Article

Can Natural Laws Create Our Universe?

Man Ho Chan

Man Ho Chan

Stephen Hawking suggests that our universe can be created by natural laws without any supernatural explanation. In this article, I argue that it is not possible for natural laws or science to create our universe. Science can only illustrate how the universe evolves; it cannot explain why our universe exists. The existence of our universe can be addressed only by other disciplines such as religion or theology.

Modern astrophysics indicates that our universe has a beginning. We are living in a universe which was created 13 billion years ago.[1] A philosophical problem associated with this issue is why the universe comes into existence. A related issue is that the laws and parameters of our universe seem to be "fine-tuned" so that life can exist.[2] Can these provide the evidence to prove the existence of God?

In *The Grand Design*, Stephen Hawking and Leonard Mlodinow announced that modern science has found a way to address the problem of the beginning of the universe.[3] They deny that the existence of God should be taken into account and claim that the theories of gravitation and quantum mechanics are enough to provide a clear picture of how the universe begins. They suggest that our universe may not necessarily have a beginning, and suppose that the beginning of the universe was like the South Pole of Earth, with degrees of latitude playing the role of time. As one moves north, the circles of constant latitude, representing the size of the universe, would expand. The universe would start as a point at the South Pole. However, the South Pole is much like any other point. Technically speaking, Hawking and Mlodinow suggest that time at the very beginning is an imaginary number (e.g., $i^2 = -1$) rather than a real number, so that "t = 0" does not exist.[4] Therefore, our universe can be considered to have no boundary in space and time.[5]

Moreover, natural laws allow nearly infinitely many universes to exist, and they can explain why our universe seems to be fine tuned.[6] The extrapolation of string theory and inflation theory can provide a theoretical framework for the existence of nearly infinitely many universes. According to string theory, a particular Calabi-Yau manifold may represent a particular set of fundamental constants in nature. Mathematical estimation shows that there are 10^{500} possible types of Calabi-Yau manifold, and that the number of possible types should be finite.[7] In other words, if there really are many universes, and each universe is characterized by a particular Calabi-Yau manifold, there would be about 10^{500} possible universes existing in nature.[8] Hawking and Mlodinow suggest that all universes could be generated through this mechanism, and so we should not be surprised that our

Man Ho Chan *graduated from the Chinese University of Hong Kong in 2002. Later, he obtained his master's and doctoral degrees in physics in 2004 and 2009, respectively; Master of Arts in Christian studies in 2010; and postgraduate diploma in education in 2012 from the same university. Chan is now a lecturer in the physics department of the Chinese University of Hong Kong. His research interests include astrophysics, philosophy of science, and dialogue in science and religion.*

universe is fine tuned. Since there are so many universes with different fundamental constants, it is highly probable that the right set of fundamental constants that are life permitting will occur.

In this article, I claim that the problems of the beginning of the universe and its fine-tuning can never be explained by natural laws. These problems can be solved only with the help of other areas or disciplines, such as religion and theology.

What Can Science Explain?

Generally speaking, scientific laws are a set of laws that describe nature. Most of them are based on empirical studies, such as experiments and investigations. A scientific law can be established if numerous experiments are conducted and the results generated do not contradict that law. Therefore, most scientific laws, such as conservation of energy or Newton's law of gravitation, are based on countless repeatable experiments. These laws describe our universe and enable us to make predictions. For example, in physics, Newton's law of gravitation tells us how a particle moves under the action of gravity. We can also predict how the particle moves under given environmental constraints, or, in other words, under the initial conditions and under the forces acting on that particle. In this context, scientific laws are deterministic. What you need to provide are the necessary initial conditions. Otherwise, scientific laws cannot tell you the next step.

However, the rise of quantum mechanics tells us another story in modern science. In the small-scale regime, the wave nature of a particle becomes significant. The phenomenon of wave-particle duality makes an exact prediction impossible. The uncertainty principle tells us that you can never simultaneously measure the position and momentum of a particle precisely. Within the context of quantum physics, the particle's behavior becomes indeterminate. There may be many possible states that a particle can be in at a given time, but it will "fall into" only one of them when you measure it. The state of a particle can be described by a wave function, which is a superposition of (perhaps infinitely) many possible states. What you can do is calculate the probability that the particle will fall into a certain state; but you cannot guarantee this prediction for any particular instance of measurement.

