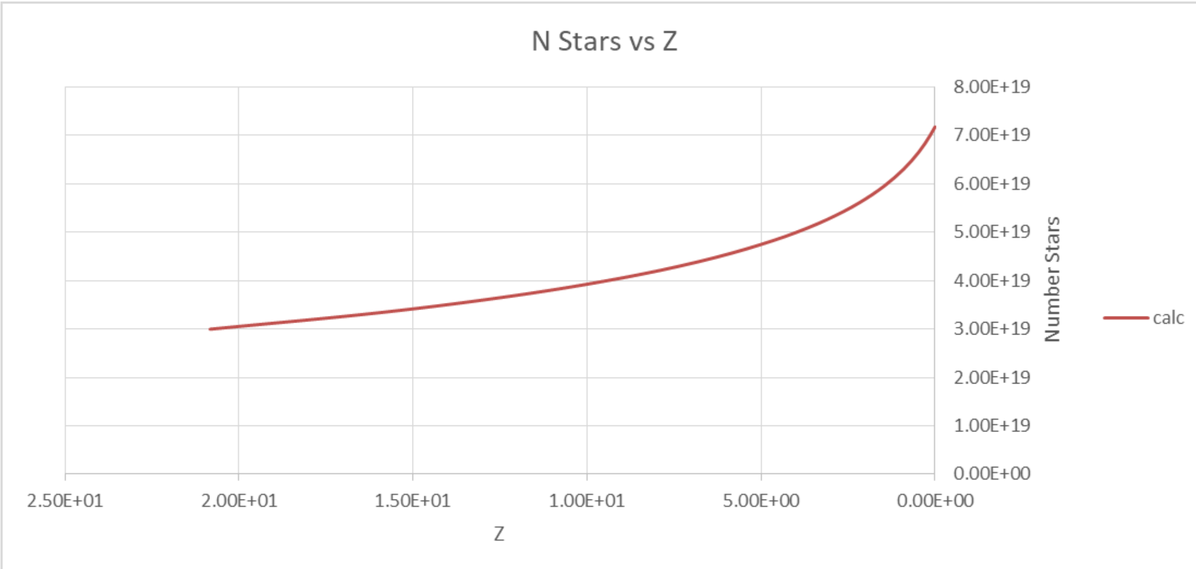
Expansion and cosmology parameters are currently based on differential radiometer projects known as COBE, WMAP [3][7][5], and Planck. They are compared to supernova data from Cmagic [5] that suggest an accelerating universe. Expansion follows R=R'(time'/time)^(2/3) throughout almost all of expansion. But this gives the wrong Hubble constant (slope of the expansion curve/divided by the radius at the present time). The Hubble constant has been accurately measured by many projects and is equal to 2.26e-18/sec [7]). This means that a second expansion component is increasing the radius, but what causes it? The graph below shows the problem. Data suggests the upper curve but this requires an unknown energy source. The concept "dark energy" is a placeholder and the author explored the possibility that energy produced by stars is the unknown energy source.



Exploration

The sky temperature is 2.725K. Star formation starts at about z= 16= (Rf/R-1). The average star is about 5e29 Kg [4] but there are potentially a significant fraction 2.49e51/5e29= 1.2e21 stars if their mass is 2e30 kg similar to our sun (fraction is about 0.1 of potential). The sun emits 2.37e39 MeV/second and has a lifetime of about 10 billion years. Since early star formation many atoms have moved through a well-documented solar burning cycle. Our sun is mainly hydrogen but a supernova in our vicinity produced the heavier elements that make up the earth and other planets. Heavier elements are measured throughout the universe and NIST publishes data regarding elemental abundance.

Our goal is to determine the expansion energy available after stars form. This expansion component will be called R3. The question is can this replace what cosmologists call the Lambda component of expansion? One might think that this energy is redshifted away but in cellular cosmology expansion is driven by energy, energy related to temperature and the energy is inside the cell. We will base our estimate on stars that are similar to our sun. The first step is to determine the number of stars as a function of time.



Star energy is added starting at z=16 where stars light up [Wiki]. Papers also present the rate of star formation. Each has a surface area and in cellular cosmology the surface area is mathematically the surface of a large sphere.

The basic equation for MeV/meter^2=3.54e5*T^4, where T is the surface temperature (K).

The surface area of all the stars with surface temperature 5778 K is giving off photons at 3.54e5*5778^4=3.59e20 MeV/M^2 but the remaining dark sky area is only giving off 3.54e5*2.44^4= 1.25e7 MeV/M^2.

Area overall sky= 4*pi*4.02e25^2= 6.77e51 M^2

Calculate the average temperature = (1.97e7/3.54e5)^.25=2.73 K. The average temperature is a composite of T=5778 K and 2.44 K.

area (M^2)	3.54e5*5778^4 (Mev/M^2)			
3.67E+38	3.95E+20	1.45E+59	area*mev/area	
2.03E+52	1.25E+07	2.55E+59	area*mev/area	
		6.77E+51	total area	
Temp (K)	Temp (K)	1.97E+07	mevtotal/area total	
2.44	5778	2.73E+00	(1.97e07/3.54e5)^.25	

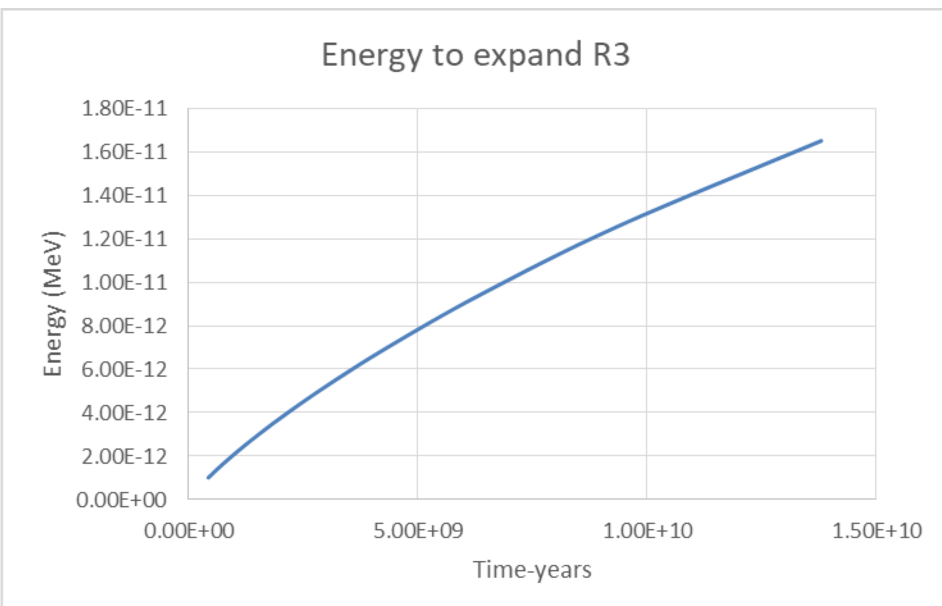
In cellular cosmology all added energy counts and the stars add a significant amount of energy. Delta E is the difference between sky temperature with stars (2.73 K) and the temperature without stars (2.45 K). These values apply to the end of expansion at 4.02e25 M. Delta E= (2.73-2.45)/(1.5*8.6e-11)= 3.63e-11 MeV. This delta E increases the radius. Delta R= Delta E/F*1.6e-13=3.63e-11/6.69e-49*1.6e-13= 8.67e24 M.

The calculations below represent energy released by stars as a function of time. The calculation procedure is an incremental calculation using the force in the cell and the energy addition by stars. Delta R=dE/F*1.6e-13 (1.63e-13 is an energy conversion constant).

