Age Of The Universe Essay, Research Paper

The Age of the Universe

INTRODUCTION:

The goal of the project is to find the age of the universe according to the theory

that there were equal amounts of the two uranium isotopes U235 and U238 at

the time of the Big Bang. At present, there are 137.7 U238 atoms for each atom

of U235. We know that the half-life of U235 is 0.71 billion years, and the

half-life of U238 is 4.51 billion years, we used this information to determine the

age of the universe. We started by looking at the problem mathematically and

then after figuring out the age of the universe with the above information. We

proceeded to look for other sources of information about the age of the universe

with supporting data. The two largest sources that were found were a Seattle

University professor and a theory proposed by Edwin Hubble.

CALCULATIONS

Using the information above, we

Y238(t) = Y238(0)ekt = No ekt Where No ekt is initial amount presumed equal

for both isotopes.

Y238(0) is the amount at Big Bang.

Using the half-life formula of k = -ln2/T1. Where T1 is 4.51 in billion of years.

Y235(t) = Y235(0)ekt = No ekt

Y235(0) is the amount at Big Bang.

Using the half-life formula of k2 = -ln2/T2. Where T2 is 0.71 in billions of years.

Given these equations, they hypothesis of the problem is states that

Y235(tnow) 1

Y238(tnow) = 137.7

Y238(tnow)

Y235(tnow) = 137.7

So Y238(tnow) = Y238(0) ekt = No ek2tnow = etnow(k2-K1) = 137.7

Y235(tnow) Y235(0) ekt Noek1tnow

Given that tnow cancels out for both U235 and U238 we are left with the

equation of:

tnow ( -ln2 + -ln2) = 137.7

4.51 0.71

tnow ( .82257) = ln(137.7)

tnow (.82257) = 4.92508

solving for tnow:

tnow = 5.987 billion years.

So this theory estimates the age of the universe to roughly 6 billion years old.

COUNTERING THEORIES:

HUBBLE THEORY

In 1929, Edwin Hubble decided that because the light coming from most galaxies

was redshifted.

(The apparent change in wavelength of sound or light caused by the motion of

the source, observer or both. Waves emitted by a moving object as received by

an observer will be blueshifted (compressed) if approaching, redshifted

(elongated) if receding. It occurs both in sound and light. How much the

frequency changes depend on how fast the object is moving toward or away

from the receiver.)

Hubble concluded that the universe must be expanding after exploding from an

infinitesimal volume of super hot, super dense concentration of matter and

energy. The explosion is called the big bang, which propelled matter in all

directions and at all speeds. According to the big bang theory, the farther away

an object is from us, the more redshifted its light. Also, a greater redshift means

the object is moving away faster than objects with less redshift. In Designs and

Origins in Astronomy, Mulfinger explains the redshift technique for measuring

distances to distant galaxies. If the universe is not expanding, this cannot be true

and the redshift must be due to other causes. An astronomer can tell how old the

universe is by the rate of expansion. Cowen in 1994, clarifies that if the redshift is

due to something other than expansion, nothing can be said about the universe’s

age.

As we shall discuss further in connection with the big bang, there is strong

evidence that the Universe has not always existed, but instead came into being a

finite amount of time ago. There are several measures of the age of the Universe.

Let us discuss two: (1) the age of globular clusters and (2) the inverse of the

Hubble constant.

Globular Clusters

As a counter to the mathematical theory, globular clusters provide a measure of

the age of the cluster. A cluster is a system of galaxies containing from a few to a

few thousand-member galaxies, which are all gravitationally bound to each other.

Thus, the age of such clusters place a limit on the age of the Universe, for it must

be at least as old as the objects that it contains. Such estimates typically yield

ages in the range 14-18 billion years

Hubble Time

The inverse of the Hubble constant H has the units of time because the Hubble

law is

v = H d

where v is the velocity of recession, H is the Hubble constant, and d is the

distance. Thus, from this equation, we have that 1/H = d/v. but d/v is distance

divided by velocity, which is time (e.g., if I travel 180 miles at 60 miles/hour, the

time required is t = d/v = 180/60 = 3 hours).

