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Philosophical Issues in Modern Cosmology

Conjecture about the nature, origin, and fate of the Universe has been at the centre of philosophy since Classical periods. In fact, what the Universe is, and why it is, are questions that have been asked (and answered, in theory) since the origin of humanity, and have been central to myth, religion, philosophy and science. In modern times physics has taken a central role in trying to understand the history of the universe we live in. Physics has used empirical methods and mathematical calculations to study this field, which is known as cosmology, and in modern times, physics certainly holds the greatest share in our cosmological understanding. However, every new scientific theory brings with it a wide variety of philosophical and even theological ramifications. Thus physics, philosophy, and theology work together to try to answer the question of why there is a universe, and what that means for humanity, our origin and fate, and for the existence of a supreme being.

Our current understanding of the history and nature of the universe, the field known as Modern Cosmology, is based largely on the work of Hubble, Einstein, and the contributions of Quantum Mechanics. This modern understanding started with Hubble, who observed that the universe is not static, but in fact expanding. Galaxies, on the average, can be observed to be moving away from us. Hubble made the observation that the further the astronomical body is away from us, the faster it moves, all according to a linear relationship called *Hubble's Law* (Barrow and Tipler 373). If we try to observe this expansion in reverse, we will witness a universe that collapses as we move backwards in time, and Einstein's Theory of Relativity predicts that this collapse will lead back to a point, called a singularity (Hawking and Ellis 348). Current scientific theory and observation therefore tells us that our universe started as a point about 15 billion years ago, and then exploded in what is called the *Big Bang*. The observed expansion of the universe in our epoch is simply the result of this Big Bang.

If we chose to ask the question, "What happened before the Big Bang?" the answer would simply be that there is no "before" the Big Bang. Time and space both had their origin with this initial singularity. This involves no violation of the "law of conservation of mass/energy;" i.e. that nothing can come into existence from nothing, because this law assumes that there is a prior time in which the matter/energy that exists would not have existed, as is *not* the case in the Big Bang. We can therefore say that the matter and energy in the universe have been there for *all time*, remembering that all time has only been around for 15 billion years.

A number of Cosmological models called *Friedmann Models* have been proposed to describe the nature of the universe (Mireau 29). Some are topologically *open*, which means they are infinite in size, and some are *closed*, meaning that they are finite.[1] There are also models in which the universe will continue to expand forever, and others in which it will only expand for a finite amount of time and then begin to re-collapse in what is called the *Big Crunch*. Such a universe could even expand and contract periodically; this is called an *oscillating* model. Current observation seems to indicate that we live in an open, forever expanding universe (Mireau 49). Unfortunately, a forever expanding universe has the characteristic that all the energy within it will eventually be scattered; this amounts to saying that every star, every galaxy, every supercluster will eventually burn out, leaving a cold, dead universe. This process is referred to as the *Heat Death* of the Universe.(Barrow and Tipler 166). Some scientists even conjecture that at some time in the very distant future, protons, one of the main building blocks of all matter, will decay, leaving absolutely nothing but scattered radiation roaming through the universe.

Given this current understanding of the nature of the universe, we are left to ask the question of how it came to be as it is. A teleological perspective has resurfaced in cosmology due to a number of startling discoveries about the apparent order in the universe. Basically, it has been observed that unless the universe had had certain very precise values for various cosmological constants, like the elementary electric charge, mass of a proton, strengths of the four forces of nature, speed of light, etc., the universe would not have evolved into the one it has, capable of bringing forth intelligent life, us, creatures capable of observing that universe. This seemingly amazing coincidence that the universe is just as it is (from a endless realm of possibilities) so that humanity can evolve to observe it,

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[1] A closed topology is analogous to a circle. If one travels along the circle in one direction for long enough, she would return to her original position. If the circle were expanding fast enough however, she might not be able to catch up to her original position which would get further and further away, even if she were traveling at the speed of light, the fastest possible speed in the universe.

is an issue that some physicists and philosophers have tried to address. One philosophical understanding of this issue is called the *Anthropic Principle.* This principle limits the number of possible properties of the known universe by taking into account the fact that the universe must be capable of existing in the form we see it today, a form that is capable of producing intelligent life to look at it (Barrow and Tipler 16).

Leslie conjectures that this order of the only known universe can only be explained by saying that there are many possible universes in existence (and ours is the one we observe because we're in it to observe it) or that there is a God that orders things so that we can arise out of it (310). Some quickly dismiss the many universe model quickly, due to its inability to be verified. However, from the perspective of physics, any model that is not eliminated on scientific rationale must be considered as a possibility.

The many universes approach may be possible in any one of four different ways. One is that the universe as we know it, in which time and space are distinct, is just a bubble in a larger universe of a sort of *quantum soup,* in which space and time are smeared. Another way to explain it is in theorizing that for every quantum possibility there is an entire universe that springs from it, thus there are infinitely many universes constantly springing forth with every quantum effect that occurs. A third possibility is that the infinite universe we live in is made up of many different regions, perhaps all causally disconnected due to its infinite size, and thus all with different physical laws and constants of nature.[2] The fourth possibility applies to an oscillating model of the universe: each successive oscillation brings with it unique physical laws and properties (Leslie 300). I would suggest that there may not be anything unique about our universe's ability to bring forth intelligent life. While it may be true that carbon based life forms as we know them can only come into existence in a universe like ours, I think it might be possible that life forms completely different to what we have encountered and perhaps even conceived might also be able to evolve into existence in any one of a number of different types of universes.