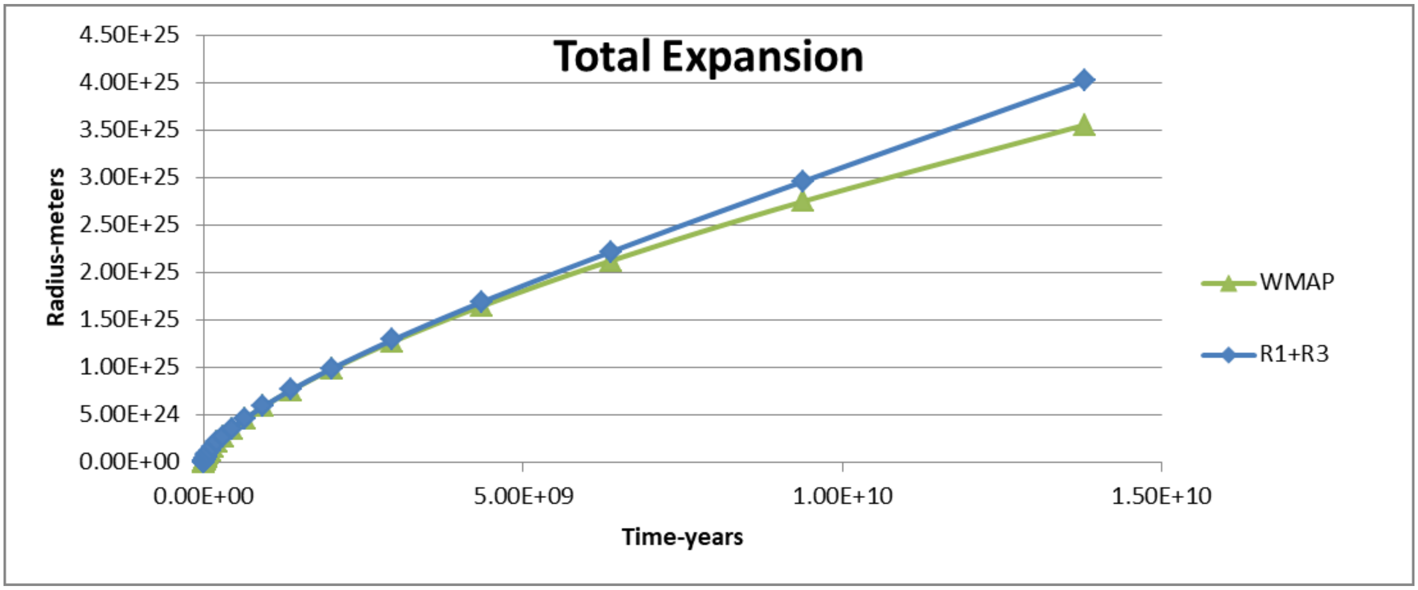
The expansion curve for star energy

1.19E-02	1.53E-02	1.98E-02	2.56E-02	3.32E-02	4.29E-02	5.54E-02	rgrav = 7.22e-14*9.87/ke	
6.01E-11	4.65E-11	3.60E-11	2.78E-11	2.15E-11	1.66E-11	1.29E-11	ke (MeV)	
1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00	gamma	
1.07E+02	9.43E+01	8.29E+01	7.29E+01	6.41E+01	5.64E+01	4.96E+01	Velocity (M/sec)	
1.3306E-60	7.9592E-61	4.7608E-61	2.8476E-61	1.7033E-61	1.0188E-61	6.0941E-62	Fcell=mV^2/r*(1/exp(90))	
6.67E-11	6.67E-11	6.67E-11	6.67E-11	6.6743E-11	6.67E-11	6.6743E-11		
3.67E+00	2.61E+00	1.80E+00	1.16E+00	6.72E-01	2.93E-01	0.00E+00	Z=Rfinal/R-1	1.21E+00
6.73E+24	8.72E+24	1.13E+25	1.49E+25	1.98E+25	2.74E+25	4.03E+25	R1+R3	9.30E+07
1.293E-01	1.000E-01	7.734E-02	5.981E-02	4.626E-02	3.578E-02	2.767E-02	star growth	-1.00E+00
5.82E+18	8.56E+18	1.26E+19	1.85E+19	2.72E+19	4.00E+19	5.88E+19	stars	3.69E+08
6.08E+09	2.18E+09	7.78E+08	2.78E+08	9.96E+07	3.56E+07	1.28E+07	3.54e5*2.73^4	1.00E+00
3.95E+20	3.95E+20	3.95E+20	3.95E+20	3.95E+20	3.95E+20	3.95E+20	3.54e5*5778^4	
9.3006E+50	1.5549E+51	2.5995E+51	4.3460E+51	7.2657E+51	1.2147E+52	2.0308E+52	Area sky w/o stars area	
3.54E+37	5.20E+37	7.65E+37	1.13E+38	1.65E+38	2.43E+38	3.58E+38	Area sky with stars	
1.15E+01	8.87E+00	6.87E+00	5.34E+00	4.19E+00	3.33E+00	2.73E+00	Temp with Stars	
1.14E+01	8.85E+00	6.85E+00	5.30E+00	4.10E+00	3.17E+00	2.45E+00	Temp w/o stars	
9.11E-13	1.73E-12	3.28E-12	6.18E-12	1.15E-11	2.10E-11	3.63E-11	Delta E (MeV)	
1.02E+22	3.25E+22	1.03E+23	3.25E+23	1.01E+24	3.08E+24	8.92E+24	dR=de/f*exp(60)*1.6e-13	

The radius without stars would be R1=4.13e25 meters at the present time if stars did not add energy. The calculations above show Delta E for earlier R where there were fewer stars and the associated Delta R (called R3). Adding R1 and R3 gives expansion with stars as a function of time.



Stars have a significant effect on expansion because the star Delta E (MeV) is a sizable fraction of normal expansion energy. Calculations show that this keeps the expansion curve from following the curve proportional to R'=R*(time'/time)^(2/3) after stars. But considering energy from stars an expansion curve is produced that replaces the Lambda component. It considers the rate the rate of star formation.



Hubble Check

We subtract the last two radius columns and divide by the difference in the last two times. The check Hubble, we divide again by R. The WMAP Hubble value was 2.26e-18/sec. The values match.

2.74E+25	4.03E+25	R1+R3	9.27E+07	Delta R
2.96E+17	4.35E+17	Delta time	2.31E-18	H=Delta R/R

Dark Energy Resolution

Currently very little energy is required for expansion since most of the original and He4 fusion kinetic energy has been converted to other forms of energy. The energy produced by stars as they light up must be considered in cellular cosmology. Delta R expansion from star energy is on the order of R3= 8e24 meters. The concept of dark energy was a place holder until the true cause was uncovered. Stars produce enough energy to explain observations. Photon energy released by stars flattens (or accelerates) the curve like the WMAP Lambda expansion component or the data reported by expansion model CMAGIC [3].

Problem 5; Baryon fraction at equality

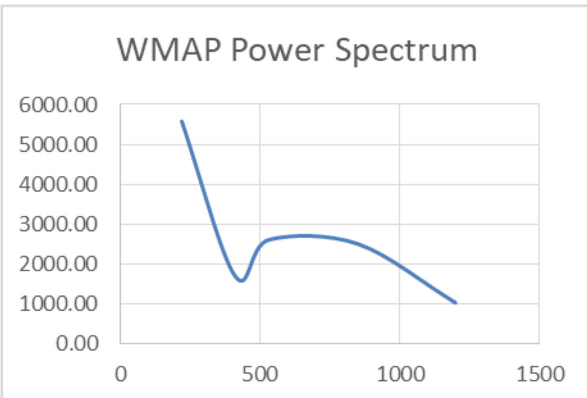
Another limitation is related to the radius and temperature where equality of radiation and mass occurs. The thought was that baryons had to be limited so that equality occurred early enough to allow development of the measured primary hot spot at decoupling. After equality waves occur. Their speed in the plasma is V= C/3^.5 meters/sec. The wave progression radius R=V*delta time= 2.31e21/(pi*Ru)=0.0106 radians at decoupling [4] (pi is used because they are measuring distance in radians against the radius of the universe at that point). WMAP data was updated for 9 years as additional data came in [4]. But listen to the language in the report: “The peak at 74.5 micro-degrees K is due to the baryon-photon fluid falling into pre-existing wells resulting from Gaussian disturbances from inflation and dark matter”. Really?

WMAP interpretation that ratio of peaks determines dark/light ratio

The WMAP limitation on baryon fraction was based on the interpretation of hot spots measured by WMAP and refined by PLANCK scientists. We will first review the WMAP data [4][26] reduction (a power spectrum expected from acoustic waves).

L	L*(L+1)/2pi*cl micro K^2	La	L*(L+1)/2pi	cl	delta temp K	radius (meters
		0.735				5.10E+23
220	5580.1	299.32	7738.11	0.72	7.47E-05	2.32E+21
412	1681.0	560.54	27081.17	0.06	4.10E-05	1.24E+21
531	2601.0	722.95	45022.14	0.06	5.10E-05	9.60E+20
850	2500.0	1156.46	213038.79	0.01	0.00005	6.00E+20
1200	1020.0	1632.65	424496.26	2.64E-03	3.34664E-05	4.25E+20

The WMAP power spectrum for the above measurements is shown below:



Results from cellular cosmology model:

The calculations below show the period from equality to decoupling with 1.0 baryon critical density. Equality and decoupling occur at the correct radius and temperature combinations and wave progression produces the same primary 0.0106 radian hot spot.

