Lesson Unit

**OUR TITLE IS:**

Contemporary Cosmology, Anthropic Coincidences, and the Question of God

**OUR TOPIC IS:**

The theological significance and implications of cosmological theories and anthropic coincidences.

**OUR DESCRIPTION IS:**

The modern scientific understanding of the existence and nature of the universe has both challenged and enriched the Christian’s ability to believe in God. In light of both the development of “Big Bang Theory” cosmology and the discovery of various “Anthropic Coincidences,” belief in God, Creator of the universe, has never been so greatly informed by scientific knowledge. This lesson seeks to explore the question of belief in God in light of these modern discoveries. Students will come to appreciate the significant contributions that the Big Bang Theory and Anthropic Coincidences have made to belief in the existence of God, without at the same time overstating the case that can be made from scientific evidence.

**OUR ESSENTIAL QUESTIONS ARE** (minimum of 2, maximum of 4)**:**

1. What is the Big Bang Theory, and how does it differ from the cosmological theory and ideas that preceded it?
2. How can the discoveries of modern physics relating to the “Anthropic Coincidences” help us to better appreciate the truth about God the Creator?
3. Can science prove or disprove the existence of God?

**The KNOWLEDGE that students participating in our lesson will gain is** (include a maximum of 4)**:**

1. Demonstrate a basic understanding of the Big Bang Theory relative to theories and ideas that preceded it.
2. Articulate the concept of “Anthropic Coincidences.”
3. Explain how scientific knowledge can positively contribute to philosophical and theological speculation.
4. Explain the limitation of scientific knowledge with respect to demonstratively proving the existence of God.

**The SKILLS that students participating in our lesson will gain will be:**

1. Evaluate an argument for God as Creator and recognize important metaphysical questions when thinking about the origin of the universe.
2. Synthesize scientific, philosophical, and theological knowledge with respect to the existence and nature of the universe.

**OUR METHOD IS BELOW:**

**Day 1**

**Opening**

Begin by asking students to pair up and discuss the question displayed: **What if the universe was eternal[[1]](#footnote-0)? Would that eliminate the need for a Creator? Why or Why not?[[2]](#footnote-1)**

Allow students to share their responses.

After listening to student responses, guide students to think about the idea of creation.

1. What does it mean to create something? Is there a difference between something having a “beginning” and something having an “origin”?
2. More specifically, is there a difference between having a “beginning” and “being created”?

**Core Lesson**

*Presentation by teacher*

The idea that the universe has always existed is a very old idea, going back to Aristotle. Two Scientific discoveries in the 19th century seemed to support this belief:

1. *Law of the conservation of mass*: when matter undergoes changes (for example, in chemical reactions) the total amount of mass in the universe does not change
2. *Law of the conservation of energy*: energy can neither be created nor destroyed but only converted from form to another

The cosmological[[3]](#footnote-2) picture seemingly evidenced by the latest science at the time provoked questions that went beyond the scientific ones: If the universe has always existed, does that mean God did not create it? And if God did not create the universe, does this mean that perhaps God doesn’t exist? Does this falsify the Genesis creation account? If we no longer need God to explain how the universe came to be, then what do we need God for?

Given the scientific evidence at the time, these questions seemed answerable in favor of atheism, or at the very least against the biblical understanding of God.

Key question to ask students: *Is it true that if something does not have a “beginning” (i.e. there was no moment in time at which it did not exist) that it is therefore “uncaused” and in no need of a creator?*

**Activity**

Show students an image of a ball being illuminated by a lamp. Inform students that this ball has been illuminated by this lamp for eternity (or perpetually); in other words, there is no point in time at which the ball has not been illuminated by this lamp.

Now, ask students the question, “Even though the illumination of the ball had “no beginning” does that mean its illumination is ‘uncaused’?

*Accept reasoned answers.*

Students should be able to see that even though the ball’s illumination had no “first moment” in time, it is still caused by the light from the lamp. Get students to see the connection between their explanation of the illuminated ball and the original question posed above.

Teacher Explanation: Likewise, determining whether the universe had a temporal beginning does not at the same time determine whether the universe has a cause for its existence. It is possible in principle for God to have caused the universe to perpetually exist. The fact that a thing has no first moment of existence does not mean it has no cause or explanation for its existence (e.g. A play may have a beginning or end, yet we still need an author to explain why the play exists at all.)

This reflection raises another important question: *What does the Christian faith mean when it claims that God created the universe?*

Creation is the act by which God gives **reality** to the universe. Creation deals with **why** something exists at all.

