

An Ecology of Grace and Justice for Our Times
Organizing in the Bio-Commons for Lutherans

Assignments for Week One: January 27, 2012

1. Genesis 1-11 (in your Bible)
2. Small Catechism, Apostle's Creed, Article 1
3. Large Catechism, Apostle's Creed, Article 1
4. Excerpt from Journey of the Universe, by Brian Swimme and Mary Evelyn Tucker;
5. Excerpt from Evocations of Grace by Joseph Sittler
6. Excerpt from Quest for the Living God by Elizabeth Johnson
7. Article: "Is it Really Possible to Decouple GDP Growth from Energy Growth?" by Gail the Actuary, November 21, 2011
8. Article: "New School of Thought Brings Energy to 'the Dismal Science'" NY Times, October 23, 2009 by Nathaniel Gronewold
9. Excerpt: "Peak Everything" by Richard Heinberg
10. Excerpt: The Biosphere by Vladimir Vernadsky
11. Article: "Big Think" Interview with Elinor Ostrom
12. Article: "Elinor Ostrom's Nobel Prize in Economics" from Foundation for Economic Education, posted by Peter Boettke
13. Article: "The Crossing" October 15, 2009
14. Excerpt: The Great Work by Thomas Berry
15. Article: "The Liturgy of Abundance and the Myth of Scarcity" by Walter Brueggemann, The Christian Century, March 24-31, 1999.

The Small Catechism

Creed: The First Article. Of Creation.

I believe in God the Father Almighty, Maker of heaven and earth.

What does this mean?--Answer.

I believe that God has made me and all creatures; that He has given me my body and soul, eyes, ears, and all my limbs, my reason, and all my senses, and still preserves them; in addition thereto, clothing and shoes, meat and drink, house and homestead, wife and children, fields, cattle, and all my goods; that He provides me richly and daily with all that I need to support this body and life, protects me from all danger, and guards me and preserves me from all evil; and all this out of pure, fatherly, divine goodness and mercy, without any merit or worthiness in me; for all which I owe it to Him to thank, praise, serve, and obey Him. This is most certainly true.

The Large Catechism

Creed: Article I.

9] I believe in God the Father Almighty, Maker of heaven and earth.

10] This portrays and sets forth most briefly what is the essence, will, activity, and work of God the Father. For since the Ten Commandments have taught that we are to have not more than one God, the question might be asked, What kind of a person is God? What does He do? How can we praise, or portray and describe Him, that He may be known? Now, that is taught in this and in the following article, so that the Creed is nothing else than the answer and confession of Christians arranged with respect to the First Commandment. As if you were to ask a little child: 11] My dear, what sort of a God have you? What do you know of Him? he could say: This is my God: first, the Father, who has created heaven and earth; besides this only One I regard nothing else as God; for there is no one else who could create heaven and earth.

12] But for the learned, and those who are somewhat advanced [have acquired some Scriptural knowledge], these three articles may all be expanded and divided into as many parts as there are words. But now for young scholars let it suffice to indicate the most necessary points, namely, as we have said, that this article refers to the Creation: that we emphasize the words: Creator of heaven and earth. 13] But what is the force of this, or what do you mean by these words: I believe in God, the Father Almighty, Maker, etc.? Answer: This is what I mean and believe, that I am a creature of God; that is, that He has given and constantly preserves to me my body, soul, and life, members great and small, all my senses, reason, and understanding, and so on, food and drink, clothing and support, wife and children, domestics, house and home, etc. 14] Besides, He causes all creatures to serve for the uses and necessities of life sun, moon, and stars in the firmament, day and night, air, fire, water, earth, and whatever it bears and produces, birds and fishes beasts, grain, and all kinds of produce, 15] and whatever else there is of bodily and temporal goods, good government, peace, security. 16] Thus we learn from this article that none of us has of himself, nor can preserve, his life nor anything that is here enumerated or can be enumerated, however small and unimportant a thing it might be, for all is comprehended in the word Creator.