Radius R (meters)	8.54E+21	1.10E+22	1.43E+22	1.85E+22	2.39E+22	3.09E+22	3.99E+22	5.16E+22	6.67E+22
Z=Rf/R-1	4707.77	3640.74	2815.51	2177.28	1683.67	1301.92	1006.68	15.51	11.77
photon density (Kg/m^3)	equality	wmap calcs						decoupling	
Temperature (K)	2.03E+04	1.57E+04	1.21E+04	9.39E+03	7.26E+03	5.61E+03	4.34E+03	3.36E+03	2.60E+03
8*PI()/(H*C)^3*(1.5*B*T)^3	2.38E+20	1.10E+20	5.09E+19	2.36E+19	1.09E+19	5.04E+18	2.33E+18	1.08E+18	4.99E+17
Proton mass dens=1.67E-27*EXP(180)/(4/3*PI()*R^3)	9.54E-16	4.41E-16	2.04E-16	9.45E-17	4.37E-17	2.02E-17	9.35E-18	4.33E-18	2.00E-18
photon mass dens=8*PI()/(HC)^3*(1.5*B*T)^3	**1.11E-15**	**3.98E-16**	**1.42E-16**	**5.09E-17**	**1.82E-17**	**6.51E-18**	**2.33E-18**	**8.34E-19**	**2.98E-19**
dens ratio= proton mass dens/photon mass dens	1.16E+00	9.00E-01	6.96E-01	5.39E-01	4.17E-01	3.22E-01	2.49E-01	1.93E-01	1.49E-01
progression of wave (spot) at C/3^.5	2.26E+20	3.32E+20	4.88E+20	7.17E+20	1.05E+21	1.55E+21	2.28E+21	3.35E+21	4.92E+21
Spot size (radians=spot/(2*pi*R)	0.0000	0.0048	0.0054	0.0062	0.0070	0.0080	0.0091	0.0103	0.0118

3.05E+22	3.94E+22
1029.61	15.89
	decoupling →
2.52E+03	1.95E+03
4.58E+17	2.12E+17
2.09E-17	9.68E-18
2.66E-19	**9.52E-20**
1.27E-02	9.84E-03
1.30E+21	1.84E+21
0.0136	0.0148

Calculation of dt

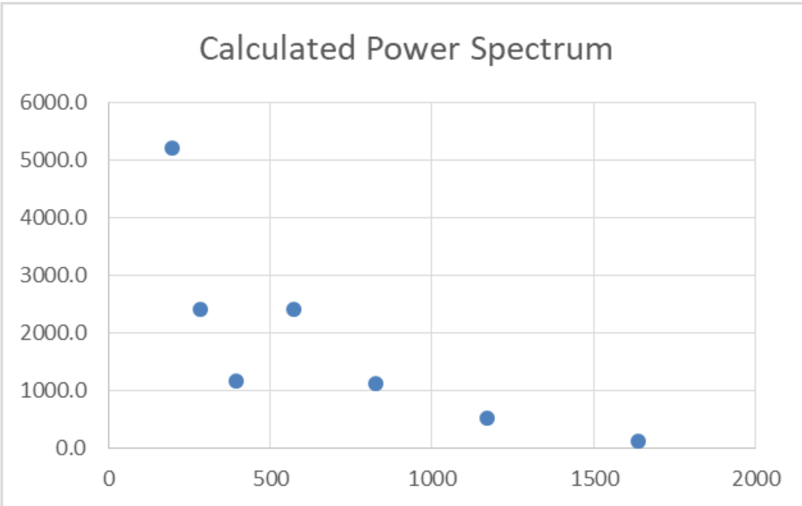
The temperature peaks called dt are in micro degrees (2.730074 K). The thermal peaks are a function of density. There is a misunderstanding that progression of the wave causes densification. In fact the density of the universe (decoupling and slightly sooner) is recorded in the wave. The waves at that point become visible (the plasma clears). That period is recorded by radiometers but the radiation has been highly red shifted to 2.73 degrees, Density near the decoupling radius is provided by the cosmology model. This density is the key to understanding WMAP temperature anisotropy.

dt=2.73*(1.2*(9.14e-27/4.33e-18)^.5+1)^.333-2.73

Delta t (dt) is calculated from the density near decoupling compared to the final density (also critical density). Spots inside larger spots are earlier densities that are visible to radiometers in the CMB as time and the wave progresses. The following combinations of wave progression and temperature produce the power spectrum below. *The important combination at decoupling yields exactly 74 micro degrees (the value 7.34e-5 in the table below) from first principles!*

wave progress	5.30E+19	1.31E+20	2.46E+20	4.14E+20	6.62E+20	1.03E+21	1.56E+21	2.35E+21
radians	0.0015	0.0029	0.0042	0.0055	0.0068	0.0082	0.0096	0.0112
Delta t (dt)		7.299E-06	1.073E-05	1.578E-05	2.320E-05	3.411E-05	5.015E-05	7.373E-05

model result dt (K)	wave R progression	wave R with harmonics	L 5.1e23/prog	L*(L+1)/2pi*cl micro K^2	La 0.735	L*(L+1)/2pi	cl cl=(dt*1e6)^2/((L*(L+1)/2pi)	delta temp K
73.73	2.35E+21	2.35E+21	217	5436.1	295.38	7536.01	→ 0.72	← 7.373E-05
		1.17E+21	434	1156.0	590.75	30074.94	0.04	3.400E-05
50.15	1.56E+21	1.56E+21	327	2514.8	444.31	17025.16	0.15	5.015E-05
50.15	1.56E+21	7.81E+20	653	2514.8	888.62	125816.33	0.02	5.015E-05
34.11	1.03E+21	5.13E+20	994	1163.4	1352.41	291312.81	0.004	3.411E-05
23.20	6.62E+20	3.31E+20	1541	538.2	2096.74	700029.01	0.001	2.320E-05
10.73	4.14E+20	2.07E+20	2463	115.2	3351.22	1787946.28	0.000	1.073E-05
7.30	2.46E+20	1.23E+20	4153	53.3	5650.66	5082714.20	0.000	7.299E-06



Result of possible baryon limitation from hot spot data

The entire equality to decoupling analysis was based of 1.0 baryon fraction of critical. The hot spots measured by WMAP were calculated. The density of the universe and how waves progress are the two variables of interest. There is no reference to dark matter in the calculation and the ratio of the first and second spots is NOT the dark to normal matter ratio (contrary to a WMAP statement). I believe I have characterized the hot spots and they do not limit baryon fraction to 0.046 fraction of critical density.

Problem 6; Mass Accumulation

At decoupling the plasma clears and normal matter can accumulate. The first accumulation is densification into a volume that will form clusters of galaxies. The wave (velocity=C/3^.5) that starts at equality and progresses to decoupling determines the first accumulation. The wave starts as high density and progresses outward. As it reaches decoupling, it determines central mass because matter inside the wavelength radius has more density than the outside radius (all gravitation is based on central mass and this defines what is central). Here is the calculation:

6.67E+22	R decoupling (M)
2.29E+04	N clusters
2.35E+21	Jeans at decoupling (M)
1.09E+47	Avg mass of cluster (Kg)

This determines the number and mass of clusters (N= 2.29e4= (6.67e22/2.35e21)^.33) and mass/galaxy=2.49e51/N=1.09e47 Kg).

Mass accumulation starts at this point and the equation derived below determines acceleration (a) toward the central mass (M) for a time period (t).

Touch down equation		
L=at^2/2=1/2*GM/R^2*(2R/at)^2=GM/(at^2)		
at^2=2GM/(at)^2		
a^3*t^4=2GM		
a=(2GM/t^4)^.333		

Mass M can be cluster central mass 1.09e47 Kg, galaxy central mass or star central mass.

Next, the radius that "reaches out" from (a) and "pulls in" mass during the time period (delta t) is calculated:

R (reach) =a*(delta time)^2/2.

From this the volume (4/3piR^3) multiplied by the density available determines the developing central mass for this time period.

Mass moved to center= volume*density.

The calculation is repeated, adding mass as time progresses (line 2):

4.24E+46	6.91E+46	1.09E+47	M Cluster	1.70E+02
3.67E+44	7.37E+44	1.28E+45	Mc accumulation=M+dM	
9.35E-18	4.33E-18	2.00E-18	density	
2.65E-05	1.87E-05	1.30E-05	touch dwn	
1.85E+20	2.73E+20	4.01E+20	Reach	
3.70E+44	5.44E+44	8.00E+44	Vol*dens	

However, for clusters the reach is limited to R=Vdt where V is limited to 4.4e7 m/sec (the kinetic energy of the fall cannot exceed 10.15 MeV). In addition, reach is later limited to 2.35e21 meters since that determined the central mass at decoupling. Clusters do not densify mass because they do not create an orbit. For stars, once a stable orbit is reached, expansion within the orbit stops. Recall that expansion is pressure driven. If there is no orbit, the pressure (and density) will everywhere be the same.

Galaxy Mass Accumulation

Galaxies form by the above process except the Jeans wavelength drops. The wave progression velocity was C/3^.5 before decoupling but after the plasma clears the speed drops to the speed of sound and the Jeans wavelength falls to approximately 1.9e19 meters.

2.4E+21	R decoupling (M)
1.8E+06	N galaxies in cluster
1.9E+19	Jeans for galaxy (M)
6.0E+40	Avg mass of galaxy (Kg)

This determines the number and mass of galaxies (N=(2.4e21/1.9e19)^.33) and mass/galaxy=1e47/N=6e40 Kg because the Jeans wavelength determines the boundary of the central mass. Mass accumulation is from "virgin density" (2.49e51/total volume).