In theology the term “creation” does not refer to a temporal physical process. Creation is notan "event" that happened at some time in the distant past. Rather, creation is about the absolute dependence of all things on God’s causal power. We are not talking about a change from something to something else; rather, we are talking about the “coming-to-be” of all reality from total non-being (or nonexistence)

The word "creation" has two meanings in theological writing.

1. *Creatio ex Nihilo*: Creation “out of nothing”
2. *Creatio Continua*: “Continuous Creation”

Creation: referring to God bringing into existence of something from nothing in the ***absolute*** sense.

It may be difficult for students to separate the idea of creation from the idea of temporal beginning. This may be because we compare God’s creation with human creation

Since human creation is always time-bound (in which a physical cause precedes a physical effect in time), we tend to think of God’s act of creation in this way, but this is a mistaken way of thinking about it.

**Philosophical Demonstration of God as Creator**

*What follows is a philosophical argument that demonstrates the necessity of a First Ultimate Cause to reality—a cause that transcends time-space and is the “Cause of all causes” in the universe. This argument may be difficult for students to grasp, and so you may need to carefully walk students through it*

**Handout Guide[[4]](#footnote-3):**

When we reflect on our experience, we recognize that the universe in which we live contains a variety of conditioned beings (i.e. beings that depend on other beings for their existence)

As we look around us, we see that beings depend upon other beings outside of themselves to exist. For example, beings depend upon things that came before them to come into existence.

Philosophically we can call “causes” which produce effects in such a way that those effects can continue to exist even after their causes themselves have ceased to exist, **"non-simultaneously acting causes".**

*A child depended on her parents to exist, and so her parents are the causes of the child’s existence. However, the causal effect of procreation is “non- simultaneous”, which means the effects of the cause can continue to exist even after the cause itself ceases to exist. Though you needed your parents to come into existence, you do not need them to remain in existence right at this moment--your parents are not holding you in existence at this moment.[[5]](#footnote-4)*

However, there is a second kind of dependency in which the effect and cause are essentially dependent on one another. This means that the effect would cease to exist should the cause cease to exist or stop its causal activity. Let’s call this **“simultaneously acting causes”**.

Ex: The earth is causing its “gravitational field” to exist right now. The existence of the earth is the present condition for the existence of its gravitational field. Without the existence of the earth, its gravitational field would cease to exist.

*A gravitational field is an example of something that depends on another thing, distinct from itself, in order to exist, in such a way that this dependence is simultaneous with the ongoing existence of that distinct thing.*

**Student Question:** What other “simultaneously acting causes” do you depend on for your existence?

*Human beings are dependent upon simultaneous causes as well. For example, air, temperature within a certain range, cosmic forces, such as the stability of the proton, and the existence of the water molecule.*

*Without any one of these, you would not exist. They exist, therefore you can exist--they are simultaneously acting causes of your existence.*

*However, these causes also have simultaneous causes for their existence, such as the stability of the proton, which makes the atomic elements (e.g. hydrogen and oxygen) to exist to form the water molecule*

When thinking about the question of why the universe exists at all, we are not thinking about non-simultaneously acting causes but rather “simultaneously acting causes”.

Can an unending chain of simultaneously acting causes exist without a primary uncaused cause of the whole chain?

**Student Question:** Train analogy: You and your friend are watching a train travel down a track. After the final car passes by, you turn to your friend and ask, “What is pulling the caboose?” To which your friend responds, “The car in front of it.” You then ask, “Well, what is pulling that car?” To which your friend responds, “The car in front of it.” In this scenario, does your friend’s answer give you a complete explanation of the caboose’s movement?

*While the initial answer is correct, it is misleading and unsatisfying, for the caboose ultimately is receiving its motion from the engine car through the intermediate cars. In other words, all the cars in front of the caboose are instrumental causes of its motion; while the ultimate cause of its motion is the engine car. If the engine car stopped working or ceased to exist, then the instrumental causality of the intermediate cars would stop and the caboose would not move. Just as an unending chain of train cars fails to ultimately explain why the train is moving, so too does an unending chain of simultaneously acting causes (or non-simultaneously acting causes) explain why the universe exists at all, for such an “infinite regress” would not ultimately explain anything; it would not explain why the chain exists in the first place.[[6]](#footnote-5)*

*There has to be one “thing” that currently exists which does not depend on another thing for its existence, a being that is totally unconditioned in its existence*

*For any conditioned being to exist in the here and now, there must exist an unconditioned, uncaused Cause to account for the existence of all other conditioned things*

*This is what we mean by God: the uncaused Cause who is transcendent and wills creation into existence as its divine simultaneous causes.*

*God is the origin of the chain of simultaneously acting causes by whom all things ultimately depend for their own existence at every moment that they exist.*

If students are unable to grasp this argument, or cannot see how it applies to our discussion of “beginning” and “creation”, then perhaps it may be helpful just to summarize the main point as it relates to the rest of the lesson:

**Summative Message:** Even if the scientific evidence suggested a perpetual universe, the universe would still need an ultimate and transcendent cause for its existence. Therefore, the need for a Creator would not be eliminated by a material universe without a first moment in time. Creation is not equivalent to “having a beginning”; creation is more metaphysically fundamental than a temporal beginning

**Reflective Assessment**

Have students look at the diagram[[7]](#footnote-6) below. Ask them to reflect on the diagram (See attachment) and respond to the questions below:

1. If the area of the circle (“A”) represents all created space in our universe, and the arrow represents time, how is God’s relation to the universe represented by the diagram?
2. What are the “lines” coming from God meant to represent? What type of cause do the lines represent: “non-simultaneously acting causes” or “simultaneously acting causes”?
3. If the arrow representing time pointed in both directions (meaning that time had no beginning), would that change the meaning of this diagram?
4. How does this diagram show that creation is distinct from questions about the beginning of the universe?

*Accept reasoned answers.*

**Explanation**:

The diagram shows God causing created beings to exist, here and now. Created beings are now depending on God for their very existence. God created AND God creates. The creative act begins with nothing, yet something created is the result. But more than the created product is the result; so also is the relationship of the creator to what is created.

God’s causal activity is Primary and simultaneously acting; the causes within the area of the circle are secondary causes, the types of causes that science studies. The diagram shows a finite universe with a beginning in time, but even if it should a perpetual universe, it would still need God’s causal activity

**Day 2**

This section introduces students to the Big Bang Theory, the beginning of the expanding universe that we inhabit today, and the key scientists who helped and made this incredible discovery.

# [**A Harvard Astrochemist Discusses Big Bang Cosmology**](https://youtu.be/R_N6k1Ah3ic)

The Big Bang – *How* the universe began!

Begin the lesson by asking students their level of familiarity with Edwin Powell Hubble and Fr. Georges Lemaître. What do these two people have in common? Most will relate Hubble to the famous Space Telescope that bears his name, but less will be familiar with Fr. George Lemaître. Briefly introduce the topic of the lesson by explaining that Lemaître was a Belgian priest and physicist who proposed the Big Bang Theory, a complex scientific explanation of the creation of the universe.

*Big Bang Theory: The prevailing cosmological model for the beginning of the observable universe, describing how the universe expanded from a high-density, high-temperature state billions of years ago* (C. Baglow, p. 304)

**Classroom Activity**

For this activity you need several balloons for several students or enough balloons for everyone in the class. In addition, you will need black sharpies. Though no analogy is perfect, this balloon activity can help students understand something of the Big Bang and the notion of an expanding universe. You may choose to give balloons to everyone in the class, in which case prepare for multiple and numerous “bangs,” or just have two or three students stand in the front of class to do the demonstration. Have your students place one or several dots on their flat, deflated balloons. Have the students then blow up the balloons and explain they are witnessing the expansion of the universe. Once the balloons are completely inflated students can observe how the dots have moved away from each other. This demonstrates how the universe has expanded over time since the Big Bang. You may or may not choose to have the students pop the balloons at this point.

**The Roles of Einstein, Hubble, and Lemaître**

*Classroom Activity*: In order to introduce the students to these three great scientists, have students conduct a simple Google search on each scientist or consider doing a jigsaw with several groups. Have students 1) identify three key takeaways, 2) ask two questions, and 3) one interesting fact. Have one-to-two other students record their findings on their board .

|  Hubble |  Einstein |  Lemaître |
| --- | --- | --- |
| Telescope | Relativity Manhattan project       | Catholic priest |

**Teacher Lecture**

Introduction: Many believed that a perpetual or eternal universe negated any need for a creator While some atheists thought this would close the deal, Catholics understood from St. Thomas Aquinas that even a perpetual universe was “‛contingent’ and therefore need an ultimate cause” (Baglow, p. 160)

Albert Einstein

Though the renowned Albert Einstein did not seem to have a problem with the existence of God and spoke of “God” in generic terms. For example, his famous statement, “God does play dice with the universe.” Yet, he was still very much committed to a perpetual universe. Ironically, the equations of this celebrated scientist led to the conclusion that the universe had a beginning and is expanding.

Edwin Hubble

Does that name sound familiar? It should! The famous Hubble Space Telescope named in honor of this well-known scientist who discovered that not only was the universe expanding but was doing so at a rather significant rate. Furthermore, he observed that there are galaxies beyond our own.

[Georges Lemaître (1894-1966)](https://catholicscientists.org/scientists-of-the-past/georges-lemaitre/)

Monsignor Georges Lemaître personifies the relational unity between science and religion, faith and reason. Lemaître was a Belgian priest and one of the two originators of the Big Bang theory.

