Mass accumulation and cosmology

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Abstract

New observations indicate that stars and star clusters form earlier than previously thought. WMAP reported that re-ionization occurred at expansion ratio Z=20. This is 138 million years after the beginning. There are observations of stars after 200 million at Z=8. It is also observed that massive black holes form early. This raises questions regarding how structure forms.

The author has been developing a model of the proton and applying it to cosmology. The model contains energy values that define time and space. It also defines the Newtonian constant G and initial expansion kinetic energy. These features form the basis of a cosmology expansion model previously reported.

This paper indicates how the model treats accumulation of mass in stars, galaxies and clusters. It also calculates the Hubble constant and uses observations to verify an expansion model that includes the number of stars. Based on this model there is no dark matter, nor dark energy. Star densification and fusion initiation explain why we observe stars at about Z=8, although mass accumulation starts earlier.

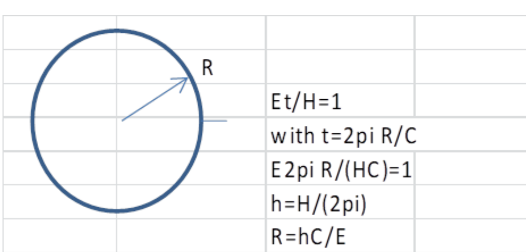
Gravitational relationships in the proton model

Relationship between field energy and a quantum circle

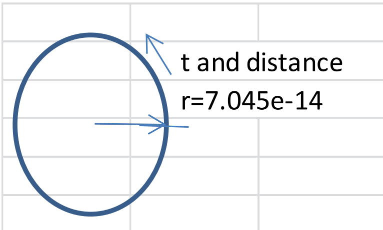
General relativity was a solution to a basic problem (action at a distance) in physics and is correct but it did not fully bridge the gap between large scale gravity and quantum physics.

The gravitational field energy 2.801 MeV from the proton model is used in a Schrodinger wave function [9][13]. Collapse of the wave function at P=exp(i*2.801*t/H)*exp(-i*2.801*t/H)=1 is a circle diagrammed below (imaginary vertical axis).

Et/H=1 where H = Planck's constant = 4.14e-21 MeV-sec leads to R= quantum circle radius= HC/2pi=1.973e-13/2.801=7.045e-14 meters. I consider this fundamental space.



Time also originates with this quantum circle. Et/H=1 with t=2pi r/C leads to r=HC/(2pi)/E. Time repeats around this circle in increments of 2pi R/C= 1.47e-21 seconds.



Origin of the gravitational constant G

The gravitational constant G is a combination of values found in the proton model. The values are: kinetic energy 10.15 MeV, fundamental radius 7.045e-14 meters and the mass of protons (1.67e-27 kg). The N values in the model define the probability of one proton p=1/exp(90)*1/exp(90)=exp(180). Probability 1 is recovered with exp(180) protons (described more fully in appendix 2).

The cumulative effect of exp(180) central protons curve space into a large sphere with radius 7.045e-14*exp(90)=8.59e25 meters. The large numbers can be combined into the factor 1/exp(90). This yields the relationship below between two protons [6].

G=10.15124*2*7.045e-14*1.602e-13/EXP(90)/1.675e-27^2			
6.69E-11	Grav Const Nt m^2/Kg^2		

The factor 1/exp(90) is recognized as a bridge between large scale Newtonian physics and the quantum scale. The value 1.6e-13 Nt-m/MeV in the equation is a conversion constant. With kinetic energy (ke)=10.15 MeV and r0=7.045e-14, the equation above can be used to define how the radius of a cell changes with kinetic energy. A cell is the space that one proton defines, a concept called particle-space. Newtonian gravity is in complete alignment with the concept of particle-space [13]. With G constant, radius R expands as kinetic energy is converted to potential energy.

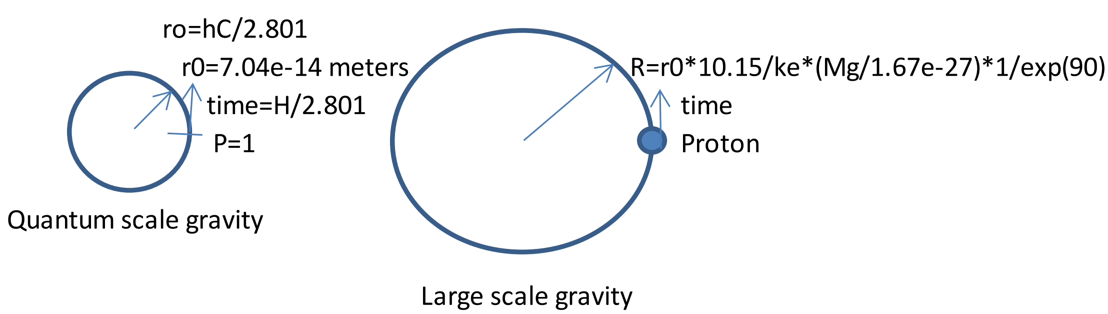
G=2*ke*r0/m^2*1.6e-13	
G=G as R increases	
2*10.15*r0/m^2= 2*ke*R/m^2	
10.15*r0= ke*R	
R=r0*10.15/ke	

This means that the proton model is more descriptive than Newtonian gravity alone because kinetic energy is a property of proton and the space it defines (this makes the proton a widget producing expansion). Expansion occurs as kinetic energy is converted to gravitational potential energy. The above relationships can be further expanded as follows:

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*10.15/ke=7.04e-14*10.15/ke
R=7.04e-14*10.15/ke*exp(90)*(Mgalaxy/Muniverse)
R=r0*10.15/ke*(Mgalaxy/1.67e-27)*(1/exp(90))

The above equation equals R=GM/V^2 but kinetic energy is a specific value associated with particle-space.

Relationship between quantum scale and large scale gravity



R in the diagram on the right is another way of writing R=GM/V^2. It can be used to give the radius a proton would orbit any central mass. For example, Mg could be the mass of a galaxy but kinetic (ke) is determined by particle-space.

WMAP review

WMAP [11] and later PLANCK were satellite projects that measured the cosmic background radiation. Temperature variations on the order of 74 micro-degrees in the 2.73 degrees microwave background were characterized by power spectrums. Density variations had long been predicted by cosmologists [Peebles, for example] and are traced back to the period between equality and decoupling. They are formed by waves that originate at equality (where photon density = mass density) since before equality they are dampened. The waves increase in length between equality and decoupling (decoupling is the temperature that allows electrons to fall into orbits around protons). This clears the plasma and temperature variations can still be observed as cosmic background radiation, although it has expanded about 1080x. Several harmonics were observed but power spectrums translate to scale invariant density variations of the order of d'/d=8e-5. A wave initiated at equality builds in length to 2.35e21 meters at decoupling.

Review of the author's expansion model

There is enough information in WMAP reports to construct expansion curves except the final radius is somewhat uncertain. The author's expansion model (called R1+R3 in Appendix 1) contains information that allows the final radius to be determined from the Hubble constant. There are two differences: Firstly, the R1+R3 model contains temperature and radius changes associated with primordial nucleosynthesis [7] that occurs within the first few minutes. This allows the model to match the observed baryon-photon ratio without assuming dark matter. Secondly, the R1+R3 model contains calculations for late stage expansion called R3 [8]. As stars light up, energy from the stars causes the universe to expand more than the R=r0*time^(2/3) model.

The important period equality to decoupling occurs at about 3e5 years, on the left side of the expansion graph in the section below entitled "Calculating the Hubble constant". Reference 8 contains information about this period showing that there is no need for dark matter or dark energy. Reference 12 explains flat galaxy rotation curves without assuming dark matter.

Partitioning the universe into spheres (stars) inside spheres (galaxies) inside spheres (clusters of galaxies).

At decoupling the universe is filled with 2.35e21 meter waves that we can associate with clusters of galaxies through observation. After decoupling, the wavelength of the waves change to normal acoustic waves studied by Jeans. This partitions the cluster spheres into smaller spheres associated with galaxies inside the cluster. Later these waves partition the galaxy spheres into smaller spheres inside the galaxy associated with stars.

Waves and density variations

The wave that originates at equality is given by the equation below. It propagates at the speed of light/3^0.5 and is dependent on density.

```
WL=0.57*3e8/3^0.5/(PI()*6.67e-11*6.24e11*1.783E-30*3e8^2*(baryon density+photon density))^0.5
```

This wave has length 2.35e21 meters at decoupling. It determines the size of the cluster spheres.

The Jeans acoustic wavelength associated with galaxies is shown below. It is dependent on the speed of sound that, in turn, is dependent on temperature.