Star mass Accumulation

The process again repeats determined by waves determining the volume of central mass. The fractional Jeans wavelength (empirical) 4e15 meter determines the average mass of the stars.

1.9E+19	R Jeans for galaxy (M)
1.0E+11	N stars in galaxy
4.1E+15	Jeans for stars (M)
5.2E+29	Avg mass of star (Kg)

Detailed WMAP ratios give number of clusters & stars				Ratio		Mass (kg)		
					1.67e-27 kg*exp(180)	**2.5E+51**	**Kg Universe**	
Taking values from table		R1+R2	6.67E+22					
Number of clusters/universe			**2.3E+04**	((4.72e22)/1.62e21)^3=2.6e4	divide by 2.6e4	**1.1E+47**	**Kg Cluster**	
		spot (m)	2.35E+21	(Radius/spot)				
		spot*2 (m)	2.35E+21					
Number of galaxys/cluster			**1.8E+06**	((3.17e21)/2.67e19)^3=1.7e6	divide by 1.7e6	**6.0E+40**	**Kg Galaxy**	
	Jeans lo speed	1.93E+19→	1.93E+19	(Spot/Jeans length)		**4.1E+10**	**numb galaxies**	
		red-empirical				6.031E+40	data galaxy count	
		Jeans lo (m)	1.93E+19			data	http://universe-review.ca/F05-galaxy.h	
stars/galaxy			**1.2E+11**	(2.67e19/5.6e15)^3=1.1e11	divide by 1.1e11	**5.2E+29**	**star mass**	compare data
	Jeans fraction		3.95E+15	(Jeans length/Jeans fraction)		**4.8E+21**	**number stars**	3.17E+29
http://en.wikipedia.org/wiki/Jeans_instability					stars/universe=clusters/universe*galaxys/cluster*stars/galaxy			

Star formation rates

The cosmology model developed above in Problem 3 allows star formation rates to be calculated. The number of stars is used in calculations for expansion component R3 (Problem 4 Dark Energy). The calculation uses the number of clusters, galaxies and stars listed above.

Stars= sum(2.3e4*(Mc/1.1e47)*1.8e6*(Mg/6.0e40)*1.2e11*(Ms/5.2e29)).

The ratios (Mc/1.1e47), (Mg/6.0e40), and (Ms/5.29e29) are lower than 1 because R (reach=a*t^2/2) calculated with acceleration (a) from the touchdown equation is limited to the Jeans wavelength since the central mass was established at earlier points in expansion (Z). As the universe expands, the central mass associated with the wavelength does not change. This leaves some mass out of reach. As stars develop, star number= sum(stars formed per time increment).

1.14E+47	1.14E+47	1.14E+47	1.14E+47	1.14E+47	M Cluster	1.70E+02
2.07E+46	2.07E+46	2.07E+46	2.07E+46	2.07E+46	Mc accumulation=M+dM	
2.80E-25	1.25E-25	5.46E-26	2.29E-26	9.08E-27	density	
1.55E-10	9.29E-11	5.56E-11	3.33E-11	1.99E-11	touch dwn	
2.35E+21	2.35E+21	2.35E+21	2.35E+21	2.35E+21	Reach	
6.33E+40	6.33E+40	6.33E+40	6.33E+40	6.33E+40	M Galaxy	
4.83E+39	4.83E+39	4.83E+39	4.83E+39	4.83E+39	Mg accumulation=M+dM	
2.80E-25	1.25E-25	5.46E-26	2.29E-26	9.08E-27	dens	
2.26E-12	1.35E-12	8.11E-13	4.85E-13	2.90E-13	touch dwn	
1.90E+19	1.90E+19	1.90E+19	1.90E+19	1.90E+19	Reach	
1.54E+05	1.35E+05	1.19E+05	1.05E+05	9.22E+04		
1.78E+20	2.30E+20	2.98E+20	3.85E+20	4.96E+20		
2.05E-22	9.47E-23	4.38E-23	2.03E-23	9.45E-24		
5.42E+29	5.42E+29	5.42E+29	5.42E+29	5.42E+29	M Star	
3.76E+28	3.76E+28	3.76E+28	3.76E+28	3.76E+28	Ms accumulation=M+dM	
2.80E-25	1.25E-25	5.46E-26	2.29E-26	9.08E-27	dens	
4.67E-16	2.80E-16	1.67E-16	1.00E-16	5.99E-17	touch dwn	
4.10E+15	4.10E+15	4.10E+15	4.10E+15	4.10E+15	Reach	
5.78E+19	6.13E+19	6.48E+19	6.83E+19	7.17E+19	Sum stars	
				3.48E+18	Stars for dt	
Stars= 1.15*sum(2.3e4*(1.37e46/1e47)*1.9e6*(3.32e39/6e40)*1e11*(2.3e28/5.2e29))						

The star numbers calculated above are used (yellow below) for calculating temperature and expansion due to star energy addition (R3). The value 1.15 is in very good agreement with the energy required to raise the temperature from 2.45 K to 2.73K and accelerate expansion. This model indicates that stars developed earlier than observations, perhaps as early at 2e6 years. But the current time is only 13.8 billion years and stars can burn for 10 billion years. Starting early still allows two generations.

4.20E+07	1.50E+07	3.54e5*2.73^4
3.95E+20	3.95E+20	3.54e5*5778^4
9.3906E+51	1.5699E+52	Area sky w/o stars area
1.71E+38	1.80E+38	Area sky with stars
3.43E+00	2.73E+00	Temp with Stars
3.30E+00	2.55E+00	Temp w/o stars
1.35E-11	1.77E-11	Delta E (MeV)
2.26E+24	4.94E+24	dR=de/f*exp(60)*1.6e-13

Another interesting value from the cosmology model is; Velocity=a*time calculated with acceleration (a). It shows that the velocity produced by the star central mass and planet central mass is not enough to establish an orbit. This means that "solid" objects form. (Mass densification associated with clusters and galaxies form orbits from which stars develop but they themselves are not solid objects.)

Successive densification and black holes

The cosmology model indicates that stars normally develop from virgin density (2.49e51 Kg/(Volume of universe). Densification occurs when stars falls into orbits (see Appendix entitled "Fall Velocity"). Successive densification can occur where galaxies form. Taking Z=20 as the reference point (where early mass accumulation has been observed), a galaxy can contain high density. New or interacting bodies can develop from the high density matter. This accelerates mass accumulation and may promote black hole development.

Z=20	Radius	Kg	Density		
R universe	1.62E+24	2.49E+51	1.40E-22	virgin (Kg/M^3)	
Rfall Galaxy	2.28E+19	6.33E+40	1.28E-18	galaxy (Kg/M^3)	

Summary; Cosmological parameter comparison

WMAP parameters are compared below with the revised parameters from this document summarized in the rightmost column. The total mass/volume is exp(180)*1.67e-27 kg/1e79=9.14e-27 kg/m^3. Baryon density is given by exp(180)/volume at each of the radius values with no dark matter. Cosmological parameters with dark energy removed (and replaced with star photon energy) are shown below. The table shows normal matter fraction of critical density (1.0), dark matter fraction of critical density (0) and dark energy fraction of critical density (0).

WMAP							
					THIS PAPER		
NOW				equality	decoupling	NOW	
published							
4.02E+25	Inferred Radius (m)			3.89E+21	5.08E+22	4.02E+25	= R1+R3
						4.94E+24	= R3
2.26E-18	H0					3.53E+25	= rR1
8809	Temperature at equality (K)			3.48E+04		2.73	
	Photon mass density						
	Proton mass density						
2973	Temperature (K) decoupling				2668	2.73	
0.0106	Spot angle (radians)				0.0109		
0.254	baryon number density					5.473	
5.77E+08	Photon number density					5.77E+08	
4.400E-10	baryons/photon					4.00E-10	
0.235	Dark matter fraction					0	
6.57E-27	dark matter density in kg/m^3					0	
4.24E-28	baryon matter density in kg/m^3					9.14E-27	
0.719	Dark energy fraction					0	
9.14E-27	critical density					9.14E-27	
0.0464	Baryon fraction					1.000	
2.72E+77	Overall volume (m^3)				2.46E+65	2.72E+77	
2.814E-01	overall mass density				rhoC	Volume	
					9.135E-27	2.72E+77	
					mass=rhoC*Volume (kg)		
						2.486E+51	

Conclusions

The density of the universe is 9.14e-27 Kg/M^3 (all baryons)

The standard method of simulating expansion involves the Friedmann-Lemaitre-Robertson-Walker (FLRW) model [10]:

H^2=H0^2*(OmegaMatter*(1+z)^3+OmegaR*(1+z)^2+OmegaLambda)
Where:
OmegaTotal=1 WMAP result
Rhoc=H0^2/(8/3 pi G) (critical density)
OmegaR(1+z)^2=0 (wrong shape)
OmegaMatter separated into =Omega cold dark matter and baryons
OmegaLambda is the cosmological constant
H0=2.26e-18/sec WMAP 9 year result
z=(rf/r-1) where radius is the developing radius and rf is the final radius.

