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Probability and Philosophical Value of Multiverse Theories

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ABSTRACT

In this century, the proliferation of multiverse theories transformed people's perception of reality once again, expanding the boundary of the cosmos to include an infinity of "infinite" universes. However, such speculations are inherently proofless, which arouses heated debate around the multiverse's likelihood and potential impact on our universe. Focusing on these two aspects, this article reviews nine prominent multiverse theories raised in Brian Greene's Hidden Reality and Michio Kaku's In Parallel world and considers the philosophical value of current multiverse research. This article reveals the limitations of the Observer First world view adopted by the scientific method and discusses an alternative World First perspective in understanding reality, which would revolute the relationship between physics and philosophy as disciplines.

In the 2016 book *Why String Theory?* Joseph Conlon includes only one sentence in the chapter on experimental data for string theory. The bare page reads: "There is no experimental evidence on string theory."[1] Decades of work done on string theory all seem to become empty or trivial at once. Without observation or experimentation, string theory is reduced to no more than fiction. But in this essay, I will argue that just because something is unobservable does not mean it is unlikely or untrue. Instead, considering the limits of observation itself could be the only springboard that propels us further into a reality beyond the observable, revolutionizing how we relate to nature.

For so long, observation and experimentation have been the two pillars of scientific methods and the only credible way to validate something as "real." With the development of telescopes, our concept of cosmic reality expanded from our little, local solar system to the whole Milky Way galaxy and eventually to an entire observable universe. We have now reached what appears to be an uncrossable limit, dictated by the laws of physics—the furthest distance light has traveled, or "the cosmic horizon."[2] Likewise, with the development of microscopes, the microscopic world came to include molecules, atoms, and even sub-atomic particles. We reached a different limit here. Quantum behaviors conflict with the laws governing cosmic structures. Therefore, at both the macroscopic and microscopic levels of reality, we hit the border of what our physics can probe using the scientific method. But is there a reality beyond these boundaries?

This question led to the rapid proliferation of multiverse theories around the turn of the 21st century. Several physicists, such as Andrei Linde, Alan Guth, Hugh Everett, and Leonard Susskind, have developed varied interpretations of the multiverse from varied theoretical perspectives. Braine Greene summarizes them into nine major variations in his book *The Hidden Reality:* the quilted multiverse, the inflationary multiverse, the brane multiverse, the cyclic multiverse, the landscape multiverse, the holographic multiverse, the quantum multiverse, the ultimate multiverse, and the simulated multiverse.[3] Without going into heavy details, it is crucial to notice that each of these variations has a different picture of metaphysical reality. "In some, the parallel universes are separated from us by enormous stretches of space or time; in others, they're hovering millimeters away; in others still, the very notion of their location proves parochial, devoid of meaning," Greene told us.[4] From this list Greene provides, it may seem that the term "Multiverse" embodies countless definitions at once. So, what exactly does multiverse mean? Is there something these different theories of the multiverse all have in common?

I would argue that there are two characteristics holding these different variations together: 1) the multiverse may encompass diverse sets of physical laws and potentially different universes within which these laws are enacted, and 2) our inability to collect data or perform observations on the multiverse because it is beyond our local set of physical laws. First, different physical laws and configurations can exist simultaneously in the multiverse. Some may appear like ours, but some may have "forms and structures unlike anything we've ever encountered." [5] In the immense multiverse, physical laws that program everything in our universe, such as the first law of thermodynamics, are only one of the many. Due to our own embodiment that strictly obeys the physical laws that make the "cosmic horizon" the boundary of our observable universe, no matter how much our technology improves, we can never cross the horizon to observe, collect data, or run experiments. Aside from being technologically impossible to probe, the multiverse is also unobservable through experimentation. Experiments rely on reproducibility, which assumes constant physical laws whenever and wherever, which is not a premise in the multiverse. It is, therefore, nonsensical to imagine applying the scientific method to test a reality that exceeds the laws of physics itself.

Although scientifically unprovable, the multiverse theory is not theoretically impossible. Rigorous deductions provide a solid theoretical basis for multiverse theories to become "true." If reality operates the same way as theory, the existence of multiverse would provide an extraordinary framework for explaining phenomena unexplainable by our physical laws. Since anything beyond the cosmic horizon is no longer governed by our universe's speed limit, the speed of light, anything in the multiverse could follow a different set of rules and configurations. Therefore, if the multiverse would ever leave evidence on our universe, such traces would appear in phenomena incompatible with our physical laws. If we presume incompatibility as evidence of the multiverse, the quantum realm would be the key to unveiling the multiverse's mysteries.

The double-slit experiment is an example of how quantum behaviors exceed classical physics because photons can shift from wave to particle when observed. Quantum theorist Howard Wiseman, therefore, reasoned that everything in our universe might be "entangled with some other large system with hidden variables that we are unaware of" that may inform quantum phenomena, including entanglement and superposition. [6] These effects are incompatible with classical physical laws, implying that there must be a reality more fundamental than our local physical universe.