17] Moreover, we also confess that God the Father has not only given us all that we have and see before our eyes, but daily preserves and defends us against all evil and misfortune, averts all sorts of danger and calamity; and that He does all this out of pure love and goodness, without our merit, as a benevolent Father, who cares for us that no evil befall us. 18] But to speak more of this belongs in the other two parts of this article, where we say: Father Almighty.

19] Now, since all that we possess, and, moreover, whatever, in addition, is in heaven and upon the earth, is daily given, preserved, and kept for us by God, it is readily inferred and concluded that it is our duty to love, praise, and thank Him for it without ceasing, and, in short, to serve Him with all these things, as He demands and has enjoined in the Ten Commandments.

20] Here we could say much if we were to expatiate, how few there are that believe this article. For we all pass over it, hear it and say it, but neither see nor consider what the words teach us.

21] For if we believed it with the heart, we would also act accordingly, and not stalk about proudly, act defiantly, and boast as though we had life, riches, power, and honor, etc., of ourselves, so that others must fear and serve us, as is the practise of the wretched, perverse world, which is drowned in blindness, and abuses all the good things and gifts of God only for its own pride, avarice, lust, and luxury, and never once regards God, so as to thank Him or acknowledge Him as Lord and Creator.

22] Therefore, this article ought to humble and terrify us all, if we believed it. For we sin daily with eyes, ears, hands, body and soul, money and possessions, and with everything we have, especially those who even fight against the Word of God. Yet Christians have this advantage, that they acknowledge themselves in duty bound to serve God for all these things, and to be obedient to Him [which the world knows not how to do].

23] We ought, therefore, daily to practise this article, impress it upon our mind, and to remember it in all that meets our eyes, and in all good that falls to our lot, and wherever we escape from calamity or danger, that it is God who gives and does all these things, that therein we sense and see His Paternal heart and his transcendent love toward us. Thereby the heart would be warmed and kindled to be thankful, and to employ all such good things to the honor and praise of God.

24] Thus we have most briefly presented the meaning of this article, as much as is at first necessary for the most simple to learn, both as to what we have and receive from God, and what we owe in return, which is a most excellent knowledge, but a far greater treasure. For here we see how the Father has given Himself to us, together with all creatures, and has most richly provided for us in this life, besides that He has overwhelmed us with unspeakable, eternal treasures by His Son and the Holy Ghost, as we shall hear.

Journey of the Universe



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Galaxies Forming



How are we to understand the beauty of the universe? We are surrounded by beauty. What brought it into being? Where does the intricacy of a dragonfly or a lilac come from?

Let's consider the birth and development of galaxies. Even a century ago we knew only about one galaxy in the entire universe: our own Milky Way. Over the course of the twentieth century we discovered nearly a hundred billion galaxies. Each of these contains several billion stars. What does this mean for understanding our place amidst such vastness?

We are only now entering into an ongoing reflection regard-

ing the origin of galaxies. Scientists have made several crucial discoveries. When the universe was almost half a million years old, it was like a vast cumulus cloud billowing out. We can imagine a scenario where this cloud, composed of both luminous and dark matter, just keeps expanding forever, but in the actual universe this cloud instead broke into numerous, smaller clouds. Each of these clouds pulled itself out of the cosmic expansion of the universe and collapsed into a single galaxy or a cluster of galaxies. Thus each jelled and remained the same size while the distances between the clouds continued to increase. As a result, each cloud could start on its own unique journey.

We can see here something of the nature of creativity in the universe. To enter its own creative development, a dynamic system will sometimes pull itself away from its larger enveloping network. As long as a system is tightly held within a larger system, it is dominated. But as it becomes free its intrinsic potentialities come forth and are amplified so that something new can enter into existence.

A further insight into the creativity of the universe follows from this question: What caused the fracture of the initial cloud into all these smaller clouds? For the power that breaks up this cloud is the power that sets the universe in a new direction. This power is responsible, in a primordial sense, for the advent of the galaxies.