Therefore, the combination of deterministic gravitation and indeterminate quantum physics is not that easy. Both the implicit natures of the theories themselves and the vastly different scales governed by these laws make it difficult. String theory is one of the theories tackling this problem in mathematical physics. Although no robust observations can prove the legitimacy of the theory, the picture of string theory is quite elegant and full of self-consistency. This theory invokes some extra dimensions and treats particles as strings instead of as points to reconcile both gravity and quantum mechanics, which, in turn, may provide a path to describe how our universe began. One of the implications of string theory is that there may be more than 10^{500} possible manifolds in the extra dimensions, and each manifold may correspond to one independent universe. Therefore, there may be more than 10^{500} different universes which have different physical laws and universal constants.[9]

Furthermore, the random nature of quantum physics enables our universe to start from nothing and come into existence. Hawking and Mlodinow used this idea to prove that we do not need the existence of God to explain either the beginning of the universe or the fine-tuning problem.[10] Since our universe is just one of many universes (or multiverse), we should not be surprised as to why our existence is so lucky. Can the above picture explain all that?

First of all, before I state my arguments, many scientists have already provided arguments to reject the idea of multiverse.[11] "Proof of parallel universes radically different from our own may still lie beyond the domain of science," Ellis said.[12] The existence of multiverse can be derived from string theory plus eternal inflation, but neither of them has been proven.[13] In addition, the existence of many universes does not necessarily mean that all of these universes can co-exist at any instant. Just as in quantum mechanics, there are infinitely many possible states for a particle to be in at a given time, but the particle can be found in only one state when we measure it. In other words, the existence of many universes in the mathematical model does not imply that they really exist simultaneously. Moreover, if a multiverse exists, it is highly probable that our universe would stay in a "dangerous region," in which the initial quantum fluctuation yielding our universe lies just at the edge of the life-permitting anthropic region. It is called the "principle of living dangerously." However, the observed value of the initial quantum fluctuation shows a negative result, weakening the theory of multiverse.[14] The assertion that the fine-tuning problem is already solved by science is far from being a consensus.

Science Cannot Explain Creation

For the beginning of the universe, I argue, in the following discussion, that science can never address this question. There are two ways to discuss this issue: (1) our universe has evolved from eternal existing energy, and (2) our universe is created from nothing. For the first case, science can never explain the assumption of eternal existing energy.

The second case is also beyond the scope of science. Some scientists think that matter and energy can be created from quantum fluctuations. It seems that quantum mechanics allows random physical processes in nature, and random fluctuations imply all possibilities. Therefore, matter and energy can be created in this oversimplified picture. However, although natural laws allow energy and matter to be created from quantum fluctuations, initial conditions and the existence of possible states also need to be taken into account. In quantum physics, "nothing" is not really nothing, but, rather, a state full of fluctuations. These fluctuations are essential conditions for creation and cannot be determined by natural laws. Therefore, natural laws can be regarded as necessary conditions for creation, but not as sufficient conditions.

C. S. Lewis had already pointed out that natural laws are more or less like the rule of addition.[15] Natural laws tell you that if you save $1,000 a month, you will have $3,000 after three months. Natural laws cannot guarantee that you will have $3,000 in the bank if you did not deposit any money. The actions (put money into the bank) together with the laws (addition rule) enable your money to accumulate correctly.[16] Similarly, initial conditions together with natural laws enable our universe to be created. Hawking suggests that our universe can be created based on existing scientific theories. However, these theories require initial conditions such as specifying the initial entropy, the initial (primordial) quantum fluctuations, and the initial inflation field.