Ho		2.26E-18	(1/sec)
rhoC	8/3 pi G/Ho^2	9.124E-27	(Kg/M^3)

Historically, the equations are written to be consistent with geometric models of the universe involving metric tensors that characterize a four dimension universe where ds^2= three distances^2 and (C*time)^2. If the overall density equals critical density the universe is considered to be flat. The term flat refers to possible shapes (hyperbolic, etc.) but also means that kinetic energy is converted to potential energy (a fact that most agree on). The model is also known as the Lambda Cold Dark Matter model or the concordance model. Lambda stands for the famous Einstein constant related to the concept of dark energy. WMAP scientists believes that Hubble's constant gives the critical density 9.14e-27 Kg/M^3. They believe in a flat universe but added lambda, dark matter and dark energy to make the total 9.14e-27. **The present work shows that the reason the universe is flat is that the density is actually 9.14e-27 KgM^3 but it is 100% baryons.**

Space-time is defined by the gravitation field energy 2.73 MeV

Space is defined by the Proton model gravitational field r0=hC/2.73=7.22e-14 meters. Initially space is comprised of exp(180) cells, each with the radius 7.22e-14 meters. Each cell contains a neutron (that decays to a proton). The cell radius is a balanced force orbit that establishes and maintains the gravitational constant G=6.67e-11 Nt M^2/Kg^2. The orbital radius is a function of its original kinetic energy and kinetic energy. As kinetic energy is converted to potential energy the cell (and the universe) expands. This is a function of (time/time')^(2/3). Time is measured around the fundamental cell circumference (cycle time=2*pi*7.22e-14/C=1.2e-21 seconds). Time counts forward by repeating this cycle. The value gamma equals (mass+ke)/mass. When performing orbital calculations, the orbital mass is mass/gamma (a result of special relativity). Gamma= (m+ke)/m is related to Schwarzschild dt=1/gamma-1. Time is slowed slightly and in this regard space-time is a proper concept. Space-time expands relative to fundamental r=7.22e-14 meters as kinetic energy (ke) is converted to potential energy. The special relativity effect gamma approaches 1.0 early in expansion. If particles gain a huge amount of kinetic energy gamma becomes significant (mesons and baryons entering our atmosphere and artificially in high energy accelerators).

There is a Schrodinger based energy=0, probability=1 construct (Appendix 1) associated with orbits defined by the Proton model. These orbits are circular leading to the question what curves space-time? At the quantum level a sine wave varying with time is represented by a circle with one imaginary axis and one distance axis. However, real orbits like those of orbiting stars follow curves because the cells that make up space are curved and G equivalence exists between the large and small scale.

Gravity is defined and maintained by the neutron and its associated outer orbit (cell).

The information we need about gravity is provided by the Proton model, cellular cosmology and the number of initial neutrons determined by probability considerations (1=exp(180)/(exp(90)*exp(90)). The Schrodinger equation is based on quantum theory and the Proton model is based on the Schrodinger equation. The Proton model gravitational field energy 2.73 MeV is a quantum value but cellular cosmology provides a bridge between small and large scales (M=m*exp(180) and R=r*exp(90)).

Creation was a zero energy, probability one separation event

The Proton model is anchored by the Schrodinger equation. The equation also appears to anchor properties of all mesons and baryons [14]. This equation described by MIT as unitary evolution [22] is the basis of a broad theory. The equation gives probability P=exp(iEt/H)*exp(-iEt/H) where H= Planck's constant, E is field energy and time t is the time around a quantum circle at velocity C.

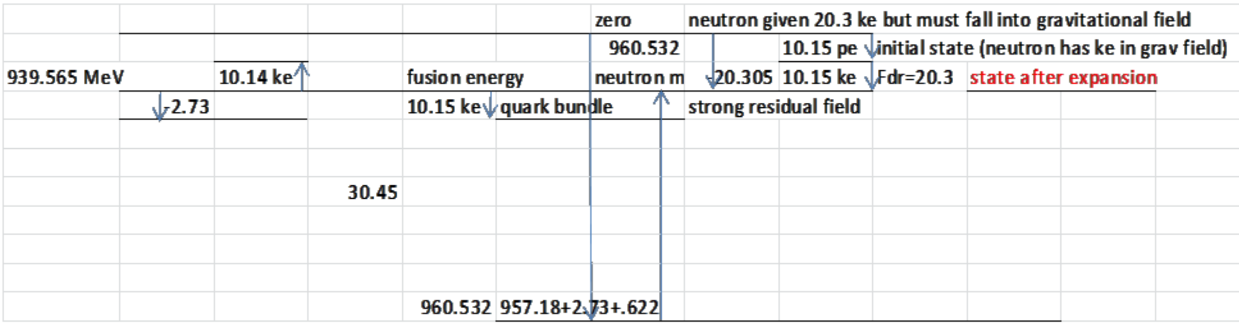
Probability in the left hand side of the Schrodinger equation is related to energy and time in the right hand side of the equation. Probability=1 occurs at the instant of wave function collapse. Historically observation is fundamental to quantum mechanics and the Copenhagen interpretation indicates that we can only describe the probability of an event within certain limits. If we use Shannon's definition of information (Information = -natural logarithm(Probability), the left hand side of the equation yields information. Many associate quantum mechanical probabilities with the process of observation but some authors [20] call it consciousness. Zero energy and probability 1 appear to be initial conditions. This implies that creation is based on separations from zero and 1. The Schrodinger equation requires a proper set of probabilities to represent the Proton model. **The probability 1, zero energy derivation naturally transitions from probability sets (p/p'=e/e') to energy sets that describes reality through the Proton model and cellular cosmology.**

The proton model is a manifestation of the laws of nature.

Previously I thought the proton model was static. The core of the cosmology model is repeated below but time and potential energy are added.

Potential energy + kinetic energy (MeV)	20.30	20.30	20.30	20.31
Potential energy (MeV)=.5FdR/1.6e-13	10.43	12.16	13.59	14.77
r0=7.22e-14*9.872/ke	7.22E-14	8.76E-14	1.06E-13	1.29E-13
ke=9.87*(time/time')^0.5	9.872	8.14E+00	6.71E+00	5.54E+00
g=938.27/(938.27+ke)	**9.8959E-01**	**9.9140E-01**	**9.9289E-01**	**9.9413E-01**
V=(1-(g)^2)^0.5*C	**4.3148E+07**	**3.9238E+07**	**3.5674E+07**	**3.2427E+07**
fgrav=(1.673E-27*V^2/(r0*EXP(90))	3.5702E-38	2.4305E-38	1.6543E-38	1.1259E-38
time (seconds)	5.29E-02	7.77E-02	1.14E-01	1.68E-01
G=fgrav*r^2/(m/g)^2	6.503E-11	6.533E-11	6.558E-11	6.578E-11

The following diagram was brought forward from Appendix 3.



Time is around the gravitational orbit R=hC/2.73. Fundamental time=1.5e-21 seconds (from problem 3 above). As time counts forward, kinetic energy decreases by ke'=ke*(time/time')^(2/3).

This provides the startling insight: The information in green above is inside every proton. The gravitational orbit has counted time cycles from the big bang and we experience this as increasing time. Time emanates from inside the proton. The sum of kinetic energy and potential energy remain constant over time. Temperature emanates from kinetic energy in the proton and when it reaches 8e10 K, part of the fusion energy 10.15 is released to increase the radius of the cell. It is now low, close to 2.73K. As stars light up, their fusion energy, again part of the value 10.15 MeV, is released to once again increase the radius of the cell. The proton is the cell. Components of the proton are improbable (1/exp(180)) but there are exp(180) cells is the universe and the universe is huge (rcell*exp(60). Overall, the proton and interactions with other protons creates the universe!

References

Some references can be downloaded at http://vixra.org/ . Search at top of page Gene H Barbee.