Jeans=soundspeed*(1/(6.67e-11*density))^0.5						
soundspeed=(1.4*k*T)^.5=3.15e4			m/sec			
where: k=Stefan- Boltzmann constant=3.54e5						
whereL T=2e3 at mass start						
Jeans	4.68E+18	meters		3.66E+15	Jeans/Nstars^.33	
3.54E+05	stephan boltzman constant			4.68e18/2.13e9^.333		
6.49E+04	temp=2e3	to 2e5 an colume do		4.68e18/1.29e3		

This temperature is typical of the equality to decoupling period.
Spheres of diameter 4.68e18 become galaxies. The spheres within the galaxy sphere that will become stars have radius 4.68e18/1.29e3 meters=3.66e15 meters.

Relationship that defines spheres for clusters, galaxies and stars

Structure is primarily determined by waves that partition an overall sphere (and an associated mass) into smaller and smaller spheres. The universe will be considered to be the total mass= 1.67e-27*exp(180)= 2.48e51 Kg. For this analysis, the number of potential stars times the average star mass (5.8e29 Kg according to Wiki) could at most equal 2.48e-51 Kg. The other structures have specific relationships with wavelengths that partition the volume. Partitioning occurs at decoupling.

Density at decoupling was 2.9e-18 kg/m^3 (from expansion model [8][13] but consistent with WMAP).
Ru universe at decoupling=5.9e22 meters (from expansion model but consistent with WMAP)
N clusters= Rdecoupling^3/(2.35e21)^3=1.58e4
Observation N galaxies (Wiki) =2e12=N clusters*Ngalaxies/cluster=1.58e4*1.27e8
Mass galaxy= 2.48e51/2e12=1.24e39 Kg
Observed average mass of stars=5.8e29 Kg (Wiki)
Potential number of stars=2.48e51/2.6e29=4.29e21

The information above can be summarized as follows. Each sphere is related to a specific radius R and r for the next smaller sphere radius is (R^3/r^3=N).

5.95E+22	R decoupling (M)		2.35E+21	Previous sphere		4.67E+18	Previous sphere
1.58E+04	N clusters	2.01E+12	1.27E+08	N galaxies in cluster	4.29E+21	2.13E+09	N stars in galaxy
2.35E+21	Jeans at decoupling (M)		4.68E+18	Galaxy sphere (Jeans)		3.63E+15	Star sphere (Jeans?)
1.57E+47	Avg mass of cluster (Kg)		1.24E+39	Avg mass of galaxy (Kg)		5.80E+29	Avg mass of star (Kg)

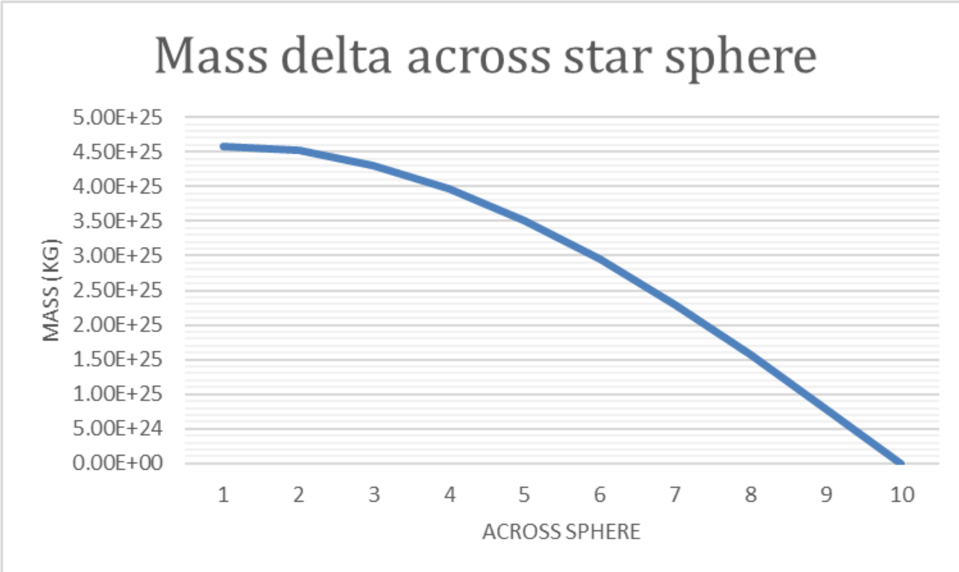
We observe clusters of galaxies and galaxies, all made of stars.

Density variations and central mass

Each line of the table below represents a radius across one of the spheres defined above. Each sphere has a slight density variation from center to edge. The peak density varies as a cosign wave that starts as a maximum on the left. For example, WMAP [11] measured a maximum delta temperature of 74 micro-degrees at the peak after the wave reached a length of 2.35e21 meters after growing from zero at equality.

										2.35E+20	
	2.35E+20	2.35E+20	2.35E+20	2.35E+20	2.35E+20	2.35E+20	2.35E+20	2.35E+20	2.35E+20	2.35E+20	1.57E+47
Cluster Jeans	2.35E+20	4.7E+20	7.05E+20	9.4E+20	1.175E+21	1.41E+21	1.645E+21	1.88E+21	2.115E+21	2.35E+21	2.37E+21
	1	2	3	4	5	6	7	8	9	10	1.583E+04
angle	0	10	20	30	40	50	60	70	80	90	
angle radians	0	0.17	0.35	0.52	0.70	0.87	1.05	1.22	1.40	1.57	
cos(radians)	1	0.98	0.94	0.87	0.77	0.64	0.50	0.34	0.17	0.00	
density	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	
den/dens	1.0000792	1.00007799	1.00007442	1.00006859	1.00006067	1.00005091	1.0000396	1.00002709	1.00001375	1	
density	2.8902E-18	2.8902E-18	2.8902E-18	2.8902E-18	2.8902E-18	2.8901E-18	2.8901E-18	2.8901E-18	2.89E-18	2.89E-18	
mass in shell	1.57E+44	1.10E+45	2.99E+45	5.81E+45	9.58E+45	1.43E+46	2.00E+46	2.66E+46	3.41E+46	4.26E+46	1.571E+47
central mass	1.25E+43	1.23E+43	1.17E+43	1.08E+43	9.57E+42	8.03E+42	6.25E+42	4.27E+42	2.17E+42	0.00E+00	
	1.249E+43										
										4.68E+17	
	4.68E+17	4.68E+17	4.68E+17	4.68E+17	4.68E+17	4.68E+17	4.68E+17	4.68E+17	4.68E+17	4.68E+17	
Reach Gal	4.6769E+17	9.3538E+17	1.4031E+18	1.8708E+18	2.3385E+18	2.8062E+18	3.2738E+18	3.7415E+18	4.2092E+18	4.67692E+18	4.72E+18
	1	2	3	4	5	6	7	8	9	10	1.27E+08
angle	0	10	20	30	40	50	60	70	80	90	
angle radians	0	0.17	0.35	0.52	0.70	0.87	1.05	1.22	1.40	1.57	
cos(radians)	1	0.98	0.94	0.87	0.77	0.64	0.50	0.34	0.17	0.00	
density	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	
den/dens	1.0000792	1.00007799	1.00007442	1.00006859	1.00006067	1.00005091	1.0000396	1.00002709	1.00001375	1	
density	2.8902E-18	2.8902E-18	2.8902E-18	2.8902E-18	2.8902E-18	2.8901E-18	2.8901E-18	2.8901E-18	2.89E-18	2.89E-18	
mass in shell	1.24E+36	8.67E+36	2.35E+37	4.58E+37	7.55E+37	1.13E+38	1.57E+38	2.09E+38	2.69E+38	3.36E+38	1.238E+39
central mass	9.85E+34	9.70E+34	9.25E+34	8.53E+34	7.54E+34	6.33E+34	4.92E+34	3.37E+34	1.71E+34	0.00E+00	
	9.8456E+34									4.19E+14	
										3.6E+14	
	3.6E+14	3.6E+14	3.6E+14	3.6E+14	3.6E+14	3.6E+14	3.6E+14	3.6E+14	3.6E+14	3.6E+14	2.139E+09
Reach stars	3.63E+14	7.3E+14	1.1E+15	1.5E+15	1.8E+15	2.2E+15	2.5E+15	2.9E+15	3.3E+15	3.6E+15	3.63E+15
	1	2	3	4	5	6	7	8	9	10	
angle	0	10	20	30	40	50	60	70	80	90	
angle radians	1	0.17	0.35	0.52	0.70	0.87	1.05	1.22	1.40	1.57	
cos(radians)	1	0.98	0.94	0.87	0.77	0.64	0.50	0.34	0.17	0.00	
density	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	
den/dens	1.0000792	1.00007799	1.00007442	1.00006859	1.00006067	1.00005091	1.0000396	1.00002709	1.00001375	1	
density	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	2.89E-18	
mass in shell	5.79E+26	4.05E+27	1.10E+28	2.14E+28	3.53E+28	5.27E+28	7.35E+28	9.79E+28	1.26E+29	1.57E+29	5.791E+29
central mass	4.59E+25	4.52E+25	4.31E+25	3.97E+25	3.51E+25	2.95E+25	2.29E+25	1.57E+25	7.96E+24	0.00E+00	

The above charts obey the partitioning described above and the total mass for each sphere equals the total volume times the density at decoupling (2.9e-18 kg/meters^3). The center on the left is the density variation d'/d=8e-5. It varies according to the cosign as follows:



The density variation is small but for the entire mass, the center is much more massive than the edge. The central mass at decoupling is calculated as follows:

Central mass cluster=8e-5*1.57e47=1.25e43 Kg
Central mass galaxy=8e-5*1.24e39=9.85e34 Kg
Central mass star=8e-5*5.8e29=4.59e25 Kg

The central mass in each of the spheres determines the starting point for accumulation. After mass falls into an orbit, the universe expands around it. Mass accumulates by "bringing in" virgin density from within the sphere.