Can natural laws create these quantum fluctuations and inflation field? The answer is no! If natural laws that govern the evolution of the universe are deterministic, as mentioned above, the initial conditions are essential. These conditions cannot be determined or described by natural laws. In fact, Hawking and Mlodinow are trying to develop "a law of initial conditions" through quantum gravity to address this problem. As noted above, they invoke the notion of imaginary time to blur the boundary at $t = 0$. It seems that we do not require initial conditions for creation.

However, there are a number of criticisms stating that the "imaginary time epoch" is ontologically unreal and unintelligible.[17] Strictly speaking, our universe is transformed from an ontologically *unreal* state to an ontologically *real* state. Our universe began to exist. Therefore, Hawking and Mlodinow's solution does not fully address the singularity problem but, rather, replaces it with another problem. If the natural laws that govern the evolution of the universe are fully indeterminate, then randomness is involved in creation, and probabilities should be taken into account. However, we can still ask, "Is the creation highly probable?" Whether the answer is yes or no, we need to further ask why.

Furthermore, logical difficulties will be encountered if we claim that natural laws could create the universe or multiverse. Since natural laws are derived from empirical studies in the existing natural world, how can they be used to describe a universe that is created from "nothing"? Is there a law that can describe "nothing" or that can transform "nothing" to "something"? If that is right, a law or logic should exist prior to space and time.[18] But we know that all physical laws are obtained from the real world (real space and time) and not from "nothing." The extrapolation of applying natural laws to creation (transforming "nothing" to "something") requires a leap of faith. Therefore, whether or not the law is deterministic, it is not possible to have "a law of initial conditions."

The theory of multiverse also states that there may be infinitely many universes that exist at the same time. Each universe may contain certain universal constants. As a result, different universes may have different natural laws. Since this theory is derived from existing scientific theories (string theory and inflation theory), do all universes satisfy a description based on string theory and inflation? If so, then how could these different universes have different universal constants and natural laws? If not, how could different natural laws in different universes be obtained from existing scientific theories? If string theory and inflation are the ultimate scientific theories that can apply to all universes, why are they so universal and so special? These questions are definitely beyond the scope of science.

Antony Flew thought that the existence of natural laws requires an explanation. The explanation cannot be addressed by natural law itself.[19] Therefore, science can only push the problems of creation to a more fundamental level, but it can never fully address this issue. In fact, it is quite easy for us to confuse the terms "cause" and "agency." Natural laws can tell you the cause of an event, given that all initial conditions are known. However, natural laws will not tell you who or what makes the laws (the agency). For example, natural laws can tell you how a steam engine works, but not who makes the steam engine.[20] Therefore, natural laws can only tell you "how" but not "who" or "why."[21] In other words, natural laws should be based on "methodological naturalism" rather than on "philosophical naturalism."

When Hawking and Penrose formulated their "Hawking-Penrose singularity theorem," this theorem suggested that our universe had a beginning. However, scientists still work hard to create different models to give solutions that avoid the existence of singularities. Mann suggests that the ideology of reductionism plays a crucial role. Nontheists generally regard the approach of reductionism as closing off any last gaps in which hopeful believers might want to place evidence for a deity.[22] However, none of the models suggested, including Hawking's "no boundary proposal," actually work.[23] Similarly, scientists also work on quantum gravity and string theories because they are not satisfied with the twenty-seven free parameters in the Standard Model of particle physics. Unfortunately, no successful results along these lines have yet been obtained by unifying quantum mechanics and general relativity. Mann comments that the failure of unifying quantum mechanics and general relativity is, in part, due to their very distinct conceptualizations of time.[24] All of these negative results may suggest that the Standard Model and the existence of singularities have already reached the limits of science.

What Can Explain Creation?

If science cannot explain the creation event, then which discipline can possibly do so? Intuitively speaking, the existence of a supernatural being may be a possible solution. Since all natural laws cannot explain the origin of natural objects, some supernatural forces should be taken into account. Therefore, the only way to address the origin of our universe is by seeking the supernatural source that creates the natural laws and initial conditions. This argument is known as the Kalam argument. The argument can be formulated as follows:[25]

P1: Whatever begins to exist has a cause of its coming to exist.

P2: The universe began to exist.

C: The universe has a cause of its coming to exist.

