

The Human Cosmos (2005)

This paper primarily addressed the questions of why do all things we observe appear to have been formed at the same time. Based upon radiation decay rates it appears that all the matter that exists in the portion of the universe that we observe was formed approximately 10 billion years ago. However, in the kinetic particle theory there is a large “sea” of neutrinos of all energies which came into existence an indefinitely long time ago. The equilibrium between the Maxwell-Boltzmann background neutrinos and the sea of neutrinos could have been achieved much longer in the past than 10 billion years.

Now, from this sea of neutrinos there is a steady rate of hydrogen atoms being formed. Due to hydrogen’s gravitational field the hydrogen atoms begin to accumulate and eventually produce hydrogen stars. After such a star grows enough it reaches a size with a strong enough gravitational field to produce fusion. Thus, larger atoms are formed.

Stars (of hydrogen and other atoms) keep growing, but what limits their ultimate size? The next major step after being able to fuse occurs much later when the gravitational field is strong enough to collapse the atomic structure and thus form a neutron star. Neutrons still have the electrostatic field of the (collapsed) electron and the proton orbiting each other, so the neutrons have a gravitational field. Therefore, the neutron star will continue to grow.

What limits the growth of a neutron star? As the neutron star grows its gravitational field becomes strong enough to collapse the neutron structure. When this occurs, the neutrinos making protons and those making electrons are released in such abundance that the whole neutron star explodes. This would be a super-super-super nova explosion. The size of this star before the explosion is one tenth the radius of the observable universe. Before it exploded it would gather all the matter in the observable universe—out as far as the gravitational field reaches ( $10^{10}$  light years).

After the explosion the observable universe (i.e., the human cosmos) would be populated only by the debris of this explosion. Also, the explosion debris would begin to populate regions much beyond the human cosmos.

Radioactive dating would start at the time of the explosion since prior to that time only fusion would be occurring. The debris of such an explosion would consist mostly of neutron stars (black holes) but there also would be atomic stars, some mostly hydrogen stars, some small atomic masses such as planets, moons, and asteroids, and a non-negligible amount of space dust. All of these items would have the same radioactive date of birth.

The Human Cosmos<sup>1</sup>

by

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Where did the sun come from? Where did the earth come from? Why was the earth initially hot and then became cool? What in the world are black holes and where do they come from? We present answers to these questions.

We normally think of the cosmos as the comets, planets, stars, galaxies, – the whole universe. Here we consider that portion of the universe of which humans are aware. We consider humans as having existed in the universe for a very short time. The actual beginning may be some six thousand years ago according to the Judeo-Christian belief of human creation, or some tens or hundreds of thousands of years ago according to the evolutionary belief of human creation – a short time in either case when compared with cosmological times. The extent in time and space of the cosmos of which humans are aware extends in time from the present back some ten billion years and extends outward in space some ten billion light years (or  $10^{26}$  meters).

The theory of physics proposed in the book *The Grand Unified Theory of Physics* [1] provides an approach to predicting the origin of the matter in the cosmos including the planets, stars, and even the “black holes”. We approach this with a theory which can produce all of the objects in the universe observed by humans. However there may be some material (such as stars and black holes) which was produced at some time long before the  $10^{10}$  years and beyond distances much greater than  $10^{26}$  meters from us and which migrated into the human cosmos space. In the following pages we describe the process for developing black holes, stars, and planets which appear in the human cosmos and which could have been formed in the human cosmos.

In the grand unified theory of physics there is an ether gas which pervades the entire (assumed unlimited) universe. The gas is made up of elastic particles which have a diameter of  $10^{-35}$  m, a mass of  $10^{-66}$  kg, and an average speed of  $3.5 \times 10^9$  m/s (approximately 10 times the speed of light). There are  $10^{85}$  gas particles per cubic meter which gives a gas mass density of  $10^{19}$  kg/m<sup>3</sup> and a mean free path of  $10^{-16}$  m.

The most fundamental organization of these gaseous particles is a neutrino which translates at a speed equal to the background root mean square speed  $v_r$  less the mean speed  $v_m$ . Thus, the speed of light “ $c$ ” equals  $v_r - v_m$ . Neutrinos are formed from the background with right-hand and left-hand angular momentum (about the translational

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axis) and in a spectrum of masses. Neutrinos are formed by the local complete condensation of the background gas and they occur in a large spectrum of mass which is all in the condensed core of the neutrino. The condensation produces a large thrust force which propels the neutrino through the background gas. The thrust force depends only upon the background properties and is independent of the neutrino mass. A proton is formed when a neutrino having a mass (i.e., energy divided by  $c^2$ ) equal to the proton mass is knocked into a circular orbit by another massive neutrino. Only one neutrino mass will balance the centrifugal force with the thrust force and produce the angular momentum which the neutrino had in its translational path. That mass is the mass of the proton. The electron is formed concomitantly with the proton and, like the proton, it consists of one neutrino. Thus, a hydrogen atom is formed by knocking one neutrino (having the mass of a proton) into a circular orbit.

Hydrogen atoms are continually formed by the process outlined in the above paragraph. Some, of course, are destroyed by the same process. In any case, there is a large number of hydrogen atoms populating the entire universe and new ones are continually made.