Central mass initiates mass accumulation

The central mass causes mass around it to accelerate toward the center. The equation is derived as follows:

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	

L is the distance mass can travel under acceleration a. Delta time (t) is incrementally calculated based on time increments in an expansion model. Velocity (at) and radius (L=2Gm/(at)^2) are substituted into the equation for acceleration. The equation can be simplified to a=(2GM/t^4)^(1/3). This is the acceleration that mass experiences as it gravitates toward the central mass M.

Acceleration (a) acts over a time increment (in an expansion model) to move mass from the virgin density around it toward the central mass. The radius that acceleration can influence is given by L=0.5*a*(t^2), where (t) is the incremental time. The volume it influences is V=4/3*pi*L^3. The volume is multiplied by density to determine how much mass accumulated in increment time (t). This mass is added to the central mass in an incremental expansion model.

Calculations show that mass accumulates too slowly to explain structure formation (clusters/galaxies/stars) if the central mass is a single 1.67e-27 Kg proton. It will accumulate as observed based on perturbation determined central mass and the way orbits change as the mass falls.

Mass moving toward the central mass is somewhat like an ice-skater bringing her arms toward her body.

r=r0*10.15/ke			
ke=.5 m V^2			
r=r0*10.15/(.5*m*V^2)			
r*(0.5*mV^2)=r0*10.15=constant			
Rfinal will be the smaller orbit with Vfinal			
(Vfinal is larger)			
Rinitial*(0.5*mVinitial^2)=Rfinal*(0.5*mVfinal^2)			
Rinitial*(Vinitial^2)=Rfinal*(Vfinal^2)			

The original R will fall to a smaller orbit at Rfinal but the smaller orbit will have a larger Vfinal^2. This conservation law is integrated into calculations for the falling mass. Another definition is helpful: Rfinal=Rinitial*fall ratio. Fall ratio simply indicates that a large orbit can fall to a smaller orbit if the conservation rule is obeyed.

Densification of central mass to form stars

There is an initial central mass of 4.5e25 Kg due to the density variations that we discussed above in the section entitled “Density variations and central mass”. Referring to the calculations below, the touch down equation described above yields acceleration a=9.8e-13 m/sec. This acceleration affects mass within the length L=at^2/2=4.07e13 meters. Over this time increment mass falls into a much smaller orbit using the conservation law: Vfinal^2=rinitial*Vinitial^2. The density the touch down equation brings in is equal to virgin density/fall ratio^3 (labelled condensed density). The mass 6.92e28 Kg in column 2 below is accumulated and added to the central mass. The initial velocity can be calculated from the cell kinetic energy 1.94e-7 MeV and the initial radius can be calculated from the equation listed at the top of the table. The strategy of the calculation is to find the radius at which acceleration of mass falling in a gravitational field (A=GM/Rf^2) is equal to A= Vf^2/Rf. This means Vfinal^2*Rfinal=Vinitial^2*Rinitial. The orbital velocity after falling into the gravitational field is Vf in the calculation table below. The strategy sets the opposing accelerations equal at 0.62 m/sec^2. Final kinetic energy can be calculated from Vf.

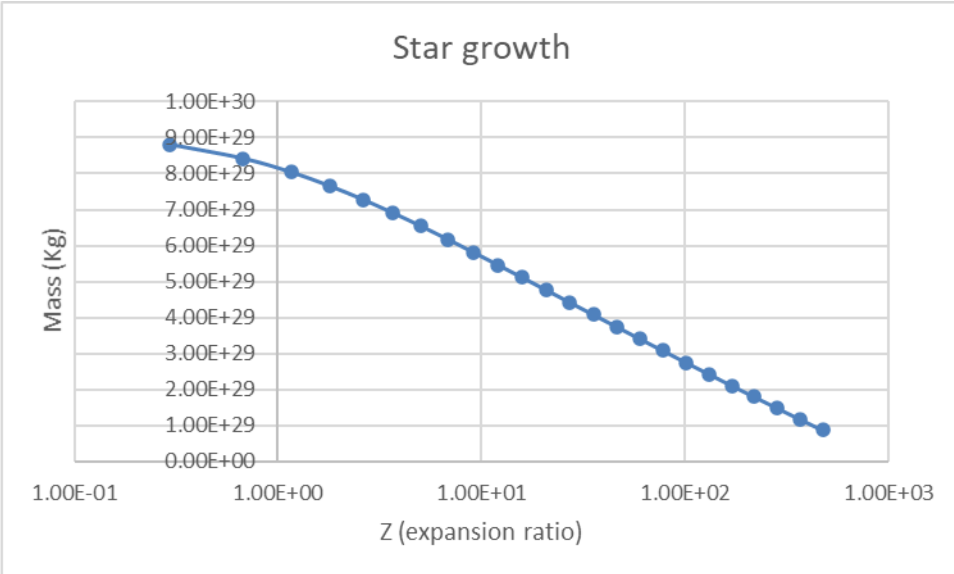
r based on temp				3.68E-06
RU				5.95E+22
Eu geodesic				3.681E-06
dens overall				2.82E-18
				4.50E+25
Central mass				5.63E+28
				1.00E+00
a=(2*M*6.675e-11/(time-time')^4)^0.333 (m/sec^2)				9.84E-13
L enclosed by a=0.5*a*(time-time')^2 (m)				4.07E+13
				5.63E+28
delta mass=4/3*pi()*(r^3-r'^3)*density (Kg)				
fall ratio			0.0242	2.42E-02
Ru (m)			10.92	5.95E+22
Mass. M (Kg)				5.63E+28
Ri=7.045e-14*10.15/ke initial*(M/1.67E-27)*1/EXP(90)				1.02E+11
Rf=7.045e-14*10.15/ke initial*(M/1.67E-27)*1/EXP(90)*8e-4				2.46E+09
Vi=(2*ke initial/1.67E-27*1.6e-13)^0.5 (m/sec)				6099.07
a=Vf^2/Rf (m/sec^2)				1.51E-02
ke initial (MeV)				1.94E-07
A=GM/Rf^2 (m/sec^2)				6.19E-01
Vf=((Vi^2*Ri)/Rf)^.5 (m/sec)				3.92E+04
a=Vf^2/Rf (m/sec^2)				6.24E-01
condensed density				1.99E-13
ke=6.67e-11*M*1.67E-27/Rf^2*Rf/2/1.6e-13 (MeV)				7.96E-06
ke=0.5*1.67E-27*Vf^2/1.6d-13 (MeV)				8.02E-06

Details:

Rinitial=7.045e-14*10.15/ke initial*(M/1.67E-27)*1/EXP(90)	
Rinitial=7.045e-14*10.15/1.94e-7*(5.63e28/1.67E-27)*1/EXP(90)=1.02e11 n	
Vinitial=(2*ke initial/1.67E-27*1.6e-13)^0.5 (m/sec)	
Vinitial=(2*1.94e-7/1.67E-27*1.6e-13)^0.5= 6099 m/sec	

The radius that is enclosed is L= 0.5*a t^2 = 4.07e13 and volume is 4/3*pi*(4.07e13^3). This new volume accumulates mass= vol* increased density= 5.6e3e28 Kg. The increased density is equal to virgin density/fallratio^3.