His work inspired Pope Pius XII (1951) to issue a response supporting the ongoing studies of theology and science. Pius XII wrote, “… contrary to affirmations advanced in the past, true science discovers God in an ever-increasing degree-as though God were waiting behind every door opened by science.” (*The Proofs for the Existence of God in the Light of Modern Natural Science* 11/22/51)

a. Called the “Father of Big-Bang cosmology”

b. Ordained a Catholic priest in 1923.

c. Studied Math/Physics at Cambridge but and studied at Oxford, Harvard, and MIT

d. In 1927 proposed what became known as the “Big Bang” model.

e. This theory, now strongly supported by observations and regarded as well

established, shows that the present universe emerged from an explosion about 14

billion years ago, which is likely to have been the beginning of the universe and

time itself.

g. The universe started with a single particle which Lemaître termed the “primordial atom.”

Space and Time?

The Big Bang not only points to the beginning of stars and galaxies, but to the beginning of space and time as well.

We cannot speak of “a time before the universe began” because there was no “time” before then. Any questions about time and space before then would be erroneous. Lemaître believed the Big Bang was “a day without a yesterday” (Baglow, p. 163).

For St. Augustine time is the creation of God, and since time is created reality, then it would be incoherent to speak of a “before” moment prior to creation. Since time is a part of created reality then it must have begun with the beginning of created reality, and so to speak of a “time before creation” is self-contradictory. There was no such “before” creation.

“From the beginning of time” is not only the beginning of the universe, but also the beginning of time. (*Fourth Lateran Council* 1215 and *First Vatican Council* 1870)

C. A rapidly expanding universe expanded slowly among scientists.

1. It took time for the Big Bang theory to win acceptance by the scientific

community, partly because of the philosophical preference of some scientists, including the great Albert Einstein, for the idea of a perpetual universe, but also because of scientific objections to the theory that turned out to be wrong.

2. Eventually Lemaître was able to win Einstein over. Einstein later called

Lemaître’s theory, “The most beautiful and satisfactory explanation of creation to which I have ever listened.”

3. Lemaître died June 22, 1966. But shortly before his death two radio astronomers,

Arno Penzias and Robert Wilson, accidently discovered significant supporting evidence for Lemaître’s Big Bang theory in 1964.

4. While working on an antenna Penzias and Wilson picked up a “noise” or “static”

that eventually became known as the “cosmic microwave background” (CMB). This “fossil” or remnant of radiation was the discovery that confirmed the Big Bang.

 5. Penzias and Wilson were awarded a Nobel Prize in Physics (1978) for their

discovery.

**Classroom Activity**

Explain to students that the cosmic microwave background radiation is a remnant of the Big Bang. Show them an image of the cosmic microwave background radiation and explain that it is the oldest light in the universe. Discuss how the cosmic microwave background radiation provides evidence for the Big Bang theory. You may find the video below helpful.

<https://www.amnh.org/explore/videos/space/cosmic-microwave-background>

**Lecture: The Big Bang and the Impact on Modern Science and the Question of God**

Many atheists found the Big Bang theory philosophically disturbing. If the universe has always existed, then it is easier to take its existence for granted as something that does not need to be explained. But if the universe suddenly and dramatically made an appearance a finite time ago – “with a bang”, so to speak – that seems to call for an explanation and makes it psychologically harder to avoid the deep question of why there is a universe at all.

Does the fact that the universe had a beginning prove that there had to be a “Beginner”?

Even a premier scientist like Stephen Hawking left the door open for God when he said, that “An expanding universe does not preclude a creator, but it does place limits on when he might have carried out his job!” (*A Brief History of Time* 1988).

Robert Jastrow once said, “For the [modern materialist] scientist … the story ends like a bad dream. He has scaled the mountains of ignorance; he’s about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries” (Robert Jastrow quoted by Baglow, p. 165).

Jastrow said in an interview with *Christianity Today* magazine,"Astronomers now find they have painted themselves into a corner because they have proven, by their own methods, that the world began abruptly in an act of creation to which you can trace the seeds of every star, every planet, every living thing in this cosmos and on the earth. And they have found that all this happened as a product of forces they cannot hope to discover. That there are what I or anyone would call supernatural forces at work is now, I think, a scientifically proven fact." ("A Scientist Caught Between Two Faiths: Interview With Robert Jastrow," *Christianity Today*, August 6, 1982).

And remember Pope Pius XII (1951) “… contrary to affirmations advanced in the past, true science discovers God in an ever-increasing degree-as though God were waiting behind every door opened by science.” (*The Proofs for the Existence of God in the Light of Modern Natural Science* 11/22/51)

So, Can the Big Bang “Prove” the existence of God???