A hydrogen atom has a gravitational field which extends  $10^{26}$  meters in all directions. Due to this attractive force, and due to the random distribution of hydrogen atoms, the atoms begin congregating. This accumulation of hydrogen atoms continues until a hydrogen gas star is formed. As a star continues to grow it eventually reaches a mass large enough to produce atoms more massive than hydrogen. A possible method for producing a neutron is to have a strong gravitational field. If this field is strong enough to produce a force great enough to balance the electron centrifugal force in a hydrogen atom then it is assumed that a neutron can be formed. The energy required in this process of producing a neutron is larger than the energy of fusion. Thus, larger atoms are made when the neutrons are made. The required size of a star so that the gravitational force on a hydrogen atom can cause fusion is now determined. The two forces are

$$F_g = \frac{GMm_e}{R^2} \quad (1) \qquad F_c = \frac{m_e(\alpha c)^2}{r_b} \quad (2)$$

where  $F_g$  is the gravitational force between the star of mass  $M$  and the electron of mass  $m_e$ ,  $G$  is the gravitational constant equal to  $6.7 \times 10^{-11} \text{ m}^3/(\text{kg} \cdot \text{s}^2)$ , and  $R$  is the separation distance (the star radius). Further, the centrifugal force is  $F_c$ ,  $\alpha$  is the fine structure constant (1/137),  $c$  is the speed of light  $3.00 \times 10^8 \text{ m/s}$ , and  $r_b$  is the Bohr radius  $5.29 \times 10^{-11} \text{ m}$ . Equating the two forces and solving for  $M/R^2$  gives

$$M/R^2 = (\alpha c)^2/(r_b G) = [3 \times 10^8/137]^2/[5.29 \times 6.7 \times 10^{-22}] = 1.35 \times 10^{33} \quad (3)$$

Using

$$M = \rho V = \rho (4/3) \pi R^3, \quad (4)$$

we have

$$\frac{M}{R^2} = \frac{4}{3}\pi R\rho = 1.35 \times 10^{33} \quad (5)$$

If we approximate  $\rho$  with the density of tightly packed hydrogen atoms then the star density is given by  $\rho = \frac{1.67 \times 10^{-27}}{(4\pi/3)(5.29 \times 10^{-11})^3} = 2690 \text{ kg/m}^3$ . We now obtain the star radius (denoting now the fusion radius as  $R_f$ )

$$R_f = \frac{1.35 \times 10^{33} \times 3}{4\pi \times 2690} = 1.20 \times 10^{29} \text{ m} \quad (6)$$

Clearly a star could not produce fusion by means of its gravitational field acting upon a hydrogen atom at rest. However let us now determine the star mass required to accelerate a hydrogen atom located at a large distance to an impact energy equal to the orbital energy of an electron. We then will assume that energy approximates the energy required to produce a neutron or, more generally, fusion. The gravitational work to take a hydrogen atom from “infinity” to the star is

$$W = \int_{\infty}^R \frac{GMm_h}{R^2} dR = \frac{GMm_h}{R} \quad (7)$$

where  $m_h$  is the hydrogen mass. The orbital energy of the electron in a hydrogen atom at rest is

$$E = \frac{1}{2} m_h (\alpha c)^2 \quad (8)$$

Using the star mass as

$$M = \frac{4\pi}{3} \rho R^3 \quad (9)$$

and equating the work to the energy gives the star radius for fusion as

$$R_f = \sqrt{\frac{3\pi}{8}} \frac{\alpha c}{\sqrt{G\rho}} = \sqrt{\frac{3\pi}{8}} \frac{3 \times 10^8}{137 \sqrt{6.67 \times 10^{-11} \times 2690}} = 5.61 \times 10^6 \approx 10^7 \text{ m} \quad (10)$$

The radius of the sun is  $1.6 \times 10^9 \text{ m}$ , a hundred times larger than this. Fusion, of course, continually occurs in the sun.

As a hydrogen star having a radius of  $10^7$  m continues to grow by collecting hydrogen atoms with its gravitational field it will eventually become a star of neutrons only, i.e. a neutron star. The maximum size of a neutron star occurs when the gravitational force on a neutron is large enough to collapse the proton structure in neutrons. Equating the gravitational force to the centrifugal force of the proton neutrino we have

$$F_g = \frac{GMm_p}{R^2} \quad (11) \quad F_c = \frac{m_p c^2}{r_p} \quad (12)$$

where  $m_p$  is the proton mass and  $r_p$  is the proton orbital radius,  $10^{-16}$  m (see[1]). Equating and solving for  $M/R^2$  gives

$$\frac{M}{R^2} = \frac{c^2}{Gr_p} = \frac{(3 \times 10^8)^2}{6.7 \times 10^{-11} \times 10^{-16}} = 1.3 \times 10^{43} = \frac{4}{3} \pi R \rho \quad (13)$$

For the density of this star we use the density of a proton

$$\rho = 1.7 \times 10^{-27} / \left( \frac{4\pi}{3} \times 10^{-16} \right)^3 = 2.3 \times 10^{19} \text{ kg/m}^3 \quad (14)$$

The radius of this type star then is (now denoting this radius by  $R_n$ )

$$R_n = \frac{1.3 \times 10^{43} \times 3}{4\pi \times 2.3 \times 10^{19}} = 1.3 \times 10^{23} \text{ m} \quad (15)$$

This is the maximum radius of a neutron star. (This is 16 orders of magnitude larger than the smallest hydrogen star that will produce fusion. This radius is 1/1000 of the radius of the observable universe, i.e. the human cosmos.)