The chart below shows the star mass growth as a function of Z, the expansion ratio. The chart is logarithmic with the start of accumulation at decoupling shown on the righthand side. Stars are observed at about Z=8. The central mass originally partitioned into this volume has been densified throughout this period and finally reach a mass where we can see its light. Mass accumulation starts at decoupling, but temperature and density must increase before fusion starts.



Further densification occurs when the layers of mass press down on the center of a developing star. The example below is for a star with mass 8.8e29 Kg and radius 5.67e8 meters (this radius is based on the density of our sun). This calculation is carried out for a star that has existed for 4 billion years, similar to our sun.

Rinitiial=7.04e-14*10.15/ke*(M/1.67e-27)*(1/exp(90)

8.81E+29	Mass. M (Kg)		
1.59E+12	Ri=7.045e-14*10.15/ke initial*(M/1.67E-27)*1/EXP(90)		
3.85E+10	Rf=7.045e-14*10.15/ke initial*(M/1.67E-27)*1/EXP(90)*9.6e-3		
6099.07	Vi=(2*ke initial/1.67E-27*1.6e-13)^0.5 (m/sec)		
9.66E-04	a=Vf^2/Rf (m/sec^2)		
1.94E-07	ke initial (MeV)		
3.96E-02	A=GM/Rf^2 (m/sec^2)		
3.92E+04	Vf=((Vi^2*Ri)/Rf)^.5 (m/sec)		
3.99E-02	a=Vf^2/Rf (m/sec^2)		
1.82E-21	condensed density=density/fall ratio^3		
7.96E-06	ke=6.67e-11*M*1.67E-27/Rf^2*Rf/2/1.6e-13 (MeV)		
8.02E-06	ke=0.5*1.67E-27*Vf^2/1.6d-13 (MeV)	sun match	
3.88E+10	After first densification		
5.67E+08	Star radius		
1.30E+03	density		

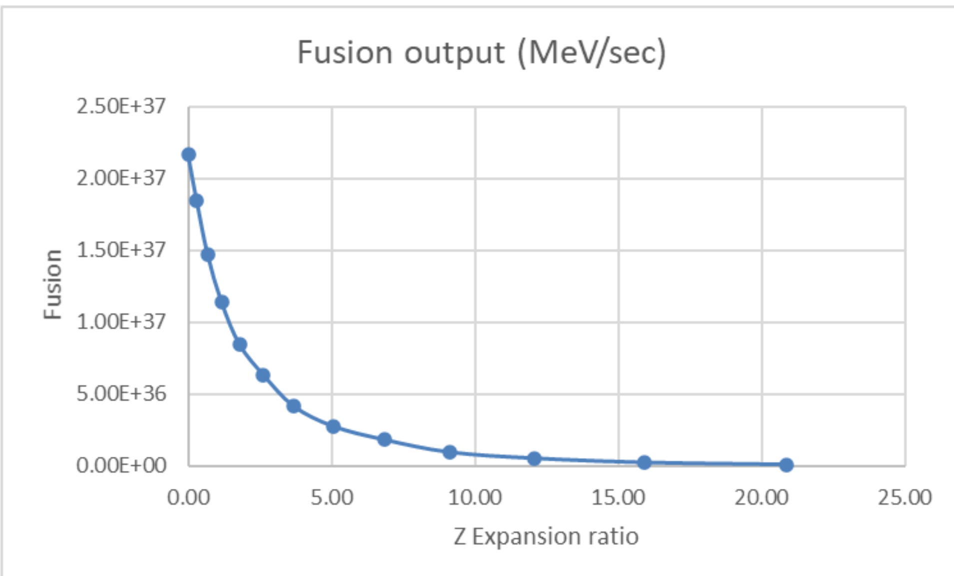
The lines in yellow indicate the further densification. The Final radius is 5.6e8 meters, the radius of the star with mass 8.8e30 Kg. For the 2e30 Kg mass of our sun the density would be 1.2e6 Kg/m^3 (Wiki). This density is consistent with the calculations below.

Fusion initiation

Stars "light up" and are observable at about Z=8 expansion ratio. The star central mass calculations for this period form the basis for a step by step densification model down from the surface of a star to the core where fusion [3][4] can occur. As mass densifies there are collisions that change kinetic energy into temperature and thermodynamics dominates. Details of the densification model are in Appendix 3.

20.87	15.91	12.08	9.11	6.82	5.05	3.68	2.62	1.80	1.16	0.67	0.29	0.00	Z=Rfinal/R-1
4.76E+29	5.11E+29	5.46E+29	5.82E+29	6.18E+29	6.54E+29	6.91E+29	7.28E+29	7.66E+29	8.04E+29	8.42E+29	8.81E+29	9.194E+29	Mc accumulation=M+dM
			first stars	first stars									density
1.29E-15	7.73E-16	4.64E-16	2.79E-16	1.67E-16	1.00E-16	6.03E-17	3.62E-17	2.17E-17	1.30E-17	7.83E-18	4.70E-18	2.815E-18	td=(2*m*6.675e-11/(t-t')^4)^0.333
4.88E+23	4.93E+23	4.99E+23	5.04E+23	5.10E+23	5.15E+23	5.21E+23	5.27E+23	5.32E+23	5.38E+23	5.44E+23	5.50E+23	5.461E+23	m=(4/3*PI()*(L^3-L'^3))*virgin density
1.20E+15	1.56E+15	2.02E+15	2.62E+15	3.40E+15	4.42E+15	5.73E+15	7.44E+15	9.65E+15	1.25E+16	1.63E+16	2.11E+16	2.7306E+16	L=a*(t-t')^2/2
3.44E+28	3.48E+28	3.52E+28	3.56E+28	3.60E+28	3.64E+28	3.68E+28	3.72E+28	3.76E+28	3.80E+28	3.84E+28	3.88E+28	3.85E+28	DM=(4/3*PI()*(L^3-L'^3))*density
4.76E+29	5.11E+29	5.46E+29	5.82E+29	6.18E+29	6.54E+29	6.91E+29	7.28E+29	7.66E+29	8.04E+29	8.42E+29	8.81E+29	9.19E+29	
1.88E+06	1.41E+06	1.11E+06	8.23E+05	6.88E+05	5.12E+05	4.01E+05	3.33E+05	2.60E+05	2.13E+05	1.74E+05	1.43E+05	1.15E+05	density Kg/m^3
6.23E+06	6.68E+06	7.14E+06	7.60E+06	8.07E+06	8.54E+06	9.02E+06	9.50E+06	9.98E+06	1.05E+07	1.10E+07	1.15E+07	1.20E+07	Temp (K)
3.57E-06	2.68E-06	2.11E-06	1.56E-06	1.30E-06	9.69E-07	7.60E-07	6.31E-07	4.92E-07	4.03E-07	3.30E-07	2.71E-07	2.18E-07	p1
4.70E-08	1.47E-07	4.01E-07	9.79E-07	2.18E-06	4.47E-06	8.57E-06	1.55E-05	2.66E-05	4.36E-05	6.87E-05	1.05E-04	1.53E-04	p2
3.933E-09	3.701E-09	3.530E-09	3.295E-09	3.196E-09	2.979E-09	2.823E-09	2.723E-09	2.570E-09	2.462E-09	2.357E-09	2.258E-09	2.145E-09	p3
6.59E-22	1.45E-21	2.98E-21	5.03E-21	9.07E-21	1.29E-20	1.84E-20	2.66E-20	3.36E-20	4.32E-20	5.35E-20	6.40E-20	7.18E-20	P
8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	8.8	
2.85E+56	3.06E+56	3.27E+56	3.48E+56	3.70E+56	3.92E+56	4.14E+56	4.36E+56	4.58E+56	4.81E+56	5.04E+56	5.27E+56	5.51E+56	N
0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.082	
1.54E+34	3.65E+34	7.99E+34	1.44E+35	2.75E+35	4.15E+35	6.24E+35	9.51E+35	1.26E+36	1.71E+36	2.21E+36	2.77E+36	3.24E+36	N/sec
1.03E+35	2.44E+35	5.34E+35	9.59E+35	1.84E+36	2.77E+36	4.16E+36	6.35E+36	8.43E+36	1.14E+37	1.48E+37	1.85E+37	2.16E+37	Fusion output MeV/sec