1. Peebles, P.J.E., *Principles of Physical Cosmology*, Princeton University Press, 1993.
2. Bennett, C.L. et al. *First Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Preliminary Maps and Basic Data*, Astrophysical Journal, 2001
3. A. Conley, et al, (*THE SUPERNOVA COSMOLOGY PROJECT), Measurement of Omega mass and Omega lambda from a blind analysis of Type1a supernovae with CMAGIC*.
4. Hinshaw, G. et.al, *Nine Year WMAP Observations*, draft June 5, 2013. http://arxiv.org/pdf/1212.5226v3.pdf Table 2.
5. Bergstrom, L. and Goobar, A., *Cosmology and Particle Astrophysics*, 2nd Edition, Springer-Praxis Books in Astrophysics and Astronomy, 2004.
6. http://cds.cern.ch/record/262880/files/940501.pdf Review of work by N. D. Schramm.
7. Patrick Peter, Jean Philippe Uzan, Primordial Cosmology, OUP Oxford, Feb 14,2013.
8. Barbee, Gene H., *A Top-Down Approach to Fundamental Interactions*, FQXi essay, June 2012 and vixra:1307.0082 revised Nov, 2014. Reference Microsoft ® spreadsheet Unifying concepts of nature.xls. This paper details a model of the proton that provides information pertinent to many aspects of nature. Starting with data from WMAP 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 anchor the energy of fundamental particles. This reference described models for the neutron and proton mass based on Shannon type information theory. In addition, it shows that information from the model unifies the electromagnetic, weak, strong and gravitational forces.
9. Barbee, Gene H., *On the Source of the Gravitational Constant at the Low Energy Scale*, vixra:1307.0085, revised Feb 2014. Prespacetime Journal Vol. 5 No. 3 March 2014. The proton model provides the energy value of a field that allows the gravitational constant to be calculated from fundamentals. 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 in general relativity gravitation is the large scale geometry of space and time and the other forces originate at a quantum level. The author offered scaling relationships called cellular cosmology that appears to resolve this conflict. With this understanding the four interactions are very similar.

10. Barbee, Gene H., *Baryon and Meson Mass and Decay Time Correlations* **[**viXra:1307.0133**]** 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. Although the work is tentative it presents calculations that match measured decay times and masses for all baryons and mesons based on the Proton model.

11. Barbee, Gene H., *THE LANGUAGE OF NATURE*, Kindle Books, ISBN 0971278202, May 31, 2014, *Unification*, viXra: 149.87028, October, 2014. This document emphasizes the important role of probability.
12. Barbee, Gene H., *Cosmology, Thermodynamics and Time*, vixra:1407.0187, September, 2014.
13. Barbee, Gene H., *Discovery of Quantum Gravity*, viXra:1508.0120, Aug 15 2015.
14. Barbee, Gene H., *Schrodinger Fundamentals for Mesons and Baryons*, October 2017, vixra:179.87306v1.
15. Barbee, Gene H., *The Effect of He4 Fusion on Primordial Deuterium*, viXra:1404.0465, May 2014, viXra:1404.0465v5, February 2017.
16. Barbee, Gene H., *The Flatness Problem*, viXra:1606.0263v2, January, 2017.

17. Barbee, Gene H., *Nature and Information*, http://www.vixra.org/pdf/1611.0302v1.pdf, December 2016. http://prespacetime.com/index.php/pst/issue/view/91

18. Barbee, Gene H., *On Expansion Energy*, *Dark Energy and Missing Mass*, Prespacetime Journal Vol. 5 No. 5, May 2014. viXra:1307.0089v8, February 2017. The proton mass model [Appendix 2] is an accurate source of constants for cosmology, including expansion kinetic energy. It gives the initial kinetic energy and later temperatures consistent with He4 formation. Expansion and associated energy changes were evaluated using a cellular model based on two expansion components, but the second component is not Lambda from the WMAP LCDM model. In this model, there is one orbiting proton like mass/cell and all cells are formed by identical laws. The author believes that space is created by exp(180) cells each with an initial radius of 7.22e-14 meters expanding to universe size space. The model predicts that a large radius of 4.02e25 meters characterizes the universe. The fusion kinetic energy released at the He4 primordial event is enough to expand the cells to their present radius/cell of 0.352 meters against gravitational resisting force (kinetic energy is converted to potential energy). Based on the author's current WMAP re-analysis, equality of matter and energy density occurs with 1.0*exp(180) protons/m^3.

19. Barbee, Gene H., *Dark Energy*, viXra 1511.0185v4, January, 2017. This document proposes that dark energy is the energy produced by stars. Information is presented that revises the WMAP conclusion that only 0.046 of the universe is normal protons. *Current re-analysis indicates that there is no dark energy or dark matter.*

20. Edwin Klingman, private communication
21. https://web.archive.org/web/20130323234553/http://www.sciops.esa.int/index.php?project=PLANCK&page=Planck_Published_Papers
22. Search "MIT22 Evolution of Function Chap 6".
23. D. E. Groom et al. (Particle Data Group). Eur. Phys. Jour. C15, (2000) (URL: http://pdg.lbl.gov).

Appendix 1 Schrodinger Fundamentals of the Proton model

The work below derives relationships that obey energy zero and probability one initial conditions. Everything will be created through separation. One result is a model of the neutron, proton and electron that provides insights into physics and cosmology.

Restrictions: P=exp(-i Et/H)*exp(i Et/H)=1 where Et/H=1. This means we deal with the unitary point where the wave function collapses on a quantum circle. The time (t) to circle radius R=HC/(2piE) is t=2 pi R/C, where E is field energy and H is Planck's constant (4.13e-21 MeV-sec). We are dealing with circles that represent spheres, not translation of particles (x,y and z) like the Dirac equation.

Components of P=1

The RHS of the Schrodinger equation will have pairs of complex conjugates exp(iEt/H)*exp(-iEt/H). Each pair of components will represent waves moving through time cycles. A sinusoidal wave is represented on a circle with a vertical imaginary axis and a real horizontal axis (exp(i theta)=cos theta +i sin theta). If there is mass and kinetic energy in the circles with balanced forces they are orbits with real vertical and horizontal axis. Looking ahead, four orbits in the proton mass model represent four fundamental interactions. The P=1 constraint and the E=0 constraint are further defined below.

Probability= 1 constraint

The probabilities contain exponential functions exp(N). The fraction 0.431=1/3+ln(3)-1.

Probability 1 Constraint

1=p1*p2/(p3*p4) but each probability=1/exp(N)

N1=13.431	N3=15.431
N2=12.431	N4=10.431
p1=1/exp(13.431)	p3=1/exp(15.431)
p2=1/exp(12.431)	p4=1/exp(10.431)

1=1/exp(13.431)*1/exp(12.431)/(1/exp(15.431)*1/exp(10.431))

These N values represent P=1, but it has four probability components.

Review of natural logarithms: Multiply probabilities by adding logarithms. Find the result with the anti-logarithm (exp(0)=1).

P	p1*p2=exp(-i Et/H)*exp(i Et/H)		
	with Et/H=1		
multiply by adding the logarithms			
ln P	ln(p1*p2)=-i+i=0		
P	exp(0)=1		

Example of exponent sign change:

exp(2)=7.39=1/exp(-2)

Evaluate the RHS of the Schrodinger solution

Energy= 0 constraint

Apply the constraint: Energy components have overall zero energy. Mass and kinetic energy are positive and field energy is negative. It will be shown that the Schrodinger equation becomes relativistic, like the Dirac equation with P=1 and energy=0. The example math below is similar to Dirac's development with Et/H=1. It allows us to separate energy terms from time terms.

Constrain Energy to zero

1=exp(itE/H)*exp(-itE/H)

take the natural log and divide boths sides by i

0=itE/H-itE/H

0=t/H*E-t/H*E

take the square root. Since Et/H=1, E=1/(t/H)

0=(E-E)*(t/H-t/H)

0=E1-E1

Example:		
a=1/b	a=.5	b=2
ab-ba		0
(a-a)*(b-b)=0	(0.5-0.5)*(2-2)=0	

The example math above is expanded to give the energy =0 constraint with four components, each with matching complex conjugates.

1=exp(itE1/H)*exp(-itE1/H)*exp(itE2/H)*exp(-itE2/H)*exp(itE3/H)*exp(-itE3/H)*exp(itE4/H)*exp(-itE4/H)

The natural log of the RHS is:

0=(itE1/H)+(-itE1/H)+(itE2/H)+(-itE2/H)+(itE3/H)+(-itE3/H)+(itE4/H)+(-itE4/H)

Using the square root procedure above with each t/H=1/E, we only need the energy terms that are equal and opposite. The square root also has a (t/H-t/H)= 0 solution that contains inverted terms.

E1-E1+E2-E2+E3-E3+E4-E4=0

E1+(E3+E4-E1-E2)+E2-E3-E4=0

Evaluating E

Next evaluate E. Looking ahead, there is another meaning associated with P=1. Overall the initial condition of the universe is probability 1, meaning it does indeed exist. There are many protons, each with mass that make up the universe. Specifically:

P= 1= probability of each proton* number of particles=1/exp(N)*exp(N). The probability of each proton is 1/exp(N). The proton itself is made of improbable components like quarks. We can evaluate the probability of particles that makes up the proton if energy is itself a probability, i.e. p=e0/E=1/exp(N), where e0 is a small constant.

p=e0/E=1/exp(N), i.e. E=e0/p.

With p=1/exp(N), E=e0*exp(N).

E1-E1+E2-E2+E3-E3+E4-E4=0

Identify E as E=e0*exp(N), using the same N values as the LHS.