St. Pope John Paul cautions Catholic and Christian thinkers.

“In speaking of the existence of God we should underline that we are not speaking of proofs in the sense implied by the experimental sciences. Scientific proofs in the modern sense of the word are valid only for things perceptible to the senses, since it is only on such things that scientific instruments of investigation can be used. To desire a scientific proof of God would be equivalent to lowering God to the level of the beings of our world, and we would therefore be mistaken methodologically in regard to what God is. Science must recognize its limits and its inability to reach the existence of God. It can neither affirm nor deny his existence.”

As particle physicist Stephen Barr explains: “That the Big Bang theory is correct, however, does not necessarily settle the question of whether had a beginning. There remains the possibility that the explosion that occurred 14 billion years ago was only the beginning of a certain part of the universe or a certain phase in its history, rather than the beginning of the universe as a whole. In fact, over the years many scenarios and theories [in which the Big Bang is not the beginning is not the Beginning] have been proposed.” (Stephen Barr, *The Believing Scientist*, p. 128)

So, What Can We Say about God and the Big Bang?

Expert in the study of Science and Religion, Dr. Chris Baglow explains that the Big Bang is still important for Religion and Theology and makes three helpful closing points:

1. The Big Bang Theory is important because it may suggest that more than science is needed to explain the universe.
2. The Big Bang Theory shows that the idea of a beginning can be made sense of scientifically, something that was not clear before Einstein’s theory.
3. The Big Bang Theory shows that time – like space and matter – is not a necessary feature of existence but merely a feature of the physical universe.

**Homework:**

Have students read [“The Argument from Design”](https://www.peterkreeft.com/topics/design.htm) by Peter Kreeft and complete the following assignment:

1. Summarize Kreeft’s presentation of the “Argument from Design.”
2. Do you agree or disagree with the conclusion?
3. Write one paragraph justifying your position.

**Day 3 (Anthropic Coincidences)**

*On Day 2 students explored one domain of physics, namely cosmology, to determine how its findings may or may not shed light on the question of the existence of God. On Day 3, students will investigate how the findings of other scientific domains reveal that the universe seems to have been “fine tuned” for the possibility and existence of life, which in turn has interesting philosophical and theological implications that point to – without demonstratively proving – the existence of God.*

**Warm-Up:**

Begin class by having students turn to the classmate nearest them and discuss the Argument from Design and their position with respect to it.

**Lecture:**

Kreeft mentioned the “Anthropic Principles” (or “Anthropic Coincidences”) to illustrate the Argument from Design, which Christopher Baglow defines as “a feature of the universe that is exactly what is needed for the existence of life but yet seemingly could have been otherwise.” In other words, it is from the very nature, laws, and orderliness of the universe itself that the existence of God is made manifest.

The following presentation will provide greater detail concerning some of the fundamental laws and orderliness of the universe that make it so unique such that it can bring about and sustain organic and human life.

These deeper laws and phenomena, which we will consider, are: (1) Gravity and (2) Strong Nuclear Force.

Each of these laws entails the existence of a universe that is “just so,” such that even the slightest adjustment or tweak to its de facto underlying laws and forces would result in an entirely different sort of universe wherein it would not be possible for life to emerge.

By exploring these “Anthropic Coincidences” we’ll come to better understand and appreciate how the fine-tuning of the laws of the universe themselves points to the existence of God, though it ultimately falls short of a knock-down, demonstrative proof.

As the physicist Paul Davies explains: “Scientists are slowly waking up to an inconvenient truth —the universe looks suspiciously like a fix. The issue concerns the very laws of nature themselves. For 40 years, physicists and cosmologists have been quietly collecting examples of all too convenient ‘coincidences’ and special features in the underlying laws of the universe that seem to be necessary in order for life, and hence conscious beings, to exist."

**Activity:**

Before beginning our exploration into two of the four fundamental forces and anthropic coincidences, we will first engage in a fun exercise that will help us appreciate the nature of the Anthropic Coincidences.

Break students up into small groups, and give each a handful of toothpicks and coins. Instruct the students to suspend a coin two inches above the desk, but do not tell them how to do so. Allow them to work through the difficulty of the task themselves.

*Students should arrange the coins on the desk in such a way that they can support multiple toothpicks, each of which will lean against one another for support. A coin should be balanced on top of these toothpicks for support. It is preferable that teachers will have completed this activity in advance but hide it from the students under a plastic cup*.

Offer the following explanation to the students: As you can see, it is only possible to suspend a coin above the desk by utilizing and arranging the other pieces in such a way that they can achieve an end that is greater than themselves, and if these pieces were differently shaped or weighted than they actually are, or if they were arranged differently, then the end result of the suspended coin would not be possible.