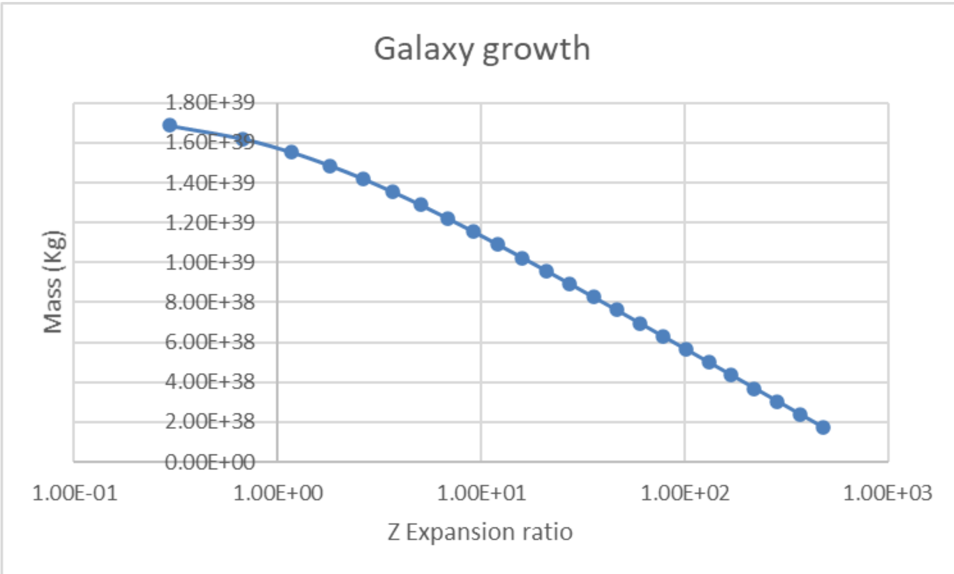
The bottom line above is the fusion calculation for the calculated density and temperature. It is plotted below:



The fusion calculations indicate that energy output increases dramatically after about Z=8. This is consistent with our observation of the first stars.

Galaxy densification

Volumes are densifying and becoming stars but the stars themselves are falling into orbits around galactic centers. The dynamics are identical and lead to the following growth charts.



Star velocity orbiting galaxies

The mass of our galaxy is approximately 2e41 Kg. The velocities of stars moving around this mass have been measured and is 2.25e5 meters/sec. This serves as a measure of the fall ratio. The fall ratio required to allow the galaxy to build in mass is approximately 2.4e-2. The velocity associated with this fall ratio is 2.5e5 m/sec (as observed). This indicates that the stars have interacted and lost some kinetic energy as they fall into their orbits.

fall ratio		3.00E-02
Mass. M (Kg)		2.00E+41
Ri=7.045e-14*10.15/ke initial*(M/1.67E-27	a=V^2/R	8.82E+21
Rf=7.045e-14*10.15/ke initial*(M/1.67E-27	v^2=GM/R	2.65E+20
Vi=(2*ke initial/1.67E-27*1.6e-13)^0.5 (m	V^2R=GM	39051.59
a=Vf^2/Rf (m/sec^2)		5.77E-12
ke initial (MeV)		7.96E-06
A=GM/Rf^2 (m/sec^2)		1.91E-10
Vf=((Vi^2*Ri)/Rf)^.5 (m/sec)		2.25E+05
a=Vf^2/Rf (m/sec^2)		1.92E-10
		9.52E-22
ke		2.63E-04
ke		2.65E-04

Before the fall, each proton had a kinetic energy of 1.94e-7 MeV. After the fall each proton has 2.63e-4 MeV indicating that some potential energy has been converted back to kinetic energy.

Black Holes

For stars further densification occurs when the accumulated mass loses enough energy by interaction with other mass to form a body. Once this occurs layers of mass press down on one another eventually creating fusion. The same process can occur for galaxies since the dynamics of accumulation for the central mass are identical. However, galaxies are bringing in mass that will become stars. Stars can interact (combine), lose energy and form black holes. The center mass of the galaxy is more likely to have black holes. Massive black holes are observed in the center of galaxies and are reported to have a billion times the mass of a sun. This would make them 5.8e29*1e9=5.8e38 Kg. This agrees with the galaxy accumulation chart above.

Cluster densification

The dynamics are identical except galaxy orbits within clusters do not fully form.

Review

Expansion is caused by r increasing with the equation r=r0*10.15/ke. Radius increases as r=r0*(t'/t)^(2/3). Each r is a geodesic (variables that obey the Newtonian relationship R=GM/V^2). During expansion kinetic energy is converted into potential energy conserving 20.3 MeV/proton.

Mass accumulation is the reverse process. Each orbital radius is a geodesic based on a large mass that falls to a smaller radius but V^2 becomes larger. Again, kinetic energy plus potential energy is conserved at 20.3 MeV/proton. The fall ratio= Rinitial/Rfinal. R initial is defined by re-writing R=GM/V^2 as:

```
Rinitial=7.045e-14*10.15/ke initial*(M/1.67E-27)*1/EXP(90)
```

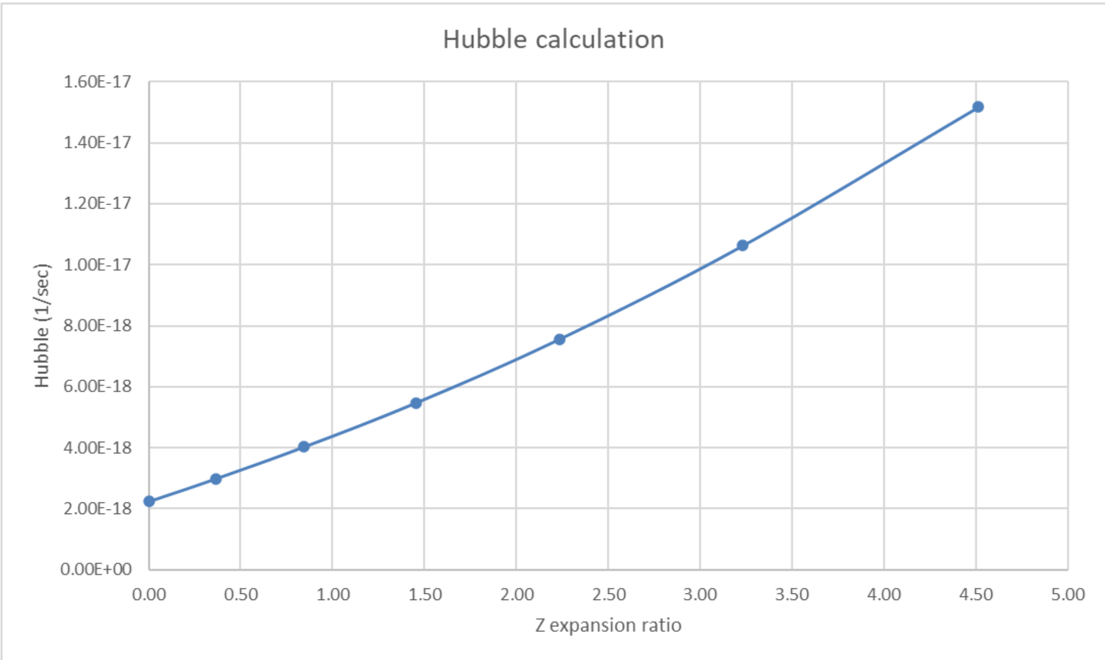
Mass starts to accumulate because perturbations exist in the "spheres' defined above. The density perturbation 8e-5 measured by WMAP causes each of the spheres to have a central mass. Each central mass can acceleration (a) new mass toward the center. Over time increment (t) a radius L= 0.5*a*t^2 can be enclosed. But as the new mass falls from Rinitial to R final, the virgin density is increased: condensed density= virgin density/fall ratio^3. This determines the new central mass and as time increases, the central mass continues to increase.

Calculating the Hubble constant

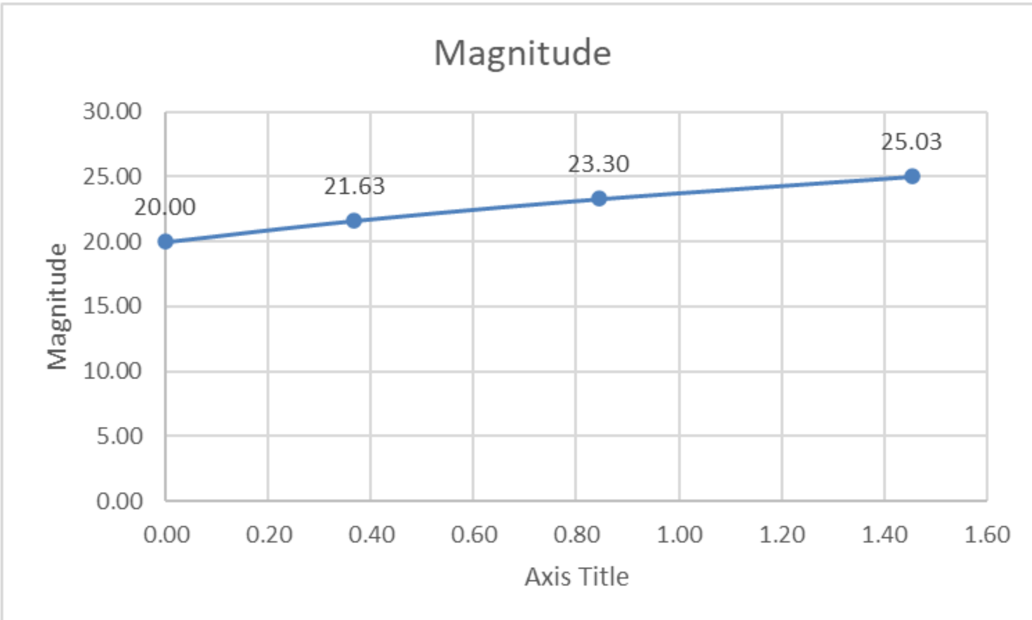
WMAP reported a Hubble [11] value of 2.23e-18/sec. But other measurements using supernovae indicate that the universe is experiencing late stage expansion. This was unexpected and a Hubble constant of 2.39e-18/sec is reported [15].