0=eo*exp(13.431)-eo*exp(13.431)+e0*exp(12.431)-e0*exp(12.431)+e0*exp(15.431)-e0*exp(15.431)+eo*exp(-15.431)+eo*exp(10.431)-e0*exp(-10.431)

Mass plus kinetic energy will be defined as positive separated from equal and opposite negative field energy. E1 is the only mass term, E3 and E4 are field energy and the remainder is kinetic energy.

E1+(E3+E4-E1-E2)+E2-E3-E4=0 (rearrange)
E1 is mass, (E1+E4-E1-E2)+E2 is kinetic energy.
E3 and E4 are equal and opposite field energies
mass1 + kinetic energy- field energy3-field energy4=0

Probability 1 in the LHS gives the probability of finding mass1 with kinetic energy at the collapse point on the circle defined by exp(iE1t/H)*exp(-iE1t/H)*exp(iE2t/H)*exp(-iE2t/H), etc,.

Summary

The E= 0 construct was derived using the N's from the P= 1 construct. We then took the natural log of both sides of the equation. The (LHS) natural log of P=1 equals 0. The RHS natural log converts the values to additions and subtractions, depending on their sign. We then multiplied each value by e0 which gives E=e0*exp(N) for the eight matched energy values. We rearranged the N values. We define a probability component p =e0/E where e0 is a constant and has the same units as E. This means energy is increased by a low probability, i.e. E=e0/p. Schrodinger's equation shows exp(iEt/H) with the imaginary number i. Using complex probabilities on both sides of the equation eliminates imaginary numbers. The LHS imaginary numbers are eliminated because the four complex probabilities multiply with their four conjugates (1/1*1/1=1). The RHS imaginary numbers are eliminated because the imaginary probability multiples with iE (iE*i/P). This gives E= i^2 eo*1/(-exp(N))=eo*exp(N). Energy E=e0*exp(N) can be high since it follows an exponential relationship but Et/H=1 is maintained because each time t is corresponding low.

Appendix 2 The Proton model

Number of neutrons in nature

There have been several missions (COBE, WMAP [5], HSST, and PLANCK) and earlier work [15][4] that yield a great deal of information about the universe. Measurements and models allow astronomers, astrophysicists and cosmologists [1][5] to estimate the number of neutrons in the universe.

Neutron components

The author found N values for neutron components based on the way three quark masses and their kinetic energies add to the neutron mass. The related information components total N=90 for the neutron. They are listed in Table 1 below.

	Neutron particle and kinetic energy N			Neutron field energy N
Quad 1	**15.43**	quark 1	**17.43**	strong field 1
	12.43	kinetic energy	**10.43**	gravitational field component
Quad 2	**13.43**	quark 2	**15.43**	strong field 2
	12.43	kinetic energy	**10.43**	gravitational field component
Quad 3	**13.43**	quark 3	**15.43**	strong field 3
	12.43	kinetic energy	**10.43**	gravitational field component
Quad 4	**10.41**		**-10.33**	
	-10.33		**10.41**	gravitational field component
Quad 4'	**10.33**	pre-electron	**10.33**	
	0.00		**0.00**	
	90.00	Total	**90.00**	Total
	Table 1		Table 2	

There is a remarkable relationship between the natural logarithms 90 and the natural logarithm 180. Information (N) is a measure of how improbable an event is. It is very improbable that a single proton will form with exactly the N values listed in table 1. The probability that it will contain the particle and kinetic energy N values is: P=1/exp(N)=1/exp(90). Likewise, it is highly improbable that the proton will contain fields with the N values of table 2. Again the probability P=1/exp(90). Probabilities multiply and the probability of a neutron with these particles *and* field energies is P=1/exp(90)*1/exp(90)=1/exp(180).

But we know that neutrons exist. When we know something for certain, its probability is 1.0. Mass plus kinetic energy is equal and opposite field energy. Both exist and together they make up neutrons. Nature apparently creates mass equal to exp(180) to maintain probability=1 as an initial condition.

P=1=1/exp(180)*exp(180), where the probability of one mass with kinetic energy and its field is very low but there are many neutrons and fields.

The "big bang" duplicates the zero based neutron many times. Neutrons decay to protons, electrons and neutrinos in space.

Schrodinger's wave functions for the neutron

Details of the Proton model are in Appendix 2 but the table above labelled "Neutron components" specifies quad 2 (one of the quarks) below:

The Proton model energy values (E) are the exponents in the MIT unitary evolution equation [22] with four parts:

The E=0 construct is below with E= 2.02e-5*exp(N) MeV:

		mev			mev		
		E=e0*exp(N)			E=e0*exp(N)		
N1	13.43	13.8	E1 mass	N3	15.43	101.95	E3 field
N2	12.43	5.1	E2 ke	N4	10.43	0.69	E4 field

E1= 2.02e-5*exp(13.43)= 13.79, E2= 2.02e-5*exp(12.43)=5.07, E3= 2.02e-5*exp(15.43)=101.95, E4= 2.02e-5*exp(10.43)= 0.69 (all in MeV).

Energy zero construct					
	E3+E4-E1-E2				
E1 mass	ke	E2 ke	E3 field1	E4 field2	Esum
mev	mev	mev	mev	mev	
13.80	83.76	5.08	-101.95	-0.69	0.00

Overall, above: E1+(E3+E4-E1-E2)+E2-E3-E4=0=(E1-E1)+(E2-E2)+(E3-E3)+(E4-E4)

Surprisingly this means mass E1 with kinetic energy (E3+E4-E1-E2) orbiting field E3 and mass+ke also orbiting field E4 with kinetic energy E2. The energy E2+E2= 9.87 MeV is fundamental to atomic fusion and expansion.

Schrodinger equation Left Hand Side:

P= 1= (1/exp(13.43)*1/exp(12.43))/(1/exp(15.43)*1/exp(10.43))

Schrodinger Equation Right Hand Side:

P (RHS)=exp(ie0*exp(N1) t/H)*exp(ieo*exp(N2) t/H)*exp(-ie0*exp(N3) t/H)*exp(-ie0*exp(N4) t/H)

N1= 13.43, N2= 12.43, N3= 15.43 and N4= 10.43 and e0= 2.02e-5 MeV.

Proton model review

For reference the Proton model is shown below. The left hand side defines N values for four probabilities associated with three quark (quads 1, 2 and 3) and N values that lead to the electron (quads 4 and 5). The right hand side of the table below describes the Energy=0 construct. This model shows 129.54 for the mass of the quarks. Study of mesons and baryons [17] indicated that 129.5 MeV transitions to 9.34 MeV + kinetic energy. The quark masses agree with Particle Data Group (PDG) [23] data, one with 4.36 and two with 2.49 MeV (multiples of 0.622 MeV from Quad 5).

					Mass, Kinetic Energy and Fields for Neutron=0						
	N for Neutron Energy Interactions								Expansion		Gravitational
	mass	Energy	S field	Energy	Mass	Difference I	Weak KE		KE	Strong field	Field
	ke	MeV	G field	MeV	MeV	MeV	MeV	MeV	MeV	MeV	MeV
Quad 1	15.43	101.95	17.43	753.29	101.95	652.03				-753.29	
	12.43	5.08	10.43	0.69							-0.69
Quad 2	13.43	13.80	15.43	101.95	13.80	88.84				-101.95	
	12.43	5.08	10.43	0.69							-0.69
Quad 3	13.43	13.80	15.43	101.95	13.80	88.84			10.15	-101.95	
	12.43	5.08	10.43	0.69		-30.45	10.15		10.15		-0.69
Quad 4	-10.33	0.00	-10.33	0.00							
	10.41	0.67	10.41	0.67				0.671	t neut ke		-0.67
Quad 5	10.33	0.62	10.33	0.62		0.62				-0.62	
	0.00	0.00	0.00	0.00							
	90.00	sum	90.00	sum	129.54	799.87	939.5654133	**0.671**	20.30	-957.81	-2.73
							NEUTRON MASS		Total m+ke	Total fields	
									Total positi\	Total negative	
									960.54	-960.54	
									MeV	MeV	

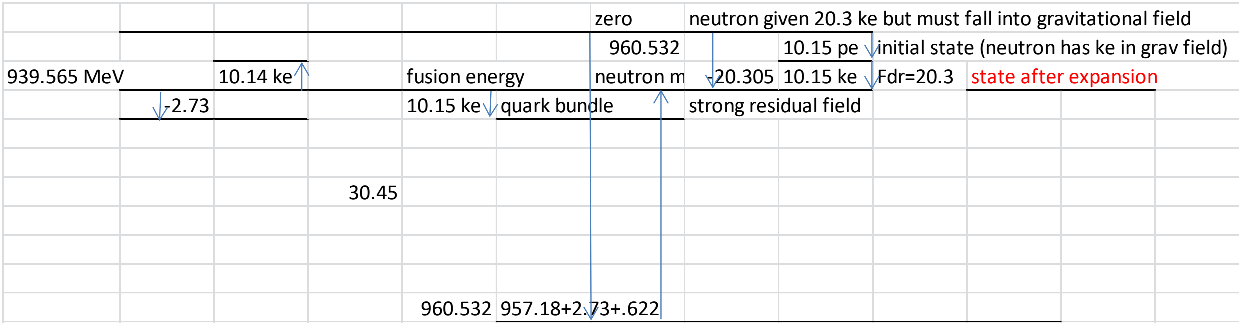
The neutron energy 939.5654 MeV is constant and agrees with the PDG [23] data within many significant digits.

