§ 4. Excursus on Natural Theology
Lecture 13
Second Scientific Confirmation of the Second Premise / The Nature of the First Uncaused Cause

We've been looking at the *kalam* cosmological argument, particularly the second premise – that the universe began to exist. Last time we finished looking at the first scientific confirmation of that premise which is based upon the expansion of the universe.

If this weren't enough, there is actually a second scientific confirmation of the beginning of the universe, and this one comes from the Second Law of Thermodynamics. According to the Second Law, unless energy is being fed into a system, that system will become increasingly disorderly.

Now already in the nineteenth century scientists realized that the Second Law implied a grim prediction for the future of the universe. Given enough time, all the energy in the universe will eventually spread itself out evenly throughout the universe. The universe will become a featureless soup in which no life is possible. Once the universe reaches such a state, no further significant change is possible. It is a state of equilibrium. Scientists call this state of thermodynamic equilibrium the "heat death" of the universe.

But this unwelcome prediction of the future raised a further puzzle: if, given enough time, the universe will eventually stagnate in a state of heat death, then why, if it has existed forever, is it not now in a state of heat death? If, in a finite amount of time, the universe will reach equilibrium then why is it not now in a state of equilibrium if it has existed for infinite time? Given infinite past time, the universe should by now already be in a state of thermodynamic equilibrium. But obviously it's not. We're in a state of disequilibrium, where energy is still available to be used and the universe has an orderly structure.

The nineteenth century Austrian physicist Ludwig Boltzmann presented a daring solution to this problem. Boltzmann hypothesized that perhaps the universe is, in fact, in a state of overall equilibrium. Nevertheless, by chance alone, there will arise here and there in the universe little pockets of disequilibrium formed by fluctuations in the overall state of equilibrium. Boltzmann referred to these little patches of disequilibrium as "worlds." He said our "world" (or universe) is just one of these little patches of disequilibrium in the overall sea of equilibrium that prevails. Eventually, in accord with the Second Law, our patch of order will dissolve and the universe will return to the overall state of equilibrium.

Contemporary scientists have universally rejected Boltzmann's daring Many Worlds Hypothesis as an explanation of the observed disequilibrium of the universe. The fatal flaw in Boltzmann's suggestion is that if our universe is just a chance fluctuation in an overall equilibrium, then we ought to be observing a much smaller patch of order than we do. Why is that? Simply because a small fluctuation from equilibrium is vastly more probable than the huge, sustained fluctuation that would be necessary to create the universe we see, and yet a small fluctuation could be sufficient for our existence. For example, a fluctuation from equilibrium that formed a patch of order no larger than our solar system would be sufficient for us to exist and would be incomprehensibly more probable than a fluctuation which formed the entire observable universe that we see![1]

In fact, Boltzmann's hypothesis, if it is consistently carried out, would lead to a strange sort of illusionism: in all probability on Boltzmann's hypothesis we in fact do inhabit a smaller patch of order, and the stars and the planets that we observe are just illusions, mere images or pictures on the heavens as it were. For that sort of illusory world is much more probable than a universe which has, in defiance of the Second Law of Thermodynamics, moved away from an equilibrium state for billions of years in order to create the universe that we observe. On the Boltzmann hypothesis we would have to believe that most of what we see in the universe is really just an illusion and that the universe does not really exist.

The discovery during the 1920s (that we already talked about) that the universe is expanding led to a different account of the sort of heat death that the Second Law predicts, but it didn't alter the fundamental question.

In fact, recent discoveries indicate that the expansion of the universe is actually speeding up – it is actually accelerating. Because the volume of space is increasing so rapidly, the universe actually becomes further and further away from a state of equilibrium in which matter and energy can be evenly distributed. But this acceleration in the universe's expansion only hastens its demise, for now what happens is that different regions of the universe become increasingly isolated from other regions of the universe in space. Each marooned region becomes dark, cold, dilute, and dead. Again, the question remains the same. Why isn't our region of the universe in such a cold, dark, dilute, and lifeless state if the universe has already existed for infinite time?

