

In the Beginning

A meditation on the 'New Story'
offered for the Earth Day Service by
Ralph Maust

at

Sayville Congregational United Church of Christ
Sunday, April 26, 1997

In the beginning, about 13.8 billion years ago, the Universe flared forth with unimaginable power, the pure Energy of Creation. Within seconds some of that energy was transformed into **all** the matter that would ever be. So **all** matter, all stars, all planets, the Earth, the seas, the oak of the pews and you and me, all matter is a form of the Energy of Creation, the first light of the Universe.

But in those first moments of Creation, the Universe was too hot for matter, as we know it, to exist, too hot for planets or people or pineapples, too hot for molecules, even too hot for stars. Too hot even for atoms to exist. But from the beginning, from the first moment of creation, the potential for all these things existed! And, in the fullness of time, each would be created, atoms and stars, planets, pineapples and people.

Now this is the way it happened. After about three hundred thousand years, the Universe cooled enough for atoms to form from the myriad of tiny particles that had been forged out of the Energy of Creation. And when this happened, light was set free from the blinding fires of Creation and could radiate freely throughout the Universe. Were we there to see it, **all** of the Universe would shimmer with a warm rosy glow, a harbinger of sunrises to come; though it was still too hot for galaxies or stars or planets, people or pineapples.

But finally, after a hundred million years or so, the Universe cooled enough for galaxies and stars to congeal from the atoms that had previously formed. But those atoms were only hydrogen and helium, the two lightest and simplest kinds of atoms. There were no heavier elements. No carbon atoms for making coal or cookies. No silicon atoms for making jelly jars of computer chips. No sodium atoms for sea salt or street lamps. But the **potential** for all these existed from the beginning, and in time they would all be fulfilled. But now I want to tell you about **how** the heavier elements were born. They were born in the hearts of stars!

Stars are **huge** spheres of hydrogen and helium. The Sun is a star and it is **so** huge that a million Earths could fit inside it. In the hearts of stars, hydrogen

and helium are fused into heavier elements; every carbon atom of our bodies, every calcium atom in our bones, every nitrogen and oxygen atom in the air we breathe in and sing out as hymns. The fluorine atoms in our toothpaste, the neon atoms in an advertising sign, the iron atoms in the hemoglobin in our blood; **all** were fused into existence in the heart of a star. In addition, as stars fuse heavier elements, they convert some of their matter **back** into the energy of Creation. And it is this energy of Creation which we see shining forth from the stars as they twinkle in the night or blazing from our 'day-star', the Sun. But **how** did these elements get from the heart of a star into you and me or to make a tree from which to build a church or make a book?

It happened in this way. When massive stars die, they die explosive deaths, bursting forth with unimaginable energy, scattering the elements they had fused during their lives and forging, with the violence of their deaths, the heaviest elements, (silver, nickel, platinum, gold) blasting them all back into the galaxy, into the space between the stars, into the space where new stars form.

And so it was that, some five **billion** years ago, just such a massive star died in the outskirts of our Milky Way galaxy. And from the debris of its death was resurrected a new star and planets. A star which some future inhabitants of its third planet would one day name "the Sun". So here we are, the stuff of stars contemplating stars, the resurrected body of a by-gone sun.

And what is the energy that we run on? None other than the liberated Light of Creation; liberated by the fusion of matter, in the heart of the sun, **back** to its original form, the Energy of Creation, which was captured by green plants which became our food.

And so we know that there is but one light in the Universe, whether the light of the chancel candles, or the light streaming through the stained glass face of the Good Shepherd behind you, or the light of our minds as we contemplate this awesome story. There is only **one** light, one energy, in the Universe, the liberated Light of Creation!

It is so

In the Beginning

In the beginning, some 13.8 billion years ago, the Universe flared forth¹ from a state of infinite temperature, infinite compactness and infinite simplicity, as the Pure Energy of Creation. Within a tiny fraction of a second the 'rules of the game' (the Laws of Nature; gravity, the strong and weak nuclear forces and electromagnetism) were established that would shepherd the evolution of the Universe's scale, complexity and diversity from then on. And then, within a few seconds, *all the matter that would ever be was forged from that Energy of Creation*¹ (read that italicized part slowly again three times). That is **all** the matter that would eventually make **all** the galaxies, **all** the stars, **all** the planets and **all** the people and **all** of everything else, was transformed from the Energy of Creation in the first moments of time. It was still too hot for any of these creations to evolve, but the **potential** for all things to be (including you) has existed from the beginning of time.

High temperature implies simplicity. The matter that emerged was in the simplest of forms, protons, neutrons, and electrons, all the particles that are needed to make atoms, but they were still too hot to 'stick together' electromagnetically to form atoms as we know them today. For the next few minutes the entire universe (though rapidly cooling) was still as hot as the **core** of a star. And, as such, was able to do the things that the cores of stars do today, that is to fuse some of the protons and neutrons into helium nuclei. But by the end of about three minutes, the universe had cooled enough that it could no longer forge any additional elements and so element building came to an end ('temporarily'). After this brief frenzy of creativity, the 'stuff' of the Universe was left with only about 10% of it having been fused into helium nuclei (along with weensy amounts of lithium). Essentially all the rest remained as un-fused protons (Hydrogen nuclei).

Now our bodies and essentially all other earthly living beings are about 80% water and as we know, each water molecule (H₂O) is made of two atoms of Hydrogen and one atom of Oxygen. So we are all made up of at least 63% Hydrogen atoms and 24% Oxygen atoms. But the important 'take away' from this is that every one of those Hydrogen atoms is essentially unchanged from the beginning of time when they were all forged from the Energy of Creation. So most of what we all are made of is the transformed Energy of Creation dating from the beginning of time some 13.8 billion years ago.