Scientists have discovered that a series of waves passing through the universe were responsible for fragmenting the initial cloud. And the origin of these waves? This is the biggest surprise. These waves had their origin in the birth of the universe itself. In the initial flaring forth the universe was pervaded with waves. These waves, which are fluctuations in the density of matter, grew as the universe expanded. Eventually they broke the universe apart so that galaxies might form.¹

We know now that the galaxies emerged from the primordial vibrations in the birth of the universe. These vibrations in matter certainly had a special power of creativity. Perhaps we can regard them as a kind of music, a "music of the spheres."

Pythagoras, who laid the foundations for mathematical science twenty-six centuries ago, would certainly be delighted, for his intellectual heirs have discovered that the billions of galaxies were formed by a cosmic music that moved the universe into the next phase of its journey.

GALAXY CLUSTERS AND A MULTICENTRIC UNIVERSE

How can we orient ourselves within this cosmic music, amidst the vast structures of the universe?

Each culture has had its own particular understanding of the universe, enabling its members to orient themselves with respect

to space and time. One of the most fundamental orientations for humans concerns the center of things. Again and again, we have asked ourselves, where is the heart of the universe?

Each culture has its own answer regarding the center. Some locate it on a special mountain such as Mount Kailasa in Tibet or Mount Kilimanjaro in Africa. Others designate a particular city, such as Jerusalem, Rome, or Mecca in the West, and Beijing, Varanasi, or Jogjakarta in Asia. Such cities become places of religious pilgrimage or seats of political power.

We can easily appreciate how significant such cities are for humans. To be related to the center is to receive a special value. For instance, citizens of the city at the center of the world enjoy a status not readily extended to someone from the periphery. And certainly any laws or decrees issuing from the center carry a special authority.

The five-hundred-year enterprise of modern Western science has also been concerned with identifying the center of the universe, and this effort has led to a series of "de-centerings." We have learned that our former ideas concerning the center were not the full story. Perhaps the most famous contribution to de-centering the human world was when we discovered that the Earth was not the unmoving center of things, but was rather in motion around the Sun. This was first conjectured by Aristarchus in the third century BCE on the island of Samos in Greece, and later was independently discovered in Europe by Copernicus in 1543. Within a few centuries, our ongoing

investigation led to the realization that although the Sun, indeed, was the center of the solar system, it was not the center of the universe. In 1918 Harlow Shapley provided evidence indicating that the Sun was moving in a great ellipse around the center of the Milky Way galaxy. This de-centering process was carried still further when Edwin Hubble and others, in the 1920s, discovered that the Milky Way was not the central galaxy of the universe. Rather, our Milky Way is just one galaxy in a universe filled with galaxies.

When scientists discovered that the observable universe contains a hundred billion galaxies, they were stunned. For scientists and nonscientists alike, absorbing the significance of living within such a vast, evolving universe is an ongoing challenge.

A surprising development in the second half of the twentieth century has led to an entirely new understanding of center. This understanding goes against common sense and is a challenge to absorb fully. For what we have come to realize is that there is not one center, but millions. Each supercluster of galaxies is at the very center of the expansion of the universe. We live in a multicentered universe and are only now awakening to this new discovery.

For instance, our Milky Way galaxy is one of a several dozen galaxies revolving around each other. This system as a whole is moving around the Virgo Cluster of galaxies. There are also other groups revolving about the Virgo Cluster, and this entire system is called the Virgo Supercluster. We can picture this as something like planets swirling about a central star, where the planets are the

individual galaxy clusters and the central star is the massive Virgo Cluster. What we have learned is that this Virgo Supercluster is at the very center of the cosmic expansion.

What is striking and counterintuitive is that the other superclusters throughout the universe are also at the center of the cosmic expansion. To visualize this, picture the universe as a loaf of raisin bread rising, where each raisin is a supercluster of galaxies. As the loaf grows larger, and we imagine ourselves on one of the raisins, we would see all the other raisins moving away from us. We would also conclude that we were not moving because we would not be moving through the bread. It would not matter which raisin we chose. Such is the nature of the large-scale universe. In terms of the expansion, each supercluster is stationary, while all the other superclusters are expanding away from it.

This staggering new perspective is causing a massive shift in our understanding of how we imagine our own place, our home. We realize now that we dwell in one center in a universe that is composed of millions of such centers. While this is difficult to comprehend, we are learning, nonetheless, to orient ourselves with wonder and awe in the midst of these immensities.