Likewise, the universe exists in such a way that the more complex ends and realities (such as inorganic matter and life) are dependent upon the underlying laws and matter that make them possible.

What scientists have discovered is that the deeper one penetrates the underlying reality of the universe, the deeper and more profound order and laws one finds, which is what makes possible the world in which we have evolved and life itself.

With this in mind, let us turn to our first Anthropic Coincidence: gravitational force.

**Gravity and the Big Bang**

“The balance between the energy of expansion [i.e., the speed of the expansion] and the braking power of gravitation had to be extraordinarily exact.”

~ Owen Gingerich, *God’s Universe*, 49

The first anthropic coincidence concerns how finely tuned the expansion of the universe was at the time of the Big Bang. There had to be a very precise balance between the speed of the expansion and the gravitational force pulling the matter back together. If this balance had not been fantastically precise, the universe would not have been able to expand for billions of years in the way needed for life to evolve. Let’s take a look at how American astronomer Jennifer Wiseman describes the balance of forces in the early universe:

Jennifer Wiseman, “Forces in the Early Universe”

<https://youtu.be/0pygynmkb3k>

As stated before, there had to be a very precise balance of the speed of the universe’s expansion at the time of the Big Bang and the force of gravity pulling matter back together. This competition of forces played out perfectly for the universe to exist in the way that it does. According to Chris Baglow:

“This competition had to be very precisely balanced, otherwise one of two disasters would have happened. Had the gravitational attraction been too strong, it would have quickly halted then reversed the expansion, and the matter would have come crashing back together while the universe was still very tiny and new. On the other hand, had the gravity been too weak, the matter would have spread out much too quickly and stars and galaxies would not have been able to form. We would either have had no universe or one that would not support life.”

Let us go into a little more detail about this to make clear how “fine tuned” the Big Bang explosion had to be. What was causing the “gravitational attraction” that was trying to pull matter back together? It was the mass of the matter filling the universe.

At the time of the Big Bang, that mass was almost entirely in the form of thermal energy, i.e. heat. (Remember that Einstein showed that mass and energy are related by the formula E = MC2.) So the strength of the gravitational attraction depended on the temperature of matter at that time. Therefore, balancing the speed of the universe’s expansion and the gravitational force trying to “put the brakes on it” meant that the matter had to have just the right temperature.

How precisely did the temperature have to be tuned? Think of it this way. We can imagine setting the temperature of the Big Bang like we would set the temperature dial of an oven. Most conventional oven dials mark temperature at an accuracy of 25 degree increments. Other temperature probes have more precise temperature accuracy, to measure air temperature, for example. As Baglow states,

“For the Big Bang to happen in such a way that life as we know it could result, the ‘dial’ had to be set not to an accuracy of a hundredth of a degree, or a millionth, or even a billionth, but to *thirty decimal places*, that is, to **0.000000000000000000000000000001** of a degree. Otherwise, this ‘cake’ – this universe that was able to bring forth living things – would have been ruined. The balance necessary for our life-producing universe was so exact that it is unbelievably improbable. And yet exactly what needed to happen *did* happen.”

It is easy to see how fine tuned the universe had to be in order to even exist and thus to support life. The specificity of the “setting” of this feature of the universe brings into clear light the sheer improbability of life to emerge. And yet it has.

There is actually a second fine-tuning that was necessary for the expansion of the universe to happen in the right way to allow life. We have been talking about the gravitational attraction caused by the matter in the universe, which tends to act as a brake on that expansion. But in addition to matter, there is something else filling the universe called “Dark Energy”. (Other names for this are “the Cosmological Constant” and “the vacuum energy”.) It is represented usually by the Greek letter capital Lambda. This energy can be positive or negative. If it is negative its gravitation acts as a brake on expansion. On the other hand, if it is positive it actually accelerates the universe’s expansion. In 1998 it was discovered that the universe’s expansion has been accelerating for the last several billion years, so it seems that there is a positive amount of Dark Energy. How big is the density of Dark Energy? In certain natural units called “Planck units”, its value is about 10-122. That is, it is zero to over 120 decimal places! (But not exactly zero.) If this Dark Energy did not vanish to over 120 decimal places, either the universe’s expansion would have been so rapid as to tear galaxies and even matter apart (for Lambda positive) or the universe would have stopped expanding and collapsed after a very short time (for Lambda negative). No one understands why Lambda is so close to zero. This is regarded by physicists as the deepest and most difficult puzzle in fundamental physics. (It is called “the Cosmological Constant Problem” and has remained unsolved for almost a century.)