Springing forth however from this Anthropic Principle is what Tipler calls the *Omega Point Theory*, loosely based on a theory proposed by Teilhard de Chardin (Tipler and Barrow 195, Tipler 313). This theory basically suggests that humanity will continue to accumulate information and evolve to the infinite extreme, called the Omega Point, which is essentially God. Such a God would depend on the universe to create it. Tipler considers his theory to be only possible within a closed model of the universe. As the life within the universe collapses in the big crunch, it becomes one with it. All time and space become part of it, and it becomes the eternal God (322). Tipler admits this theory does not work in an open universe. I would suggest a slightly simpler model, with the infinitely expanding universe we seem to live in. Given an infinite amount of time, it seems reasonable that intelligent life would evolve into a God which is transcendent of time, and which would then create the universe in just such a way that would allow for it to come into existence. Interesting as this model is, two major problems occur to me almost immediately. First of all, this theory assumes that evolution of intelligent life has no upper limit, a conclusion that I am not prepared to make on physical and biological grounds.[3] Second, even if it can evolve to infinity, the theory assumes that it will evolve sufficiently in the finite amount of time before the Heat Death of the universe to survive it.

Many scientists and philosophers do not try to deal with teleological understandings of cosmology. Instead they focus on the universe itself, and try to explain its existence: where it came from. Modern physics tells us the universe came from the Big Bang, but then I may ask where the Big Bang came from? In quantum theory, it is predicted that particles and their anti-particle pairs can come into existence in a vacuum, essentially from nothing. This is provided that they collide again quickly enough so as not to violate the

[2] The observable universe would be about 15 billion light years in radius, if the age of the universe is 15 billion years old. This is because the relative speed of the stars on the edge of this sphere of vision would be the speed of light relative to us, and therefore the light signals from those stars would never reach us. As a result, anything on that sphere or beyond it would never have any causal effect on us.

[3] [3]It can be noted that Christian belief would suggest that human life *has* reached to its upper limit in the person of Jesus Christ. The only thing left for humanity is for all people to partake in his *resurrection*, which amounts to a transformation of human nature to transcendent union with God. However Christian belief is not that humans *become* God; the distinctness of creator to creation must be maintained in order that humans reach their ultimate existence. Christian doctrine would probably regard this notion of humans evolving into God to be heretical.

Heisenburg Uncertainty Principle[4] (Hawking 107). Some might thus suggest that the universe itself is such a quantum fluctuation. There are, however, problems with this theory, the most difficult being that it deals with creation in a space-time vacuum. The universe needs to come into existence not in a vacuum, but from *nothing*; no time and no space at all.

Hartle and Hawking, in presenting a theory for predicting a quantum mechanical wave function for the universe, suggest that the original state of the universe might not need to be in a distinct point in time. Rather they suggest that the earliest moments of existence might be described in terms of a smoothed out *quantum fuzz*, essentially a smearing of time and space. Thus there need not be a distinct moment of creation, and our classical understanding of conservation laws, and even of cause and effect need not apply here. In addition, according to Stephen Hawking, the entrance of quantum mechanics into our investigation opens the door for the idea of the universe coming to existence via the quantum mechanical process of *tunneling*[5] (Mireau 61). Accordingly, Hawking, currently the world's leading cosmologist, proposing this theory, sees no need for having the idea of a creator (*A Brief History of Time* 141). In his view, the universe brings itself into existence, simply because it can statistically. One need not grasp onto Hawking's theories so quickly however. His theory is based both on unifying the theories of General Relativity and Quantum Mechanics, a unification that has as of yet not been successful, and on the assumption that one can apply Quantum Mechanics to the entire universe, which has up until now dealt exclusively with isolated microscopic systems (Isham 401). In addition, it seems to me that the question of *how* the universe can exist, even in Hawking's understanding of a Quantum Mechanical process, still needs to be answered. Hawking himself might argue however that his theory of the universe is adequately self-contained.

It would seem that in attempting to solve questions regarding the nature and history of the universe or the existence of God, we are only led to more questions. It is possible that the insolubility of these issues is intrinsic to them. One may ask whether either science or philosophy can answer questions that seem to deal with subjects that are almost by definition beyond comprehension, like the theory of quantum mechanics, or the existence of a transcendent God. Nevertheless, science and philosophy will continue to use observation and theory to pursue an understanding of reality, that will hopefully, in the end, lead us to an understanding of our very selves and our place within that reality.

[4] The *Heisenburg Uncertainty Principle* essentially states that a particle's position and motion cannot be simultaneously known with complete accuracy. Because this is a physical reality, it allows for the possibility of spontaneous creation and destruction of particles so long as the principle itself is not violated.

[5] Tunneling involves the statistical possibility of a particle crossing an infinite potential barrier, something that is impossible in classical physics. Applied here, Hawking et al. consider the possibility of a particle tunneling from nothing, or from another position in which time and space are smeared together.

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