SPIRAL GALAXIES AND THE BIRTH OF STARS

What is the nature of our center? Is it a good place? A safe place? Such questions press into our awareness no matter where we live

on Earth. But what if we ask the questions not of our neighborhoods, or of our nation or our planet, but rather of the Milky Way galaxy?

The most powerful feature of our galaxy is its spiral structure. When scientists first detected the spiral arms they concluded that they were formed of matter and that they were spinning about the center of the galaxy. But this proved to be a mistaken theory. By correcting their mistake scientists learned one of the most astonishing features of creativity in the universe.

An arm of the Milky Way is not a static structure. It is rather an effect of huge gravitational waves, called density waves, that are pulsing through the Milky Way. In every spiral galaxy, the density waves cause the collapse of gas clouds into massive stars that burn brilliantly for a million years and then explode or die out. As this happens the wave passes farther on and ignites the formation of a new set of stars, giving the overall impression of something like a spinning pinwheel.

This spiral structure of a galaxy enables it to continue creating stars. It is in this sense always new, always capable of fresh, creative action. Thus, by virtue of their architecture, spiral galaxies are the birthing galaxies in the universe.

Elliptical galaxies, which have roughly the shape of an egg, do not have this creative capacity. Most of the stars that exist in an elliptical galaxy are doomed to die out without being replaced. Ellipticals lack the architectural form necessary for creating new stars.

The fascinating discovery is that the creativity of the universe is not evenly distributed but is concentrated in particular places. At the level of galaxies, creativity is concentrated in the spirals. But within a spiral galaxy there are particular places where creativity is more intense than in other places. And within these places there are particular regions where the intensity reaches its maximum. To find oneself in the midst of a nested domain of creativity is to move into the depths of creativity itself. To be outside the locus of creativity would be a kind of exile.

We awaken to existence and discover ourselves in the inner circles of creativity. Held by the embrace of a spiral galaxy, we enter into a multilayered and seemingly infinite fecundity.

GALACTIC RELATIONSHIP AND MUTUAL EVOCATION

The galaxies themselves come forth amidst immense creativity. The dynamics of the universe ignite creativity in new forms whenever possible. This occurs through processes that can be described as mutual evocation.

One galaxy that makes this drama clear is a satellite to the Milky Way called the Large Magellanic Cloud, or LMC for short. Though our knowledge of its history is far from settled, some astronomers speculate that LMC began as a spiral galaxy, but some cataclysm took place billions of years ago and its spiral structure was destroyed. Perhaps this occurred in a head-on colli-

sion with another galaxy. Or perhaps LMC passed by a larger galaxy whose gravitational attraction was too much to bear and tore its large-scale structure apart. Whatever the trauma was, it led to a collapse of its ability to create stars. Thus was LMC stripped of the promise it had when it came forth as a young galaxy. LMC was abandoned. It drifted about, each star's death just another step toward the final darkness that now awaited it.

But then something happened. After billions of years, LMC was drawn into a gravitational relationship with our Milky Way galaxy. LMC began a new orbit that would lead to a new destiny. In a gravitational relationship each member is changed by the interaction. The gravitational tidal force issuing from the Milky Way penetrated into the system of stars that formed LMC, and the structure of this smaller galaxy began to change. A regeneration of LMC was occurring in the presence of the Milky Way.

And then an awakening occurred. A burst of star-making activity appeared in one of the dormant regions of LMC. For billions of years LMC had drifted about, barren and dying. Now, suddenly, its potentiality was ignited through this interaction and new stars were evoked into being in all their brilliance.

The Emanating Brilliance of Stars



Why are we so fascinated by the stars? Some of our ancestors thought stars were gods. Still others thought the stars were angels pouring forth virtue upon the Earth. Contemporary scientists refer to stars as giant balls of gas.

The need to orient ourselves with respect to the stars continues, but the way that twenty-first century humans approach this challenge includes a growing base of knowledge about the stars that previous generations did not enjoy. Perhaps the most significant discovery is that stars are self-organizing processes. They are not just unchanging bright objects in the night sky. Stars

proceed through stages of development that enable their radiance to come forth.