**Universal Elements**

The second anthropic coincidence has to do with the emergence of the building blocks of life, i.e, the formation of atoms and the fundamental atomic elements: hydrogen, carbon, oxygen, and so on. None of these elements existed at the beginnings of the universe; rather, some came to exist shortly after the Big Bang and others were formed either within stars or from the explosion of stars via supernovas.

Thanks to the explosive force of supernovas, these elements were spewed out into the universe, where they could form into new stars, planets, and, eventually, living things. As a result, we now know thanks to modern science that our bodies are literally made of stardust.

Let us watch a video entitled “We Are Made of Stardust,” wherein we will learn more about how our very bodies are the result of a vast, cosmic process of star formation and explosions from Dr. Jennifer Wiseman.

**Video (5:27 minutes)**

Jennifer Wiseman, “We are made of stardust”

<https://youtu.be/rgojCWD1mlg>

While this video is interesting in its own right (and, hopefully, inspiring of wonder and awe), what is important for us in this lesson is that all of the building blocks of organic and inorganic matter are only possible because of the exact nature and strength of what is known as the “Strong Nuclear Force.”

The SNF is the attractive force that causes protons and neutrons to stick together to form an atomic nucleus; it is the atomic force of atoms.

As Chris Baglow explains, “Scientists [have] discovered that the strength of this force is… ‘fine-tuned’ in such a way as to make life possible. If it were only a few percent weaker, then protons and neutrons could not stick together; if it were only a few percent stronger, then the fusion processes in stars would be able to happen in a completely different way that would allow them to burn hundreds of times faster than they do. In the first case, the building blocks of life would never have formed; in the second, the sun (and other stars) would have burned out so quickly that there would not have been time for living organisms to evolve. This force *in* us seems to be *for* us.”

And so, like the gravitational force, we can see that the Strong Nuclear Force is also fine-tuned for the possibility of life.

This force is directly necessary for the existence of life because the very atoms out of which our bodies are made could not and would not exist if it were not for the physical integrity of their nuclei.

No atomic nuclei, no atoms; no atoms, no molecules; no molecules, no amino acids, proteins, cells, etc.; and so on. In other words, no finely-tuned strong nuclear force, no life.

**Class Discussion**

**Slide 18** Given the “fine tuning” of these features of the universe, gravity and the strong force, we are left with the final question, “Could all of the “anthropic coincidences” really *just* be coincidences?”

**Slide 19** (From *Faith, Science, and Reason: Theology on the Cutting Edge*) “Let us go back to the oven analogy, except now let us imagine the laws of physics are like a device with a large number of switches, knobs, and dials that control various features of the universe. One switch would turn on and off the force of electromagnetism; one dial would set the strength of that force, another dial would control the control the mass of the electron, and so forth”

**Slide 20** You may be thinking the “oven” might look something more like this.

“If all those switches and dials have to be set to just the right positions–some of them to fantastic accuracy–in order for life to appear, and we indeed find them set that way, is that not pretty strong evidence for a Creator who had the intention of creating a world with life in it?”

**Slide 21** “Consider this quote from Roger Penrose, a famous English mathematical physicist and Oxford scholar. He is describing the size of the number that presents the odds *against* the emergence of life:

“This is an extraordinary figure. One could not possibly even write the number down in full in the ordinary…notation: it would be 1 followed by 10^123 successive 0’s. *Even if we were to write a 0 on each separate proton and on each separate neutron in the entire universe*–and we could throw in all the other particles for good measure–we should fall far short of writing down the figure needed.”

*As a large group, students should discuss their position on the following questions.*

1. Could all of the “anthropic coincidences” really *just* be coincidences?
2. Do anthropic coincidences constitute proof of the existence of God?
3. Many contemporary atheists assume that their position on the existence of God is argued from the logical high ground. How do the anthropic coincidence turn that assumption on its head?

**Discussion Closing:** The last word in the discussion on anthropic coincidences goes to theoretical physicist Edward Witten:

“The laws of nature are very delicate. … [The fact] that galaxies, stars and planets roughly like ours could have formed, and that living things roughly like us could have formed depends on many details of the laws of physics as we currently know them being just the way they are and not being slightly different. [I think] we’ll never resolve the sense of wonder about that.”

Although anthropic coincidences do not constitute scientific proof for the existence of God (no reflection on observation can do that), they do leave us with a sense of openness, awe, and wonder at the suitability of the created world for life. With great reverence for the Creator, we can echo with Dr. Peter Kreeft that the design of the universe “seems suspiciously like a plot.”