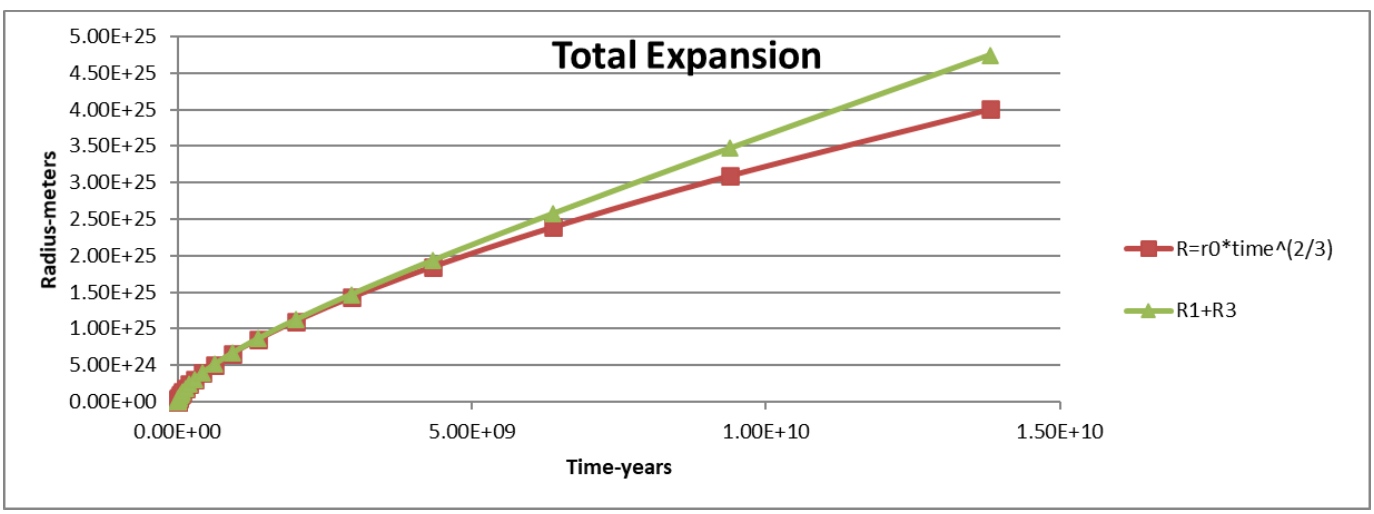
The author's expansion model can be used to calculate the Hubble constant. At decoupling mass accumulation creates gravitationally bound objects. The space they take is fixed and the universe around them expands. The distance between the expanding universe radius and the combined fixed radius of the stars increases with time. The Hubble constant = (Ru-Rstars)/(delta t*Ru), where delta t is an increment in the expansion model. This is a function of the number of stars. The potential number of stars = 1.67e-27*exp(180)/5.8e29= 4.3e21. But not all virgin density has been converted to stars. As stars light up, they release a great deal of energy. Toward the end of expansion observations indicate that expansion is increasing at a constant rate (some have measured actual acceleration). The author proposed in reference 8 that the energy that stars release cause this extra expansion. Based on this effect, the current measurements of cosmic background radiation temperature 2.73 K and matching the Hubble constant, the expansion model indicates that 9% of the available mass has been converted to stars at the present time.

Here is the calculation of Hubble's constant for matching conditions



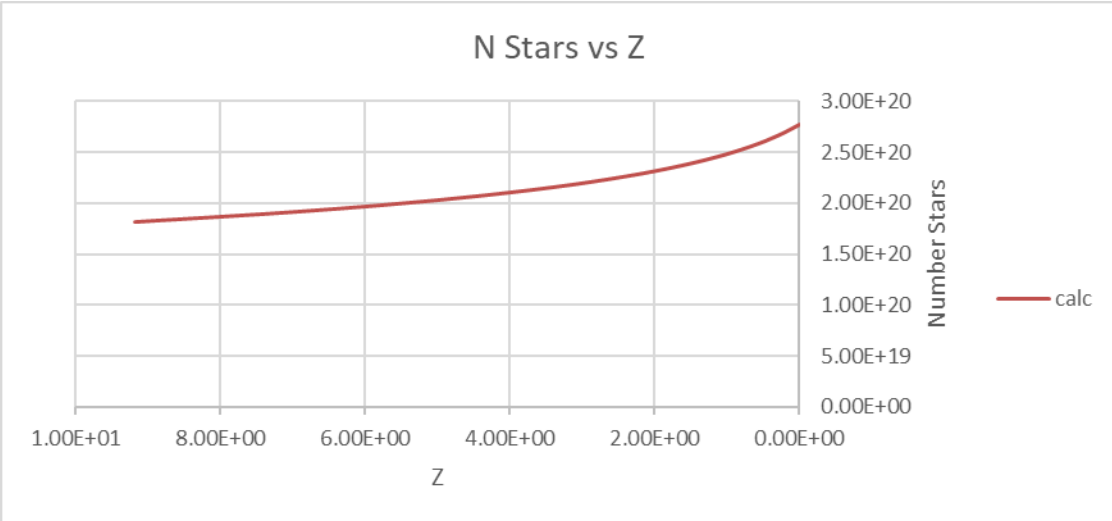
The Hubble value changes because expansion was faster in the distant past and Ru was lower. When the sun was formed 4 billion years ago, Z was about 0.35. At this point, H was 2.39e-18/sec but has dropped to 2.2e-18/sec at the present time. Measurements earlier than about Z=1 are difficult. Magnitude (dimness) is a function of distance ^(1/4). Literature indicates measurements [15] along the line below (magnitude 24.7 is approximately with Z=1). The magnitude line below is for the authors expansion model for matching conditions: Temperature, Hubble constant and reported magnitude [15].





The red line above is from the author's expansion model (R1) with the normal time^ (2/3) relationship. The green lines is total expansion, R1+R3. The late stage expansion component R3 uses the energy output of stars and a cellular model of expansion forces to determine expansion caused by the stars. It turns out that the forces late in expansion are very low and a kinetic energy addition on the order 1e-10 MeV/proton has a large effect. This is offered as an alternative to dark energy. The green line is not a density effect and the lambda-CDM model is not applicable. Based on this and the work reported in reference 8 and 12, neither dark matter nor dark energy are required to match observations. However, based on a R1 radius of 4e25 meters, the enclosed density is 9.5e-27 kg/m^3 (called critical density).

The considerations above determine the number of stars since their combined energy output are responsible for R3.



Conclusions

The proton model, the related expansion model, the mass accumulation model and the Hubble calculations reported in this document agree with observations. Perturbations measured by WMAP combined with the physics of waves measured at decoupling partition density into spheres (stars within galaxies) within spheres (galaxies of stars) within spheres (clusters of galaxies). Perturbations cause central mass that becomes densified by acceleration toward the central mass and orbital densification as the mass falls.

Further densification occurs as mass presses down on layers toward the core of a star. Eventually the density and temperature are adequate to initiate fusion. Early stars light up and are visible at about expansion ratio Z=8. The author believes that “dark energy” is the effect of star energy on expansion. Using this criterion, about 9% of the possible mass has been converted to stars at the present time. This amount of energy produces a Hubble constant of approximately 2.22e-18/sec and produces a linear late expansion curve

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Appendix 1 Expansion model based on proton model

Understanding that the gravitational constant G can be calculated with ke0= 10.15 MeV/proton of kinetic energy in a cell of radius r0= 7.045e-14 meters allows further development of cellular cosmology gravitational relationships before thermodynamics starts to dominate. As kinetic energy decreases and potential energy increases each cell expands. Kinetic energy associated with each of exp(180) cells is related to pressure acting outward on the surface. Consider how kinetic energy and potential energy change in the derivation below. Kinetic energy (ke) is be turned into gravitational potential energy (pe=Fr) over time. The increasing radius of the universe and increasing time are related through expansion.