What is the ultimate origin of a star's radiance? It comes from the intense compression of matter under the force of gravity. But what is the origin of this gravity? Strictly speaking, gravity is an effect of mass. Consider a vast cloud of hydrogen and helium that is destined to collapse into a future star. The gravitational attraction that causes the cloud to implode is generated by the mass of the cloud itself. In other words, the mass of the future star creates the gravity necessary to give birth to the star itself. In that sense, each star is a self-generating event.

And stars not only shine. They resonate, they communicate. Humans throughout history on every continent and in every culture have been stunned by the presence of stars in the vastness of the night sky. They have meditated on the beauty of the Big Dipper. So deeply moved by the majesty of the constellations and by the ineffable majesty emanating from the brilliance of stars, many have built their lives around them. They have imagined ways of not only organizing their personal lives but even patterning civilizations around the beauty and order found there.

In many cultures throughout history humans intuited that they descended from the stars, even before they had the empirical evidence from science that our bodies were formed by the elements forged by the stars. Humans felt something in the depths of the night as they contemplated the presence of the stars. They began to

suspect that the meaning of their lives went far beyond what preoccupied them during the urgencies of the daytime world. They knew in their hearts that their journey and the radiance of the stars were interwoven.

THE BIRTH OF STARS

The essence of the universe story is this: the stars are our ancestors. Out of them, everything comes forth. The stars are dynamic entities. They have a birth. They go through a development. They come to an end, sometimes a dramatic end. Here's their story.

The birth of a star begins with a cloud of hydrogen and helium imploding under the influence of gravity. The cloud shrinks moment by moment. As the atoms draw themselves together into ever-tighter spaces, they collide and vibrate with energy. After each collision they gradually heat up. Even a cloud that starts out at temperatures hundreds of degrees below zero will slowly become warmer as the eons pass.

During this increase in temperature the process of star birth recapitulates processes that were active at the time of the origin of the universe. As the clouds of hydrogen and helium heat up to several thousand degrees, the atoms begin to melt down. The hydrogen atoms dissolve back into being protons and electrons, which then move about in the core of the protostar as freely interacting elementary particles.

The culminating moment, the very birth of the star, takes place when the temperature reaches ten million degrees. When the elementary particles get this hot they fuse into new stable relationships. This is similar to what took place in the early moments of the universe when the first nuclei were formed. The star thus has the capacity to activate creative processes that were at work billions of years ago. Such originating creativity is woven through space and time, waiting to be ignited. Humans in every culture have invented myriad ways in which this primal creativity could be accessed for the collective human journey.

THE ACTIVITY OF STARS

For stars, creativity depends on maintaining a state of disequilibrium with respect to surrounding space. It is the dynamic tension between gravity and fusion that enables the star to maintain this seething disequilibrium.

The power of gravitational attraction within a star presses toward total collapse of the star. The power of nuclear fusion, where protons and neutrons fuse together and release energy in the center of the star, aims at expansion: matter is literally pushed outward, the opposite of collapse. If either of these powers comes to dominate, the star's life ends. The star exists only because these two powers are kept in creative tension for billions of years.

The atoms in a star have a fundamental resistance to being

crushed because the electrons of one repel the electrons of the other. If the gravitational attraction is strong enough, the heat that results from this resistance causes atoms to dissociate into free electrons and nuclei.

But gravity does not stop here. The entire process is repeated at the level of the nuclei. Nuclei repel each other, but if the overall gravitational "crushing" is powerful enough, this resistance can also be overcome. The protons and neutrons in adjacent nuclei are brought so close to each other that they can fuse into the stable configuration of a new nucleus. This fusion process converts hydrogen nuclei into helium nuclei, thus releasing enough energy to push the star outward and stave off further collapse.

The star then exists in between extremes. On one side there is gravitational collapse; on the other is thermonuclear fusion and outward pressure. Thus the star exists not in a world of stasis but in a realm of seething disequilibrium. Because the star holds itself in this far-from-equilibrium realm, it is capable of creating helium nuclei out of elementary particles.