Constrained by scientific methods within our physical universe, we are not capable of knowing if the multiverse is "true" (or "false"). For the past few centuries, we have validated concepts as "true" based on an "Observer First Principle," — a term invented by Nick Bostrom to describe a belief that something only becomes true when we observe it or have data clearly suggesting its existence. [7] Einstein has constructed the general theory of relativity, but it was not until 1919, when people observed evidence of his equation from a solar eclipse, that his theory became true. The English Poet John Keats put this concept in simpler terms: "nothing ever becomes real till it is experienced." [8] However, our anthropocentric observation is deeply subjected to anthropic bias. That is, we only see what we can see, and we can only see a reality that supports our existence, rendering us oblivious to the potential aspects of reality that we cannot see. For example, imagine yourself as an ant crawling on an LED television screen. There are tiny pixels that light up in blue, red, and yellow. When you look at the screen from a distance, tiny pixels form a full picture. But if you are an ant hovering over one pixel, all you observe is that one single pixel under your feet. The observer-first principle would lead you to believe that your whole world is that one LED pixel. Like many of our scientists, the ant might discover equations that predict how and why LED lights shine the way they do, but the ant will never be able to solve the entire screen or comprehend the "full picture." Like our scientific knowledge, which is rooted in only observing our universe, we cannot deduce the entirety of the multiverse from our local position. This example illustrates how the multiverse theory is different from other scientific breakthroughs and how we have reached a limit to solving for full" reality. From Galileo to Einstein, scientists have derived theories by summarizing observed patterns, which were later validated through observation. But if we only use observation and experimentation, there would be no theories of the multiverse at all. Relying on an observer-first principle would fail to open us up to the possibility that reality stretches beyond the observable into a multiverse. Returning to the original question- Can we ever know if the multiverse is true? From our perspective, the answer is No.

Nevertheless, just like the one LED pixel that the ant observes does not constitute the whole picture on the television screen, reality from an anthropic perspective is not the full reality. So, the more accurate question to ask is: will we ever know if the multiverse is true if it remains beyond human perception? We cannot answer definitively. We label things as true or false after scrutinizing them under the scientific method. But not everything in reality is testable by the scientific method, which is an observer-first and human-centered perception of reality. So, reality itself is not inherently true or false. It needs observers like us to put the "true" or "false" labels on them. In other words, a concept can only be "true" if there is an observer in charge of the labeling. If there is no observer, as the question indicated, then it is impossible to know if the multiverse is ever "true" or "false."

Similarly, to question the "likelihood" of the multiverse is ultimately futile. To find the likelihood of picking a red card from a deck of cards, we need to know the number of cards in that deck and the number of red cards in it. To find the likelihood of the multiverse, we need to know the number of all possible outcomes beyond the cosmic horizon and the outcomes where the multiverse exists. To satisfy such premises, we would need data directly suggesting what might be beyond the cosmic horizon, which is impossible by the very definition of what the multiverse is. So, if we have no data, then the possible outcomes are infinite, the math is broken, and the question of "likelihood" is meaningless. In short, it is insensible to discuss both the likelihood and truth of multiverse theories that are beyond what is scientifically observable by human observers. In short, it is insensible to discuss both the likelihood and truth of multiverse theories that are beyond what is scientifically observable by human observers. Even though the multiverse's existence is unanswerable by our scientific principles, this very effect of multiverse theories puts scientific principles into question. By failing to answer the multiverse's truth value and likelihood, we challenge the authority that the observer-first principle has established in determining reality. To think beyond a human-only perception, we need to adopt a new paradigm— the World First Principle. Instead of raising a question, then finding solutions based on observation and experimentation, the world-first principle starts by taking observation as an effect. Specifically, our existence and our physical laws are one effect of the multiverse. We can then consider what conditions the multiverse would need to encompass for our physical world to emerge from it in the way it does. However, what is controversial about this new mindset is that it no longer requires direct physical evidence of the multiverse's existence. For example, Braine Greene, who writes books on multiverse theories, stated that " no one should be convinced— of anything not supported by hard data." [9] But now, it is becoming increasingly imperative to introduce metaphysics into conversation with physics if we want to think more carefully and fully about the nature of fundamental reality. In short, discovering the limit of classical scientific thinking through multiverse theories allows us to change our orientation when probing reality by redefining science's relationship with philosophy.

In essence, although we can never know the multiverse's "likelihood" or "trueness," theories of the multiverse can still influence our everyday lives by how we produce knowledge. Dwelling in the observer-first approach for centuries, science has ingrained a reality from our human perspective instead of acknowledging that reality may exceed observation and experimentation. Multiverse theories thus humble science as a discipline and encourage us to explore forms of knowledge beyond our anthropic perception through communicating with philosophy or metaphysics. To attune human knowledge more closely to full reality, science and philosophies would need to start a dialogue. If this dialogue were already underway, perhaps that empty chapter on string theory would be full.

References

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[4] ibid,10.

[5]ibid.

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[7] Bostrom, Nick. Anthropic Bias: Observation Selection Effects in Science and Philosophy. Routledge, 2010.

[8] Kaku,182

9 Greene,14.

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