Kinetic E	Potential
ke	F r
1/2M(v)^2	GMM/r
1/2M(r/t)^2	GMM/r
1/2Mr^3/t^2	GMM
1/(2GM)*r^3	t^2
(r/r0)^3 increases as (t/t0)^2	

(r/r0) increases as (t/alpha)^(2/3) (kinetic energy requirement).

Returning to the basic concept that particles define space locally, the above equations indicate that time is changing two things simultaneously. 20.3 MeV= ke+pe. Combining the equations above:

(r/r0)=(t/alpha)^(2/3)
With r= r0*10.15/ke
r/ro*10.15/ke= (t/alpha)^(2/3)
ke=10.15/(t/alpha)^(2/3)
pe=20.3-10.15/(t/alpha)^(2/3)

These can be substituted into the space portion of the model as follows:

	2.72E-05	0.296	
	-0.6224	-10.33	
0.511	0.11	10.14	
electron n	2.02E-05		
Neutrino k	0.67	10.41	
	0.74		
expansion	ke=10.15/(t/alpha)^(2/3)		
expansion	Pe=20.3-ke		
939.68			959.99
Total N values		90.10	
r=7.045e-14*10.15/ke			

With this understanding the proton model describes expansion with time. Since time is defined by the proton and it also contains expansion kinetic energy, the proton becomes a cosmological particle with the full capability of creating the universe we see around us. Particle-space is a cosmological model (protons are widgets).

			Start	He4 transition	He4 Spike	R1	R3 stars
Time (seconds)			0.0515	438.8		4.352E+17	now
KE MeV			10.15	0.099	2.81E+00	3.26E-10	
KE expansion algorithm			10.15*(0.0511/time)^.5		2.81*(539/time)^0.666		
Expansion Time (sec)		Time (se	0.052	539	539	4.32E+17	
Temp before He4 spike K=ke/(1.5*E			7.87E+10	7.66E+08		0.386	settle back r
R meters=8.05e12*10.15/(E*pi)			8.04E+12	8.26E+14		R=4.21e15*2.81/(3.33e-10)	
R after spike=8.23e14+2.8*1.6e-13/(3.6e-42*exp(90)*exp(60)					1.20E+16	4.01E+25	4.75E+25
Temperature after He4=KE/(1.5*B)					2.18E+10	2.52	2.73
baryon photon ratio					6.98E-10		
		Stars energy delta radius (m)					7.4E+24

The table above is a summary of expansion based on energy values in the proton-space model. This is fully discussed in references 8 and 12. Expansion starts based on ro=7.045e-14*exp(60) meters (exp(180) particles in three dimensions). The original expansion energy 10.15 MeV and associated temperature decrease until the temperature associated with 0.111 MeV is reached. This value is found in the proton model as 0.662 MeV-0.511 MeV= 0.111 MeV. Neutrons and protons are in equilibrium at the beginning but neutrons start to decay with a half time of 661 seconds. There are enough neutrons remaining at energy 0.111 MeV to readily react with protons. About 25 percent of everything becomes He4. This spikes the temperature but as expansion continues it falls to near present values. The proton energy components and its gravitational relationships create the cosmology we observe over time. A comparison was made with finding of WMAP [11]. There are substantial differences that were addressed in reference 8.

Appendix 2 **Details of the proton model**

The proton model is shown below (I believe it is consistent with the standard model [10]. It is simply a list of energy components inside the proton. The left-hand side is mass plus kinetic energy and the right-hand side is the opposing and opposite field energy components. Toward the center of each particle diagram values called N are listed. Energy is related to N by the equation E=2.02e-5*exp(N).

Quark mass	Kinetic E	N=ln(E/2.02e-5)		Field E
(MeV)	(Mev)			(MeV)
101.95	646.96	15.43	17.43	753.29
	5.08	12.43	10.43	0.69
13.80	83.76	13.43	15.43	101.95
	5.08	12.43	10.43	0.69
13.80	83.76	13.43	15.43	101.95
	5.08	12.43	10.43	0.69
Weak Void	-20.30			
Weak KE	0.00			
Balance	0.00			
Neutrino ke	-0.67		10.51	0.74
ae neutrino	-2E-05			
E/M field	-2.7E-05			
938.27	MeV Proton			
	2.72E-05	0.296		
	-0.6224	-10.33		
0.5110	0.11	10.14		
electron neut	2.02E-05			
Neutrino ke	0.67	10.41		
	0.74			
expansion pe	10.15			
expansion ke	10.15			
959.99				959.99
Total N values		90.10	90.10	

Probability=1/exp(N) is written below in tabular form. Information = negative natural log(p1*p2*p3, etc.) = 90.1 is written at the bottom of each fundamental N column. With these probabilities, the components become parts of the N=90 information system.

	N	P=1/exp(N)	N	P=1/exp(N)
Quad 1	**15.43**	1.99E-07	**17.43**	2.69E-08
	12.43	3.99E-06	**10.43**	2.95E-05
Quad 2	**13.43**	1.47E-06	**15.43**	1.99E-07
	12.43	3.99E-06	**10.43**	2.95E-05
Quad 3	**13.43**	1.47E-06	**15.43**	1.99E-07
	12.43	3.99E-06	**10.43**	2.95E-05
Quad 4	**10.41**	3.02E-05	**-10.33**	3.07E+04
	-10.33	3.07E+04	**10.41**	3.02E-05
Quad 4'	**10.33**	3.25E-05	**10.33**	3.25E-05
	0.00	1.00E+00	**0.00**	1.00E+00
	P1*P2*etc	8.19E-40		8.19E-40
	ln (Ptotal)	90.00		90.00

The next level involves placing the probabilities in the Schrodinger equation to produce the neutron and proton.

Probability 1=e0/exp(N). This probability is an energy ratio and leads to the equation E=eo*exp(N). The probability is 1/exp(N) and e0=1 in natural units or 2.02e-5 in MeV units, evaluated from the electron N from the table in Appendix 1.

Energy zero= 0= E-E. Energy is created by a separation but there are two types of energy. Appendix 2 explains how energy separations from zero and probability 1 represent the neutron and proton. Probability 1 represents the other initial condition, zero information. Everything was apparently produced by separations. The components of the neutron and its fields encode the laws of nature. It means that there are particles separated in distance, each with kinetic energy for expansion of the universe.

The work below derives Schrodinger based orbits that obey energy zero. This means there will be positive and negative energy terms created through separation. This E=0 constraint and related P=1 constraint are further defined. There are sets of four probabilities of interest that contain exponential functions 1/exp(N).

Evaluating E

Evaluating E in the RHS requires consideration of overall probability, not just the probability of particles. Initially there was a probability for many neutrons to make up the universe. Specifically, P= 1= probability of each neutron* number of neutrons= 1/exp(N)*exp(N).

1=1/1=exp(180)/(exp(90)*exp(90)) where exp means the natural number e to the power 90, where 90 is a base 10 number (count your fingers).

Number of neutrons in nature

Based on the neutron model the components of mass plus kinetic energy add to N=90.0986. I used N=90 in early work and haven't resolved the 0.0986 difference. With P=1/exp(90) and equally improbable field energy components, the probability of the neutron is 1/exp(180) since probabilities multiply. If P=1, there are exp(180) neutrons in nature. These are apparently placed outside of each other to prevent nature from occurring as one large superposition. Is this the origin of the Pauli exclusion principle? The value exp(180) agrees with estimates of critical density but P=1 is difficult to accept. Does this mean there is one neutron expressed as exp(180) low probability duplicates throughout nature? I consider it a system but know this is difficult to accept.

The probability of each neutron is 1/exp(N). The neutron itself is made of improbable components like quarks. Appendix 2 uses the logarithmic values called N values for probabilities to produce an alternative table of the neutron model. The probability of particles that makes up the neutron are energy ratios, i.e. p=e0/E=1/exp(N), where e0 is a small constant. Eo is evaluated with data for the mass of the proton 0.511 MeV and its known N value 10.136 [appendix]. This means the set of N values gives the energy of its components through the equation E=e0*exp(N).

Information theory probabilities

C. Shannon [10] used S= -ln P to represent information and thermodynamics incorporates similar concepts except it is the statistics of many particles. The author's N identifies particles such as an electron and components of the electric field and E= e0*exp(N). In this system, dimensionless energy ratio e0/E=P probability. Since wavelength is proportional to 1/E=1/hv (h is Heisenberg's constant and v is frequency), the probability and a dimensionless wavelength are equivalent.