This is one of the most amazing discoveries in the history of science. Stars are fiery cauldrons of transformation. Stars are wombs of immense creativity. And one can wonder if these complex interactions that we see in the stars reflect deep patterns of creativity in other domains of the universe. Certainly there are similarities in the human world. Beset with strong emotions of attraction and repulsion, we can, even so, develop emotionally

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Tension

charged bonds that become the foundation for decades of creative action.

There is deep ambiguity threaded throughout that may result not simply in communion but also in collapse. But isn't this also the nature of the universe—both dangerous and inviting? How do we discover ourselves in forces that are simultaneously fearful and attractive? How do we live amidst shimmering disequilibrium? One thing seems certain: the universe, navigating between extremes, presses ever further into creative intensities.

THE EXPLOSION OF STARS

One of the greatest costs of creativity in the universe is the supernova, an exploding star. The astonishing fact is that many large stars are destined to explode. The energy expended in this event is unrivaled by anything else in the universe. The power of a supernova is equivalent to that of an entire galaxy with a hundred billion shining stars.

Stars do everything possible to avoid such an end. For a star twenty times the size of our Sun, the first challenge comes only ten million years after its birth. Throughout those first ten million years, the star has maintained its state of seething disequilibrium by fusing hydrogen nuclei into helium nuclei in its core. But eventually there is no hydrogen left in the core to fuse. It has all

been transformed into helium nuclei. So the outward-pushing energy that came from the fusion processes stops.

When this happens, gravity causes the star to collapse into a smaller space. Without any fusion-derived energy pushing out, the star can press itself ever smaller, but as it does so the core of the star heats up until it reaches the temperature necessary to fuse helium into carbon. Now, once again, the star can settle down into a semistable state, for the new blast of energy in its center is enough to hold back the huge force of gravity. This stable state will continue so long as there is helium to fuse. But once the helium in the core is used up, we have a repeat of the cycle in which the star implodes even further and drives temperatures up until the star reaches the billion-degree temperature necessary to fuse carbon into oxygen. And after this cycle ends, the star fuses the oxygen in the core into silicon, and so on through the heavier elements.

This process comes to an end when there is only iron in the core of the star. Iron does not release any energy when it fuses. When the star comes to a core of iron, the energies that had been pushing out from the center are now gone. There is thus nothing the star can do but implode upon itself.

In a matter of seconds, the entire core of the star becomes a tiny speck. First, all the nuclei are dismantled into their constituent protons and neutrons. Not only has the core of this once brilliant star been reduced to a speck, but the star's creativity in

bringing forth these various elements is erased. And still the contraction continues. The energy of implosion becomes so great that even the free electrons and protons are crushed together to form neutrons. It is at this moment that a great reversal takes place—the supernova explosion. The force of the neutrinos, the elementary particles released during the creation of the neutrons, reverses the entire movement and blasts the star apart. The superconcentrated dot of neutrons now explodes outward with the brilliance of a hundred billion stars. And as it expands, a stupendous new round of nucleosynthesis takes place, creating the nuclei of all the elements of the universe. What had been a dense dot of matter now opens up into hot clouds of magnesium, calcium, phosphorous, carbon, and gold. This womb of intense creativity gives birth to the elements that eventually form our planet and our bodies. Much of the matter of our bodies passed through such an intense and vast explosion.

The supernova is the most spectacular display of destruction and creation in the universe. What are we to make of this, as our very existence—indeed, the very existence of life—depends upon it? Does it suggest that the universe, in order to create a single atom of carbon, requires the destruction of an entire star? Could it be that life is not possible without vast, mysterious, and ongoing transformation?

Birth of the Solar System



Our solar system emerged out of such fiery transformation. Five billion years ago a shimmering cloud created by supernova explosions began its gravitational collapse into a thousand new star systems. Throughout this vast cloud, new centers of attraction appeared with an infant star, like a jewel shining at the heart of each center. One of these centers became our Sun with its eight planets—a solar system. This vast ocean of our solar system is like a womb that eventually brings forth life.

How did this happen?

In the beginning our infant Sun was completely surrounded