Second Scientific Confirmation of the Second Premise

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 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!

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 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 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?

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 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 thus 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 none of these has been successful. None of them has commended itself to the scientific community as an adequate explanation. For example, back in the 1970s Soviet scientists proposed various oscillating models of the universe in order to avoid the beginning. According to these models, the universe is expanding and contracting, expanding and contracting, from eternity past. I already mentioned some of the problems with that proposal, 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 is conserved from cycle to cycle. What that means is that entropy gets greater and greater with each successive cycle. This increase in entropy has two effects. It makes each cycle longer in duration and each cycle 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.

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 expansion 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."[1] 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 both go back to this common surface. On the

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

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. 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.

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.

The Nature of the First Uncaused Cause

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? 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. For 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 agent 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 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.

Richard Swinburne, who is professor emeritus of philosophy at Oxford University, offers a different argument for the personhood of the First Cause. Swinburne points out that there are two types of causal explanations. One would be a scientific explanation in terms of natural laws and initial conditions. The other type of explanation would be what he calls a personal explanation. This is given in terms of an agent and 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 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.

The origin of a world with a beginning from a permanently existing cause 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 wont to remark, this is what everybody means by "God."