START DISCUSSION

Student: How do the nonbelievers scientifically deal with the concept of the Second Law of Thermodynamics? Has anybody able to mount a challenge to the Second Law of Thermodynamics?

Dr. Craig: Not to the law itself. Thermodynamics is one of the best-understood fields of physics. In fact, from what I've read, it is almost literally a closed science, it is so well understood. What they will do is try to find some way to avert the prediction predicted by the Second Law. There has been a, shall we say, rebirth of Boltzmann's Many Worlds Hypothesis as an attempt to explain the observed disequilibrium. This is called the

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"multiverse." The multiverse hypothesis is a kind of reincarnation of Boltzmann's Many Worlds Hypothesis instead of saying there are little patches of order throughout the sea of equilibrium, now what is said is that there are other universes, and all of these universes are like bubbles in a kind of overall mother universe. Each of these bubbles is proceeding toward an equilibrium state. But by chance alone there will be universes in the multiverse that are in a disequilibrium state, and lucky us – we happen to find ourselves in one such universe.

The problem with this Many Worlds Hypothesis is the same one that sank Boltzmann's hypothesis; namely, if our universe is just a random member of a multiverse then it is inconceivably more probable that we should be observing a very tiny patch of order rather than the universe that we observe because that is incomprehensibly more probable than a universe that is in a disequilibrium state like ours.[2] The vast majority of observable worlds in the multiverse will be worlds that are these illusory worlds. This has led to what some theorists have called the Invasion of the Boltzmann Brains. That is to say, the most probable observable world, or universe, would be a world in which a single brain fluctuates into existence out of the vacuum and observes its otherwise empty world with illusions perhaps of an external world. That kind of a world is vastly more probable than a world in which there would be actual stars and planets and galaxies and distant events. On the multiverse hypothesis, you would be obliged to believe that this is really all an illusion – you are actually a Boltzmann Brain and that everything else that you observe, including your own body and people around you, are all just illusions because that kind of observable universe is much more probable than a universe with genuinely distant temporal events and entities.

This 19th century debate has played itself out again on the contemporary scene in respect to this problem – trying to explain why we observe a universe in disequilibrium. I think that the attempt to revise this hypothesis has not proved any more successful than the 19th century Boltzmann hypothesis. In fact, Roger Penrose of Oxford University, one of the most important mathematical physicists writing today, has said that these multiverse proposals are worthless in terms of explaining the orderly universe in which we find ourselves. They really are non-starters.

The problem, again, is: if in enough time the universe will suffer some sort of heat death then why (if it has existed for infinite time) is it not now in such a state? That is the mystery.

Student: Years ago I heard this one objection called the Brownian Ratchet. The idea is theoretically you could reverse the Second Law of Thermodynamics or go against it by creating a ratchet that harvests Brownian motion - it's particles dissolved in water. The

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thing kind of vibrates, and you can set a ratchet that turns only one way. That way you get energy from that. It goes against the Second Law.

Dr. Craig: I would be very skeptical of those kinds of perpetual motion situations. I've never heard that before. All of the reading that I've done is that this sort of eventual heat death is inevitable given the Second Law and our universe.

Student: I looked it up on the Internet and found an article by Richard Feynman about that, and he says the problem is the ratchet itself will undergo just as much Brownian motion and therefore it would fail. The ratchet is going to turn both ways. It is a weird objection.

Dr. Craig: OK. Thank you.

Student: [inaudible]

Dr. Craig: What I said to make it very simple is that the Second Law says that unless energy is being fed into a system it will become increasingly disorderly. Very often you'll hear the word *entropy* used to characterize that disorder – entropy increases in a closed system. That is just another way of saying the same thing. The system will become increasingly disorderly as long as it is closed – that is to say, there is no energy being fed into it from the outside. It is really a very simple idea. Of course, on naturalism, if there is no God then the universe just is one big gigantic closed system. There is nothing outside of it. So the Second Law would apply to it and imply that in enough time it will eventually reach some sort of heat death condition.