As the critical neutron star radius continues to increase (again from collecting hydrogen atoms from space by the mechanism of its gravitational field) and grows beyond  $R_n$  ( $10^{23}$  m). The neutrinos' orbital paths in the protons will collapse and the neutron star will explode. All kinds of matter will be thrown out.

A small chunk of debris could be an earth-size mass of pure neutrons. Such a body as this would soon grow into a small star as a result of the neutron disintegrations but much of the mass would be retained in the form of the complete spectrum of atoms. The star would begin cooling and eventually become a "cool" planet, such as the earth. Larger chunks of the debris could form hydrogen stars with the characteristics of hydrogen stars formed by gravitationally collecting free hydrogen atoms. Very large chunks of the debris could be dark matter which is believed to populate our universe. It appears that such dark matter of "small" size (much smaller than  $10^{23}$  m radius) could only come from the disintegration of the larger neutron stars.

The explosion of such a large mass would populate the human cosmos and many other human cosmos-sized volumes throughout the universe adjacent to the human cosmos. Furthermore, such a massive gravitational mass as a  $10^{23}$  m radius neutron star would collect all the matter within the reach of that stars gravitational field (i.e. a distance of some  $10^{26}$  meters). It can thus be concluded that all the large hunks of mass that we observe probably came from this one explosion. This then gives us a method for estimating when the observable universe was formed.

First is must be recognized that in the massive ( $10^{23}$  m radius) neutron star that the highest energy isotopes of an atom would prevail and that atom transmutations from lower energy to higher energy also would prevail. For example potassium 40 ( $^{40}\text{K}$ ) would prevail over argon 40 ( $^{40}\text{Ar}$ ). Next, the very short-lived fission transmutations would practically all be completed long before now, i.e. since the explosion  $10^{10}$  years ago. Thus, we can use long-lived transmutation to estimate the time of the explosion.

We now consider a sample of matter and measure the amounts of  $^{40}\text{K}$  and  $^{40}\text{Ar}$  and find the ratio of  $^{40}\text{Ar}$  to  $^{40}\text{K}$  is 10.3. The half-life for  $^{40}\text{K}$  is  $1.25 \times 10^9$  y. The number of  $^{40}\text{K}$  atoms " $N_K$ " at any point in time " $t$ " is given by

$$N_K = N_{K_0} e^{-\lambda t} \quad (16)$$

where  $\lambda$  is the disintegration constant ( $\lambda N = -dN/dt$ ). The number of argon atoms  $N_{Ar}$  is

$$N_{Ar} = N_{K_0} - N_K. \quad (17)$$

Eliminating  $N_{K_0}$  by combining the two equations and solving for  $t$  gives

$$t = \frac{1}{\lambda} \ln \left( \frac{N_{Ar}}{N_K} + 1 \right) \quad (18)$$

We need to determine  $\lambda$  in terms of the half-life. Let  $R$  be the decay rate

$$R = -\frac{dN}{dt} = \lambda N_{K_0} e^{-\lambda t} \quad (19)$$

or, the decay rate at any time is given in terms of the initial decay rate  $R_0$  as

$$R = R_0 e^{-\lambda t} \quad (20)$$

Since if we let  $t$  be zero in (4) we have

$$R_0 = \lambda N_{K_0} \quad (21)$$

Let  $\tau$  be the half-life, which is the time when both  $N$  and  $R$  are reduced to half their initial values, then from (20)

$$\frac{1}{2}R_o = R_o e^{-\lambda\tau} \quad (22)$$

or

$$\tau = \frac{\ln 2}{\lambda} \quad (23)$$

or

$$\lambda = \frac{\ln 2}{\tau} \quad (24)$$

We can now solve (18) for the time at which the explosion occurred by using the measured value of the number of  $^{40}\text{Ar}$  atoms per  $^{40}\text{K}$  atoms as 10.3 and the half-life as  $1.25 \times 10^9$  y.

$$t = \frac{1}{\lambda} \ln \left( \frac{N_{\text{Ar}}}{N_{\text{K}}} + 1 \right) = \frac{\tau}{\ln 2} \ln(10.3 + 1) = \frac{1.25 \times 10^9}{\ln 2} \ln(11.3) = 4.37 \times 10^9 \text{ years} \quad (25)$$

Which agrees with other computations of the origin of ordinary matter in the human cosmos.

The cosmological theory presented here seems to offer a reasonable explanation of how stars and planets are formed. The theory should be evaluated in comparison with other cosmological theories.

#### Reference

1. *The Grand Unified Theory of Physics* by Joseph M. Brown. ISBN 097129446-1  
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