Appendix 3 Orbits **associated with the Proton model**

The Proton model above is a P=1, E=0 construct that defines the quarks and their orbits (unification of strong interactions listed as Orbits 1, 2 & 3 below). Orbit 4 is associated with atomic fusion.

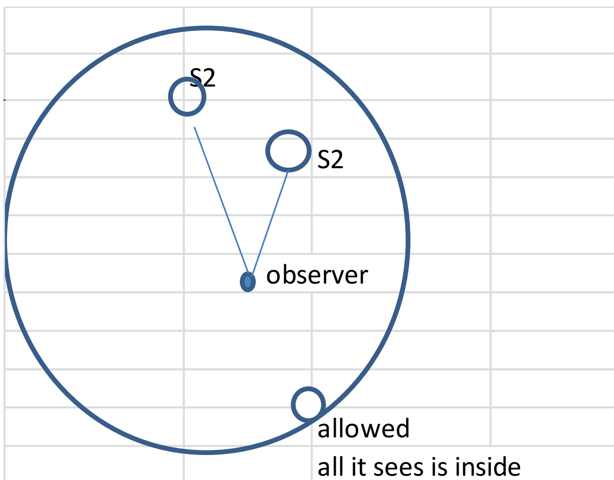
Summary of neutron model orbits		1.02608
Orbits 1,2,3	Three quark orbits are formed by quads 1,2 and 3, each with e*t=h.	
	Next, 30.45 mev of ke taken out of the quark bundle....quarks are now bound by a -30.15 MeV field.	
	(A quark bundle is the three quarks with their kinetic energy. Total=129.54+799.87= 929.41 MeV).	
	The quark bundle has 10.15 mev of kinetic energy (929.41+10.15=939.56 MeV).	
	But the energy zero criteria is 20.3 MeV "short" of being satisfied	
	This creates a -20.3 MeV residual strong field. (-20.3=(939.565+0.622-960.532).	
Orbit 4	The quark bundle mass 929.41 MeV orbits with 10.15 mev in the -20.3 mev field.	
	The energy zero components of this orbit are: 929.41+10.15+0.671-960.532=-20.3.	
	With the addition of 0.111 mev in the presence of a proton, fusion can occur	
	and this releases a portion of the 10.15 mev in the weak orbit.	
	Next, the neutron with 20.3 mev falls into a -2.73 MeV gravitational field. An orbit	
	is established with 10.15 MeV of kinetic energy and 10 PE.	
	(Fdr/2=3.656e-38*7.224e-14*exp(90)*6.24e12=10.06 MeV)	
Orbit 5	The neutron mass orbits with 10.15 mev in -2.73 mev gravitational field (the gravitational field emanates from the quark fields).	
	The energy zero components of this orbit are: 939.565+10.15+10.15+0.671-957.89-2.73=0. (some hidden).	
	The radius of this orbit is 7.22e-14 meters.	
	The attraction between exp(180) protons in the proper geometry creates the gravitational field	
	(see appendix 1 topic "cellular cosmology" and "quantum gravity".)	
	But the 10.15 MeV kinetic energy decreases as the cell expands against gravity converting ke to potential energy.	
	As the 7.22e-14 m cell expands, the universe expands.	
Electron orbit:		
	Separation creates opposite electromagnetic fields in the proton and electron	
	The bohr orbit is formed (electron mass with 13.6 ev of kinetic energy in 27.2 ev field).	
	The field energy is extracted from the proton mass.	

Diagram of Neutron Orbits

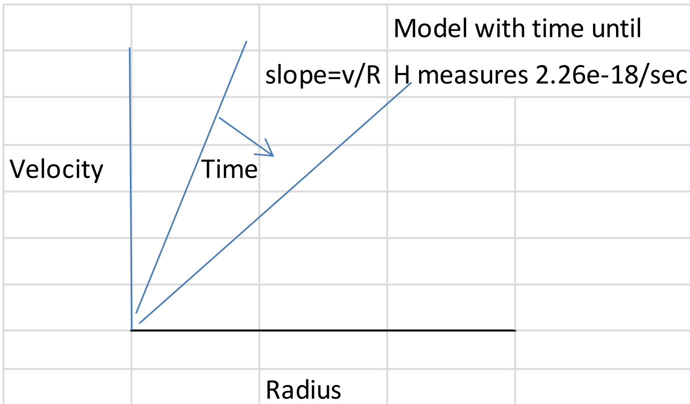


Appendix 4 Measuring Hubble's constant

Are measurements of Hubble's constant reliable? The question comes down to where mass is and how fast it is expanding. Here is a diagram:



Hubble's constant is measured with the redshift of objects of known distance. Its current value according to the WMAP, Hubble and Planck missions is 2.26e-18/sec [4]. As long as objects are treated gravitationally as the surface of spheres within a larger spherical surface, they still have no preferred position. Gravity always looks inward toward a center. Once the center is established by Jeans wavelengths, it is not appreciably influenced by gravity outside. It is not in a preferred position that would cause instability (like all of mass moving toward the center of the larger spherical surface). The Hubble measurements appear to be correct but we must remove the dark energy contribution since it not a result of kinetic energy being converted to potential energy. I use a math model of cellular expansion to determine the current radius of the universe. With time, the velocity of expansion slows and R becomes larger. This means the slope of V/R decreases. When the slope reaches 2.26e-18/sec, the current radius is reached.



It was shown above that the concept of critical density cannot be used for dark energy. However the current density is 9.14e-27 kg/m^3 and this value is related to measurement of the Hubble constant 2.26e-18/sec. WMAP literature parameters [4] are based on Cosmology Omega 9.14e-27 kg/m^3.

Appendix 5

Justification for the value 9.87 MeV as the basis of G

The following table shows one neutron falling from 20.3 MeV (total potential energy from the neutron model) to the point where an orbit is formed, at 9.87 MeV. The values on the left are calculations for G.

				Radius	Velocity	Nt	(MeV)	(MeV)		A=mVR	dA=A-a	associated with	
				Meters	M/sec							dA (m/sec)	
G			1	1.43E-13	0.00E+00	1.11E+01	0.00E+00		20.3	0.00E+00			MeV
9.83E-13	1.35E-40	274.8051	0.993726	1.42E-13	3.75E+06	1.11E+01	0.074	-0.074	20.23	4.49E-34	4.49E-34	1.89E+06	1.86E-02
			0.991115	1.41E-13	5.31E+06	1.12E+01	0.147	-0.073	20.15	6.31E-34	1.83E-34	7.75E+05	3.13E-03
			0.989199	1.40E-13	6.45E+06	1.14E+01	0.217	-0.074	20.08	7.63E-34	1.31E-34	5.61E+05	1.64E-03
	hidden cells in incremen		0.987522	1.39E-13	7.44E+06	1.16E+01	0.289	-0.074	20.01	8.75E-34	1.13E-34	4.85E+05	1.22E-03
			0.98602	1.38E-13	8.33E+06	1.18E+01	0.363	-0.075	19.94	9.74E-34	9.88E-35	4.28E+05	9.56E-04
			0.984645	1.37E-13	9.14E+06	1.20E+01	0.437	-0.076	19.86	1.06E-33	8.86E-35	3.87E+05	7.81E-04
			0.983367	1.36E-13	9.90E+06	1.22E+01	0.512	-0.077	19.79	1.14E-33	8.06E-35	3.55E+05	6.56E-04
			0.982166	1.35E-13	1.06E+07	1.24E+01	0.588	-0.077	19.71	1.22E-33	7.42E-35	3.29E+05	5.64E-04
			0.981028	1.34E-13	1.13E+07	1.26E+01	0.664	-0.078	19.64	1.29E-33	6.88E-35	3.07E+05	4.92E-04
6.59E-11	3.43E-38	1.116147	0.925844	7.32E-14	4.28E+07	4.49E+01	9.593	-0.151	10.71	2.83E-33	3.00E-36	2.5E+04	3.14E-06
6.64E-11	3.51E-38	1.083303	0.925238	7.26E-14	4.32E+07	4.56E+01	9.744	-0.152	10.56	2.83E-33	2.84E-36	2.3E+04	2.86E-06
6.70E-11	3.60E-38	1.051206	0.924632	7.21E-14	4.35E+07	4.63E+01	9.897	-0.154	10.40	2.83E-33	2.68E-36	2.2E+04	2.58E-06