Thus, the Hubble time T is just the inverse of the Hubble Constant:

T = 1 / H

Taking a value of H = 20 km/s/Mly (where Mly means mega-light years), where

all the factors are necessary to convert the time units to years (Cowen, 1994).

The physical interpretation of the Hubble time is that it gives the time for the

Universe to run backwards to the Big Bang if the expansion rate (the Hubble

“constant”) were constant. Thus, it is a measure of the age of the Universe. The

Hubble “constant” actually isn’t constant, so the Hubble time is really only a rough

estimate of the age of the Universe.

Reasonable assumptions for the value of the Hubble constant and the expansion

of the Universe typically yield ages of 10-20 billion years for the age of the

Universe. For example, H near 50 km/s/Mpc gives a larger value for the age of

the Universe (around 16 thousand million years), while a larger value of 80

m/s/Mpc gives a lower value for the age (around 10 thousand million years).

Therefore, we shall take this information, and additional information from other

methods to estimate the age of the Universe that we have not discussed, to

indicate an age of approximately 15 billion years for the Universe.

ASSUMPTIONS:

With the large difference in the time of the 3 different formulas, we are assuming

that at the time of the big bang there were equal amounts of U238 and U235.

Through the natural rate of decay, we are taking the assumption that there was

no immigration of any U235 or U238 into the universe that was not there are the

time of the big bang.

With the possible addition or subtraction of U235 and U238 through a

supernova, this could possibly skew the ratios of U235 and U238 today. David

Thorsell of Seattle University states that assuming that at the time of the big bang

there were equal amounts of U235 and U238 is a very large leap of faith and

that the case is probably not true. Also he states that two isotopes radioactivity

differ from each other due to the difference in their nuclei. Thorsell explains that

the sample of the isotopes have only been taken from earth, which is not a true

representation of the rest of the universe.

The Fate of the Universe

The Universe is currently expanding. One extremely important cosmological

question is whether this expansion will continue forever. As time will tell, this is a

question that does not yet have a definitive answer. Ultimately, this will turn out

to be a question of how much mass is contained in the Universe (Cowen, 1995).

If it is below a critical amount, the Universe will expand forever. If it is above the

critical amount, the expansion will eventually reverse and the Universe will

collapse on itself, leading to what has been termed the big crunch. If it is exactly

equal to the critical amount, the expansion will slow, but will only stop after an

infinite amount of time. Thus, in this case the Universe will expand forever too.

Is the Universe Really That Old?

Many creationists believe that the universe was, well created and that the

universe is only roughly a few thousand years old. They use the following facts to

discredit the notion of an old universe.

“Our sun is gradually shrinking at a steady rate. It is occurring fast enough that, as

little as 50,000 years ago, the sun would have been so large that our oceans

would boil. In far less time in the past (25,000 years or so), all life on earth

would have ceased to exist”. “Computer simulations of the motions of spiral

galaxies show them to be highly unstable; they should completely change their

shape in only a small fraction of the assumed evolutionary age of the universe.

The simplest explanation for the existence of so many spiral galaxies, including

our own Milky Way Galaxy, is that they and the universe are much younger than

has been assumed.”

It seems as though there is scientific data everywhere to prove and disprove any

theory. One theory that I would like to ponder is the “Big Bang”; the foundation

of the “Big Bang” is that nothing imploded from nothing and the outcome was the

universe. Scientist would have to believe this as truth and accept nothing else or

try to prove something different. It resembles believing in God, people are

convinced that God is God and he came from nothing he just was and always

will be. Scientist state that the universe came from nothing and it will forever be

expanding. One question I ask is why, why does the universe expand forever,

and if it came from nothing what is it expanding in? When it expands does it

consume nothing and create something; will the answers/theories ever be

answered? Someday all will be known, however I am sure we will be resting in

our grave when that day comes.

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