The conclusion, C, derived from the two premises, P1 and P2, needs an explanation. Natural laws support P1. However, natural laws cannot guarantee P2. Nevertheless, based on recent observations from cosmological microwave background, P2 is empirically true. Therefore, natural laws cannot be the cause of our universe. Generally, most philosophers believe that the existence of God is the ultimate cause or explanation. They advocate the doctrine of divine simplicity, which means that God is claimed to be absolutely simple without any internal complexity.[26] Therefore, God is the simplest being, and it is not necessary to transfer the existence of God to one higher level of simplicity.

Conclusion

To conclude, the two biggest problems in science and religion, the creation of the universe and the fine-tuning problem, can never be addressed by science. We should start from other disciplines such as religion to get the answers.

Notes

[1] D. N. Spergel et al., "Three-Year *Wilkinson Microwave Anisotropy Probe (WMAP)* Observations: Implications for Cosmology," *Astrophysical Journal Supplement* 170, no. 2 (2007): 377–408.

[2] M. J. Ree, *Just Six Numbers: The Deep Forces That Shape the Universe* (New York: Basic Books, 2000); A. E. McGrath, *A Fine-Tuned Universe: The Quest for God in Science and Theology* (Louisville, KY: Westminster John Knox Press, 2009).

[3] S. Hawking and L. Mlodinow, *The Grand Design* (New York: Bantam Books, 2010).

[4] An imaginary number is usually expressed as z = a + bi, where $i = \sqrt{-1}$ and a, b are real numbers.

[5] Hawking and Mlodinow, *The Grand Design*, 134–5.

[6] Ibid., 142.

[7] S.-T. Yau and S. Nadis, *The Shape of Inner Space: String Theory and the Geometry of the Universe's Hidden Dimensions* (New York: Basic Books, 2010).

[8] Hawking and Mlodinow, *The Grand Design*, 118.

[9] Yau and Nadis, *The Shape of Inner Space*.

[10] Hawking and Mlodinow, *The Grand Design*.

[11] P. J. Steinhardt, "The Inflation Debate," *Scientific American* (April 2011): 38–43.

[12] G. F. R. Ellis, "Does the Multiverse Really Exist?" *Scientific American* 305 (July 2011): 38–43.

[13] D. F. Watson, "On the Anthropic Principle in the Multiverse: Addressing Provability and Tautology" (March 30, 2011): arXiv: 1103.6044.

[14] L. A. Barnes, "The Fine-Tuning of the Universe for Intelligent Life," *Publications of the Astronomical Society of Australia* 29 (2012): 529–64.

[15] C. S. Lewis, *Miracles* (London: Fontana, 1974).

[16] J. C. Lennox, *God and Stephen Hawking: Whose Design Is It Anyway?* (Oxford: Lion Books, 2011).

[17] W. L. Craig and J. D. Sinclair, "The Kalam Cosmological Argument," in *The Blackwell Companion to Natural Theology*, ed. W. L. Craig and J. P. Moreland (Oxford: Wiley-Blackwell, 2009), 179.

[18] Ibid.

[19] A. Flew, *There Is a God* (New York: HarperCollins, 2007).

[20] R. J. Asher, *Evolution and Belief* (Cambridge: Cambridge University Press, 2012), 5.

[21] Ibid., 14–15.

[22] R. B. Mann, "Physics at the Theological Frontiers," *Perspectives on Science and Christian Faith* 66, no. 1 (2014): 2–12.

[23] See the discussion from Craig and Sinclair, "The Kalam Cosmological Argument," 132–82.

[24] Mann, "Physics at the Theological Frontiers."

[25] M. J. Murray and M. Rea, *An Introduction to the Philosophy of Religion* (Cambridge: Cambridge University Press, 2008), 143.

[26] R. Collins, "The Teleological Argument," in *The Routledge Companion to Philosophy of Religion*, ed. C. Meister and P. Copan (New York: Routledge, 2007), 411–21.

ASA Members: Submit comments and questions on this communication at www.asa3.org → FORUMS → PSCF DISCUSSION.