**Our ASSESSMENT SECTION will include the following**

[Pre-Test](https://docs.google.com/document/d/1AzpclWsLcmG0d88J9lkxmr1B-1imGW41BldIBbrNzT0/edit?usp=sharing)

[Post-Test](https://docs.google.com/document/d/1TVJ_e_RfRIovWQ-i4iukzg_38l-nhqAazhSSqSDg0BQ/edit?usp=sharing)

**Our RESOURCES SECTION includes the following**

Society of Catholic Scientists “Common Questions” website.

 [Q3: Don’t physics theories of how the universe began show that a “Creator” is not needed?](https://catholicscientists.org/questions/q3-dont-physics-theories-of-how-the-universe-began-show-that-a-creator-is-not-needed/)

[Q4: Doesn’t the Book of Genesis contradict the Big Bang and Evolution?](https://catholicscientists.org/questions/q4-doesnt-the-book-of-genesis-contradict-the-big-bang-and-evolution/)

[Q8: Science is based on evidence; what is the evidence for God?](https://catholicscientists.org/questions/q8-science-is-based-on-evidence-what-is-the-evidence-for-god/)

[Q16: Doesn’t the vast size of the universe show that humanity doesn’t matter in the cosmic scheme?](https://catholicscientists.org/questions/q16-doesnt-the-vast-size-of-the-universe-show-that-humanity-doesnt-matter-in-the-cosmic-scheme/)

Baglow, Christopher T. *Faith, Science, and Reason: Theology on the Cutting Edge 2nd Edition.* Downers Grove, IL: Midwest Theological Forum, 2019.

Austriaco, Nicanor Pier Giorgio, et al. *Thomistic Evolution: A Catholic Approach to Understanding Evolution in the Light of Faith*. Cluny Media, 2019.

[Philosophical Demonstration Handout](https://drive.google.com/file/d/1ZbA9kN7peFc60aOLtDx3bwCQQndQAZVy/view?usp=sharing)

[Creation Diagram](https://drive.google.com/file/d/1JAw6xNMEXsiKe4lJH-pPilW7EDYsdu02/view?usp=sharing)

Barr, Stephen. *The Christian Scientist*: *Essays on Science and Religion*. Grand Rapids, MI: Eerdmans Publishing, 2016.

Barr, Stephen. *Modern Physics, Ancient Faith.* South Bend, IN: University of Notre Dame Press, 2003.

Barr, Stephen. “God and Cosmic Order.” <https://catholicscientists.org/articles/evidence-of-god/>

Barr, Stephen. “‘Are we meant to be here?’ Anthropic Coincidences and the Multiverse.” <https://catholicscientists.org/articles/are-we-meant-to-be-here-anthropic-coincidences-multiverse/>

Saint Augustine. *Confessions.* Oxford, England: Oxford University Press, 2008.

Pius XII. *The Proofs for the Existence of God in the Light of Modern Natural Science* 11/22/51.

Stephen Hawking *A Brief History of Time* 1988

"A Scientist Caught Between Two Faiths: Interview with Robert Jastrow," Christianity Today, August 6, 1982

<https://www.vaticanobservatory.org/education/proofs-gods-existence-st-john-paul-ii/>

Additional video resource for Anthropic Coincidences (11:29 - 16:05): Prof. Stephen Barr Lecture for the Society of Catholic Scientists. <https://www.youtube.com/watch?v=FVZjLLuureY>

1. Eternal: means “always existing” here. Another way to describe it is “perpetual”. [↑](#footnote-ref-0)
2. This question is asked on the pre-test, and so students should already have their answers formulated. [↑](#footnote-ref-1)
3. Cosmology is the study of the origin of the universe, how it became what it is today, and how it continues to evolve. [↑](#footnote-ref-2)
4. The italicized text is not included on the student’s handout [↑](#footnote-ref-3)
5. Other examples of “non-simultaneously acting causes”: an architect and their building; a carpenter and their table; a filmmaker and his movie. Time, or historical progression, can be considered a NS acting cause as well (the present is caused by the past but does not essentially depend on the past for its existence). [↑](#footnote-ref-4)
6. Another way of thinking about this: for A to exist, B must exist, for B to exist, C must exist, and so on. But, this chain of simultaneously acting causes cannot be an unending one, because then the whole chain would never get to a being which makes A (or B, or C, etc) actually exist. Nor can the chain go around in a circle--A depending on B, B on C, and C on A--because A cannot be making other things exist while also depending on those very things for its own existence. In either scenario there would be no ultimate reason for the existence of the whole chain of causes, and thus there would be no reason, no intelligibility in any part of the chain. [↑](#footnote-ref-5)
7. The diagram is based on a diagram from Nicanor Pier Giorgio Austriaco, et al. *Thomistic Evolution: A Catholic Approach to Understanding Evolution in the Light of Faith* (Cluny Media, 2019), 68. [↑](#footnote-ref-6)