Though **most** of what we are made of is Hydrogen, there are a lot of other elements utilized by earthly life; Carbon, Oxygen, Nitrogen, Calcium, Sodium, Sulfur, Phosphorous and Iron, to name a few, as well as a bunch of heavier elements that make life interesting such as Silver and Gold, Zinc and Copper, Tin and Lead, Iodine and Uranium. The story of how **these** elements came into being is just as amazing as the forging of hydrogen out of the Energy of Creation. But first we need to pick up the story back near the beginning of time.

After a few minutes the universe had cooled enough (below about 10 million degrees) that it could no longer create heavier elements. But it was still very hot and the bits and pieces of what one day would be atoms were whizzing around at very high speeds, unable to settle down into the forms of atoms that we know today, but the potential to do this existed from The Beginning. Had there been eyes to see it then, the entire Universe would have been shining as bright as a star. Matter was still so compacted that it would have been like being in a super dense but super bright white hot fog, one in which you couldn't see your hand in front of your face yet a fog glowing as bright as a star.

1. This great flaring forth (often called the Big Bang) happened **everywhere** in the universe but that 'everywhere' was at the time, a very small space, teenier than the nucleus of an atom. So if anyone asks you **where** the Universe was born, you can answer, correctly, "Right here," and you'll be right no matter where you are.

2: Most folks know that Einstein's famous $E=mc^2$ formula has something to do with changing matter into energy, but they are perhaps vague on just how much energy this implies. It's about a hundred billion units of energy from **one** unit of matter. Further, they may not know that the formula works both ways. In fact Einstein originally wrote it $m=E/c^2$ implying that a tiny amount of matter could be made from an **enormous** amount of energy. (That's **25 million kilowatt hours** of energy to make just **1 gram** of matter.) Imagine if you can the energy equivalent of all the matter of **everything** that makes up the entire universe and that will give you a feel for the power of the Energy of Creation!

The Universe continued to expand, cool and thin out and in so doing, the 'fog' faded from white hot to yellow to orange to red. And by about 380,000 thousand years after The Beginning, had cooled enough for electrons to slow down to the point where they could 'stick to' the nuclei and form atoms as we know them today. This also resulted in the 'fog' 'lifting' and light and sight were now, for the first time, able to travel long distances through the Universe. Today as we look deeply into space and deeply back in time, the time of the 'lifting of the fog' is the farthest (earliest) we can see. The expansion of the Universe has by now stretched those first free-traveling light waves so much that we don't perceive them as 'light' waves anymore but rather as microwaves which are invisible to our eyes. Fortunately most of us have several "microwave receivers" around the house (we call them television sets). To use a TV receiver to detect some of that first light to freely move through the Universe, disconnect the cable from the cable box that runs to the TV set. When you turn the TV on you will get a screen full of 'snow'. Now most of that 'snow' is just from locally generated microwave static that your TV receiver picks up and displays as 'flecks of snow' on the screen. **But**, about 1% of those flecks, were generated by waves that have been traveling through space since almost the beginning of time, the light of the Energy of Creation.

The glow of the light of the Energy of Creation gradually faded into darkness. But in this 'Dark Age' gravity was able to begin clumping up matter into the huge masses that would one day become galaxies and within those huge masses, smaller masses were congealing into what would become the first stars. Stars, then as now, are as hot in their cores as the entire universe was during the first few minutes of Creation. And as such they are able to do the thing that the whole universe did then, which is to fuse lighter elements together to make heavier elements. But, unlike the early Universe, stars stay hot in their cores for **long** periods of time. And, as a result the more massive stars can fuse elements up to as heavy as iron (check a Periodic Table of Elements to see what that includes).

Stars don't live forever. The less massive ones like the Sun eventually die relatively quiet deaths. But, those more massive than about eight times the mass of the Sun, are destined to die a violent death called a supernova in which they latterly blow themselves to bits, blasting out into the space between stars, all the elements they have fused in their cores during their lives. Every atom of oxygen you breathe or carbon in your DNA or calcium in your bones or iron in the hemoglobin of your blood, was made in the core of a star and scattered back into space when the star died. In addition, the violence of a supernova explosion forges the elements heavier than iron; the gold in your jewelry, the silver in your fillings, the lead in your fish weights. Every atom of these was forged from the fiery supernova death of a massive star.

New stars are born from clouds of hydrogen gas that have been enriched with the heavy elements forged in dying stars. And so, over the billions of years of the existence of the Universe, stars, through their lives and deaths, have 'seeded' heavy elements into the clouds of gas that become new stars. And so it was that some five billion years ago, an unnamed massive star on the fringes of the Milky Way Galaxy, died just such a supernova death. And, some half a billion years later some of the body of that dead star was resurrected into a new star that the inhabitants of its third planet would one day call "The Sun".

Those beings that we call stars have the ability to transform some of their matter back into the Energy of Creation ($E = mc^2$) and radiate it out to places like Earth where it warms us and infuses itself into the food that 'fuels' us. So the energy that keeps your heart beating and the energy of your very thoughts as you read this, is the liberated Energy of Creation, transformation into matter at the beginning of time, freed in the core of our star, the Sun, stored in the molecules of the food we ate and now helping us to understand our connection as part of all Creation. And as we finish with this energy, it flows back into the great expanding Universe to continue its endless journey through space and time.

It is so