Student: Some people might argue that the Second Law doesn't apply on a universal scale. Would you have any credibility?[3]

Dr. Craig: I see no reason to think that the Law would not apply to the universe on a universal scale. On the contrary, as I say, physical eschatology is a field of cosmology that explores what will be the future fate of our universe. This is primarily a study based upon the thermodynamic properties of the universe as a closed system. Physical eschatology, as I say, predicts the sort of scenario that I've described. The universe, being in a state of acceleration, will not reach an equilibrium state. It will actually go further and further from equilibrium but each part of it will become increasingly marooned and will grow cold, dark, dilute, and dead. The same prediction that was made in the 19th century before the expansion of the universe was discovered still applies.

END DISCUSSION

The obvious implication of all of this is that the question is based on a false assumption, namely, the assumption that the universe has existed for infinite time. Today most

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physicists would say that the matter and energy were simply put in at the beginning of the universe as an initial condition, and the universe has been following the path plotted by the Second Law ever since its beginning a finite time ago.

The thermodynamic properties of the universe would provide a second scientific confirmation that the universe is not past eternal but had a beginning.

Of course, attempts have been made to try to avert the beginning of the universe predicted on the basis of the Second Law of Thermodynamics. But, as I've explained in connection with the earlier question, none of these has been successful. None of them has commended itself to the scientific community as an adequate explanation. Skeptics might hold out hope that a quantum theory of gravity will serve to avert the implications of the Second Law of Thermodynamics. You will recall from our discussion of the explanation of the universe, when the universe was severely contracted in its very early state, you need to have a quantum theory of gravity to describe it which we do not yet have. Someone might say maybe in this quantum-gravity regime the Second Law will not apply. But in 2013, the cosmologist Aron Wall of the University of California in Santa Barbara was able to formulate a new singularity theorem which seems to close the door on that possibility. Wall showed that, given the validity of the generalized Second Law of Thermodynamics in quantum gravity, the universe must have begun to exist, unless one postulates a reversal of the arrow of time (that is to say, that time begins to run backwards!) at some point in the past. On such a model, the universe will shrink back to a certain point at which there is a reversal of the arrow of time and there is a sort of mirror universe with time running in opposite directions. But, as Wall points out, this sort of model still involves a thermodynamic beginning in time which "would seem to raise the same sorts of philosophical questions that any other sort of beginning in time would."[4] That is to say, if time actually does reverse then this mirror universe is in no sense in our past. It does not precede our universe. What this model really depicts is two universes that have a common beginning point – a kind of forked universe and they both go back to this common surface. On the basis of Wall's theorem, the Second Law of Thermodynamics implies the universe began to exist unless you have a reversal of time's arrow at some time in the past. But in that case you have a thermodynamic beginning in time which is just as problematic as any other sort of beginning in time.[5] Wall reports that his results require the validity of only certain basic concepts, so that "it is reasonable to believe that the results will hold in a complete theory of quantum gravity." So this means of escaping the argument will not be successful.

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4 Aron C. Wall, "The Generalized Second Law implies a Quantum Singularity Theorem," arXiv: 1010.5513v3 [gr-qc] 24 (Jan 2013), p. 38.

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So once again it would seem that we have good evidence from contemporary science for the truth of the second premise of the *kalam* cosmological argument that the universe began to exist.

START DISCUSSION

Student: Is Wall's theory the oscillating universe theory? Is that one and the same?