P=e0/E=(h v0)/(h v)=v0/v=wl/wlo.

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(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

The four N values discussed in the section entitled "Evaluating E" and their associated energy is called a quad. It is defined as the E values E=e0*exp(N) in a box to the right of each N value. The key to distinguishing mass (E1) from kinetic energy (E2) and two fields is shown below. The positions are not interchangeable.

Mass	Field 3
Kinetic Energy	Field 4 (G)

		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)=5.08, E3=2.02e-5*exp(15.43)= -101.95, E4=2.02e-5*exp(10.43)= -0.69 (all in MeV).

Separation of energy from zero

Overall E1+(E3+E4-E1-E2)+E2- (E3-E4) =0= (E1-E1)+(E2-E2)+(E3-E3)+(E4-E4) obeys the energy zero restriction. I call these diagrams energy zero, probability 1 constructs. They contain energy components of a quark.

Repeating the process for the quark quads and quads that lead to the electron yields the proton model in the text [11][12].

Comparison of proton model and PDG data

Compare the above values for the neutron and proton with measured values.				update feb 2017					
931.4940281	nist		0.510998946	0.510998946					1.30E-07
931.4940955	pdg	548.5799095	0.51099895		0.5110011		-2.15856E-06		2.40E-07
simple cell g67	Data		Data (mev)		Calculation (mev)	calculation	Difference	Difference	measurement
			Particle Data Group		Present model	(amu)	(mev)	(amu)	error (amu)
		(amu)		(an	(mev)				
Neutron	nist	1.008664916	939.5654133	939.5654135	939.5654127	1.0086649	5.629623E-07	8.71281E-10	6.20E-09
Proton	nist	1.007276467	938.2720813	938.2720813	938.2720767	1.0072765	4.620501E-06	4.98855E-09	6.2E-09
Neutron/electron	1838.683662		939.5654133	nist	939.5654127		5.6296233E-07		
Proton/electron	1836.152674		938.2720814	nist	938.2720767		4.6785007E-06		

Below the proton mass the model shows energy outside the proton. This part represents space. The right two columns contain field energy values. Overall, the bottom (space) part of the diagram indicates that total mass and kinetic energy is equal and opposite total field energy 959.99 MeV.

Appendix 3 Densification within our sun

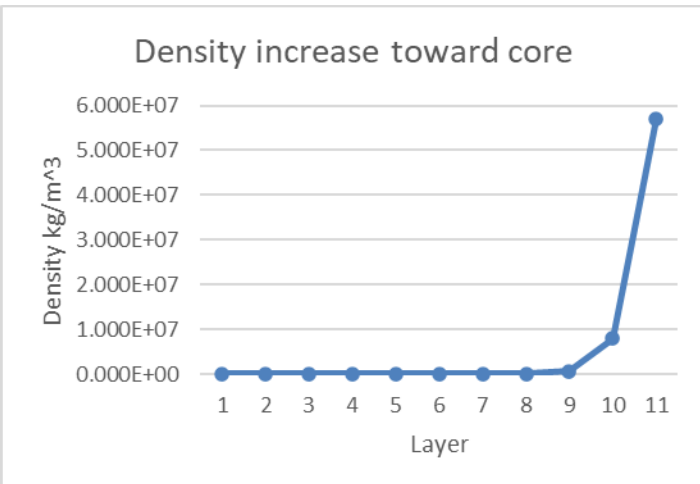
The model below calculates the gravitational pressure exerted down toward the core of our sun. Initial conditions come from the expansion model at time 4 billion years ago. The model is built with 10 layers that together have mass 2e30 Kg like our Sun. The bottom layer is consistent with Wiki data for density and temperature. The fusion calculations are from the author’s fusion model described in Appendix 3.

2.00E+30		Layers
Solar Density and Temperature Model		
2.36E+18	A=4*pi()*R^3	
4.33E+08	Rfinal	
8317	Rgas const	
6.700E-11		
4.33E+07	R/10	
2.30E-02		
1.69		
1.19E+01	m/m	
2.37E+31		
7.00E-02	rho0	
3.35E+07		
4.33E+08	h	1
1		
7.13E+02	ghigh	
9.73E+04	T (red=fl)	
7.16E+24	mass	
2.20E+09	P	
4.59E+00	rhonew	
3.90E+08	h	2
0.81	A/A	
8.81E+02	ghigh	
1.09E+06	T	
3.80E+26	mass	
1.77E+11	P	
3.29E+01	rhonew	
3.47E+08	h	3
0.64	A/A	
1.11E+03	ghigh	
2.09E+06	T	
2.16E+27	mass	
1.77E+12	P	
1.72E+02	rhonew	
3.03E+08	h	4
0.49	A/A	
1.46E+03	ghigh	
3.09E+06	T	
8.61E+27	mass	
1.26E+13	P	
8.30E+02	rhonew	
2.60E+08	h	5
0.36	A/A	
1.98E+03	ghigh	
4.09E+06	T	
3.06E+28	mass	
8.38E+13	P	
4.17E+03	rhonew	

3.57E+02	rhonew		
2.17E+08	h	6	
0.25	A/A		
2.85E+03	ghigh		
5.08E+06	T		
9.15E+27	mass		
5.14E+13	P		
2.05E+03	rhonew		
1.73E+08	h	7	
0.16	A/A		
4.46E+03	ghigh		
6.08E+06	T		
3.36E+28	mass		
4.48E+14	P		
1.50E+04	rhonew		
1.30E+08	h	8	
0.09	A/A		
5.94E+03	ghigh		
7.08E+06	T		
1.38E+29	mass		
4.31E+15	P		
1.24E+05	rhonew		
8.67E+07	h	9	
0.04	A/A		
8.92E+03	ghigh		
8.07E+06	T		
5.07E+29	mass		
2.92E+03			
5.21E+16	P		
1.31E+06	rhonew		
4.33E+07	h	10	
0.01	A/A		
2.50E+04	ghigh		
9.07E+06	T		
1.34E+30	mass		
1.47E+18	P	1.21E+07	
2.00E+07	rhonew	1.65	
9.07E+06	temp core		
2.00E+07	Kg/m^3		
2.00E+30			
2.00E+07	density Kg/m^3		
9.07E+06	Temp (K)		
3.79E-05	p1		
9.19E-06	p2		
1.042E-08	p3		
3.63E-18	P		
8.8	B years		
1.20E+57	N		
0.082	fract burn		
3.56E+38	N/sec		
2.38E+39	Fusion MeV/sec		

Key to layer calculations (example)

P9 (nt/m^2)	P9=P8+rho8*a8*h0/10		1.38E+29
rho9 kg/m^3	rho9=(P9/1e16)^(5/3)		5.90E+21
h9 (m)	h9=h8-h0/10		7.38E+02
T (K)	T9=T8+dT		1.60E+13
a10 (m/sec^2)	a9=6.673e-11*(M-m8)/(h9)^2		1.22E+15
m10 shell Kg	ms10=4/3*PI()*(h9^3-(h9-h0/10)^3)*rho8		9.94E+30
cum mass10	cumm10=cumm9+ms10		9.94E+30
P10 (nt/m^2)	P10=P9+rho9*a9*h0/10		5.30E+39
rho10 kg/m^3	rho10=(P10/1e16)^(5/3)		2.59E+39
h10 core		0	0.00E+00
r cell (m)		rcell=(1/rho10*1.67E-27/(	5.36E-23
		C=(a*R9)^.5	9.48E+08
			smallest



Appendix 4 Fusion in our sun

The following model was used for all calculations above except the calculated central mass is used for fusion [3][4].

Sun example

Temp	deg K	1.32E+07	Dmax kg/m^3	
Density	kg/m^3	1.15E+06	5.288E+11	
KE temp	1.5*B*T	1.704E-03		8.620E-11
degeneracy		7.51E+00		5.2911E-11
Degenerate radius (DR)		7.040E-12		
v/c		0.081		
Barrier		-0.0136		0.00000

Example calculation for above conditions (1.2e5/5.28e12)

rate	Pbarrier	Pd=(dens/ma	Preaction rate R/sec
Probability/sec	exp(-.0136/ke temp)		v/C*C/(2pi*degenerate radius)/exp(60)
3.59E-18	3.42E-04	2.17E-06	4.839E-09

burn time (Byrs)	8.8	
sun N	1.198E+57	2e30 Kg/1.67e-27
fract burning	0.082	
burn rate N/sec*mev/N	3.53E+38	
power mev/sec	2.36E+39	
	3.8e26 joules/sec	wiki
	2.37E+39	mev/sec