Dr. Craig: No. What Wall is saying is that this conclusion that we've talked about – that the Second Law of Thermodynamics implies that the universe is finite in the past – that will hold in a quantum theory of gravity. So you can't escape the implications of the Second Law by saying maybe in the quantum theory of gravity it won't hold. What he shows is that this conclusion will imply a beginning of the universe. The only way to avoid that conclusion, he says, is if at some time in the past you say time's arrow turns around and points in the other direction. This is an extravagance. This is absolutely bizarre. He is saying that only in this bizarre case can you escape the conclusion that the universe began to exist. His further point is, *But wait a minute. Even this isn't really an exception because you really have here a thermodynamic beginning in time of two different universes because this is not in the past.*

Student: What about the oscillating universe? Is that just the expansion and contraction?

Dr. Craig: The oscillating universe is the universe that is expanding and contracting, expanding and contracting, from eternity past. I already mentioned some of the problems with that, but actually the thermodynamics of such a universe is also problematic. This was shown by Richard Tolman back in the mid-20th century. What he showed is that entropy (which I've already mentioned) is conserved from cycle to cycle. What that means is that entropy gets bigger and bigger with each successive cycle. This increase in entropy has two effects. It makes each cycle longer in duration and has a larger radius. So if you were to plot an oscillating universe in time it would look like this *[Dr. Craig draws a diagram on the whiteboard]*. Such a universe cannot be extended infinitely in the past. On the contrary, there still has to be an origin of universe prior to the smallest cycle. It turned out that the thermodynamic properties of the oscillating model implied the very beginning that its proponents sought to avoid.

Student: Speaking of entropy in successive Big Bangs, I'm confused as to how entropy would propagate through a singularity since a singularity to me would either be the ultimate low entropy or high entropy state depending on how you want to look at it.

Dr. Craig: The point is you cannot continue space-time through a singularity. So if it shrinks back to a singularity there is no oscillating model. You are quite right. Entropy can't pass through it, but neither can anything else. If the universe has a past singularity there is nothing before it. There is nothing on the other side. That is one of the physical problems with the oscillating model. What we show here is that even if the universe could oscillate (maybe there is a non-singular bounce and that it doesn't actually reach a singularity; it bounces back first) what happens then is the entropy accumulates from cycle to cycle.

END DISCUSSION

Let's bring this argument to a close.

On the basis, therefore, of both philosophical argument and scientific evidence, we have good grounds for believing that the universe began to exist, which is the second premise of the argument. Therefore, it follows from the two premises that the universe has a cause of its beginning.

What properties must this cause of the universe possess?[6] First and foremost this cause must itself be uncaused because we've seen there cannot be an infinite regress of causes. You must have an absolutely first uncaused cause. This First Uncaused Cause must transcend time and space because it created time and space and therefore is beyond time and space. Moreover it would have to be in an absolutely changeless condition because we saw that you cannot have an infinite regress of events. Therefore, it must be immaterial and non-physical in nature because anything that is physical and material is constantly changing and therefore exists in space and time. This First Uncaused Cause must be unimaginably powerful since it created all matter and energy.

Finally, Ghazali argued that this First Uncaused Cause must be a personal being. It is the only way to explain how an eternal cause can produce an effect with a beginning like the universe.

Here's the problem: If a cause is sufficient to produce its effect, then once the cause is there, the effect must be there, as well. Otherwise the cause wasn't really sufficient. If the cause is sufficient for its effect then given the existence of the cause the effect must exist as well. For example, the cause of water's freezing is the temperature's being below 0 degrees Celsius. If the temperature were below 0 degrees from eternity, then any water that was around would be frozen from eternity. It would be impossible for the water just to begin to freeze a finite time ago. Now the cause of the universe is permanently there, since it is timeless as we've seen. So why isn't the universe permanently there as well? Why did the universe come into being only 14 billion years ago? Why isn't the universe as permanent as its cause?

Ghazali maintained that the answer to this problem is that the First Cause must be a personal being endowed with freedom of the will. His creating the universe is a free act which is independent of any prior determining conditions. So his act of creating can be

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something spontaneous and new. That is the nature of free will. Freedom of the will enables you to get an effect with a beginning from a permanent, timeless cause. Thus, we are brought not merely to a first transcendent cause of the beginning of the universe but to its Personal Creator.

This is admittedly hard for us to imagine. But one way to think about it is to envision the Creator existing alone without the universe as changeless and timeless. His free act of creation is a temporal event simultaneous with the universe's coming into being. Therefore, he enters into time when he creates the universe. The Creator is thus timeless without the universe and in time with the universe.

The *kalam* cosmological argument thus gives us powerful grounds for believing in the existence of a beginningless, uncaused, timeless, spaceless, changeless, immaterial, enormously powerful, Personal Creator of the universe. As Thomas Aquinas was want to remark, this is what everybody means by "God."

START DISCUSSION

Student: You've got to use the example of when you walk into the room and your mom is boiling water and there are two reasons she could say that water is boiling. I've used that example countless times when I have retaught this. It has been the most effective example. You've got to share it.[7]

Dr. Craig: Thank you. This is an argument from Richard Swinburne who is professor of philosophy at Oxford University. It is a different argument for the personhood of the First Cause. Swinburne points out that there are two types of causal explanations. One would be in terms of scientific laws and initial conditions. You give the initial conditions, scientific laws, and that will be a causal explanation of why something happens. The other type of explanation would be what he calls a personal explanation. This is given in terms of an agent and his volitions. Not in terms of initial conditions and natural laws but in terms of an agent and his will, his volitions. For example, if I walk into the kitchen and I see that the kettle is boiling and I say to Jan, "Why is the kettle boiling?" she could say "because the heat of the flame is being conducted by the copper bottom of the kettle to the water making the molecules vibrate more vigorously so that it is thrown off in the form of steam." Or she could say, "I put it on to make a cup of tea. Would you like some?" The one is a scientific explanation; the other is a personal explanation. Both are equally valid modes of explanation. In some contexts one would be utterly inappropriate if substituted for the other. When it comes to explaining the first state of the universe – the beginning of the universe – you cannot have a scientific explanation because there are no previous initial conditions on which the laws of nature could operate to produce the beginning of the universe. It is an absolutely first physical state. If it has a cause, as

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we’ve argued, the only category could be a personal explanation in terms of a free agent and his volitions. This would be an independent argument different from al-Ghazali’s argument for the personhood of the First Uncaused Cause. I think it is a good argument, too.

Student: I don’t really know how to ask this question, but it has been with me all week and your talk kind of leads right to it. Neil deGrasse Tyson was on one of the late night talk shows this week debating the existence of God. The word that he kept coming back to was “benevolence.” A Christian perspective takes all of the existence of the universe and sees sort of a puppet master operating from a position of benevolence. The people he was facing on the talk show seemed as though they were all Christian but nobody could really respond to that. It just left me in turmoil over the concept of benevolence.

Dr. Craig: Yes, this is very disturbing. This is a statement of the classic problem of evil, namely, if you believe that God is a benevolent person (never mind this pejorative language of the “puppet master;” that is loaded terminology) who wants the good of his creatures then why is there so much suffering in the world? That is the question. You can look on the Reasonable Faith website for extensive discussions of this problem where I argue that the problem of suffering neither shows God’s existence to be improbable nor impossible. The atheist in fact has a very, very heavy burden of proof to bear to show that it's improbable or impossible that God could have morally sufficient reasons for permitting the suffering in the world.

But what makes me impatient is that Tyson takes on Christian pastors and other non-academics in discussing these issues but he will not debate a Christian scholar like myself. For a couple of years now there have been people in Oklahoma trying to arrange a debate with Neil deGrasse Tyson with me on the existence of God. He has declined to do this. It is easy when you take on weak opponents to make your case, and it is more difficult when you go toe-to-toe with a peer. If you want to see more on the problem of evil, take a look at materials on the Reasonable Faith website on this question.

END DISCUSSION[8]

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8 Total Running Time: 35:21