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What Krauss and Scherrer's "End of Cosmology" Scenario Means for the Epistemology of Modern-Day Cosmology

by Jonathan Bartlett on September 18, 2017

Abstract

While likely intended as a playful hypothetical scenario, Krauss and Scherrer's essay "The Return of a Static Universe and the End of Cosmology," about the state of cosmology 100 billion years from now, has very important implications for the epistemology of science today and the humility required when analyzing evidence.

Introduction

Lawrence Krauss and Robert J. Scherrer surprised the cosmology world in 2007 when they published an essay titled "The Return of a Static Universe and the End of Cosmology." The paper showed that, assuming the truth of the current big bang model, in the far future (hundreds of billions of years from now) many evidences for the big bang itself will be gone, preventing future cosmologists from even being able to detect evidence for it.

In these papers, it is noted that, assuming the big bang model is true, at some point in the future, galaxies will be far enough away from each other as to not be seen. Within a galaxy, the operation of physics is relatively static. Therefore, at some point in the future, we will not be able to witness some of the more dynamic effects of expansion, which were critical in the development of big bang cosmology.

Because cosmic expansion is a fundamental piece of evidence for the big bang theory, these cosmologists note that, since cosmic expansion cannot be observed, future cosmologists will conclude, based on the data available to them, that we live in a static universe. Krauss and Scherrer call this situation the "end of cosmology" because the data available for reaching the same conclusions as these cosmologists will simply not be accessible to them.

At-a-Glance

- Secular cosmologists have shown that there will be points in time when the experimental evidence points to a false view of the cosmology.
- The problem of strict empiricism is that it prevents the acquisition of knowledge from other sources, which may sometimes be corrective to experimental evidence.
- Many scientists today lack the philosophical insights and reflectivity required to see that the limits of inquiry may be just as well applied to the present as to some distant future.
- In a comprehensive epistemology (theory of knowledge), experimental evidence is important, but is only one of many types of evidence that can be used to form conclusions, and is not inerrant, *even when the experiments are validly performed*.
- Sometimes theories about the universe can say more about the people forming the theories than they do about the universe.

The conclusion that Krauss and Scherrer come to after this examination of the present and future state of cosmology is that we live in a very special time in the universe. We live in a time

when it is possible to make the needed observations to tell us what the big bang was like. If we lived in some other time, the data would point to incorrect conclusions about what the universe is really like and about the history of the universe.

The Hubris of Modern Cosmology

Whenever I look at a thing, I always try to look at it from more than one direction. Sometimes you learn something staring at something back-to-front that you wouldn't see front-to-back. So, when faced with data that says future cosmology will be unable to infer a correct picture of the universe based on the available observational data, an obvious question for any philosophically minded person is, "Might this be presently happening to us?"

Think about it this way—Krauss and Scherrer have shown that, if the current consensus model of the universe is true, the observations of future scientists will lead them to misunderstand the universe. That is, there is more than one model that will produce a given set of observables, and the most straightforward interpretation of presently available data might actually lead you to false conclusions. This is what Krauss and Scherrer have demonstrated.

What they fail to do is to ask the question, "What if *we* are the people for whom the data is pointing in the wrong direction?" Krauss and Scherrer demonstrate that observations can in fact point to the wrong model, but they fail to see that this same situation could be applied to themselves. It could be *our* observations that are pointing in the wrong direction.

> *IT COULD BE OUR OBSERVATIONS THAT ARE POINTING IN THE WRONG DIRECTION.*

How would we know? The model presented by Krauss and Scherrer don't give any way for the observers to know whether their observations imply a true model or a tail end of a model that they aren't able to perceive and for which the evidence is largely scattered.

It amazes me that Krauss and Scherrer never seem to even consider this possibility. This is pure hubris. They simply presume that they must be the ones living in the time where their observations lead to correct conclusions, and it does not even enter their minds that they are on the other side of a different model that they themselves have trouble conceiving of, and of which much of the evidence has been long scattered.

Science and Epistemology

This leads to some important questions about science, knowledge, and science's ability to inform our knowledge. The inability to stick the universe in a lab and run a simulation of a new universe means that all of our information about the nature of the universe is entirely based on circumstantial evidence. We may have clues and signs, but we have no guarantees that these will paint a coherent picture. In fact, Krauss and Scherrer have proven that, at least at some point in time (whether today or in the future), the available clues will paint a picture that is quite coherent but fundamentally wrong.

Part of the problem is within the subject of cosmology itself. Science grew up thinking in the small. It dealt with forces and features of the universe that could be defined and delimited. Experiments could be parameterized, and the validity of any parameter could be examined and questioned within the confines of even more parameters. We normally call this sort of science "experimental" science, because for nearly every conceivable question, objection, or parameter that you can conceive of, you can also devise an experiment to test the ideas and see if they continue to hold.

However, other kinds of science (often termed "historical" science, but that is merely a partial subset) do not have this ability to experiment. Scientists cannot test every possibility, but instead must deal with the limited sets of data they are given. In astronomy, we cannot rearrange the planets in any odd assemblage and see what happens. In geology, we cannot rearrange large mountains and give tectonics a push to see what happens. We tend to view this as a problem only in historical sciences, but it is actually a problem with any science once it escapes the confines of a laboratory.

> *THERE ARE UNDOUBTEDLY SOME WHO WILL WANT TO DO AWAY WITH ANY SCIENCE THAT IS NOT EXPERIMENTAL.*

There are undoubtedly some who will want to do away with any science that is not experimental. Not only do I disagree with this, but it is impossible to do! Humans, made in the image of God, ask big questions. The important thing is to face with humility the limitations with which we can answer them. We can use ideas from science to try to answer bigger questions about the natural world and the universe, but that is merely one possible approach among many. As Krauss and Scherrer have inadvertently shown, science based entirely on inference from observation is guaranteed to be wrong about these larger issues at least some of the time. Thus, it would be wrong to imbue them with undue authority. It is certainly an interesting perspective, but they have themselves shown that it doesn't have the epistemological weight of other kinds of inquiry.

There is a further question of whether or not one can even attempt to answer these questions from science alone. As Stephen Hawking noted in *The Large Scale Structure of Space Time*, "We are not able to make cosmological models without some admixture of ideology" (Hawking, 1975, 134). In other words, there will always be questions for which nonscientific reasoning will have to be used in order to fill in gaps.

Two Epistemologies of Future Cosmologists

We can use the scenario that Krauss and Scherrer have painted to run a thought experiment. For this thought experiment, let's suppose that big bang cosmology is true, and Hawking's *A Brief History of Time* (hereafter, *BHoT*) is a reasonable approximation to what happened in the early universe. Now, in the intervening years, let us say that *BHoT* is passed down from cosmologist to cosmologist. Some people may expand it, update it, footnote it, or even write similar books, but by and large *BHoT* is so well written that people simply prefer to refer back to *BHoT*.

This handing down of *BHoT* from generation to generation then continues to occur over the next hundred billion years. However, as time goes on, cosmologists start noticing more and more that the observations of the cosmos do not match up with what is in the universe. *BHoT* refers to quasars, but nobody sees any. Other galaxies? No observational evidence exists. Expansion? All of the observable objects will be gravitationally bound and not subject to expansion.

So then we wind up with two cosmologists. Sam is an avid reader of ancient texts. He has studied *BHoT* extensively, as well as the footnotes and texts written about it throughout the ages. He has determined that while the present age looks like a static universe, it should really be interpreted through the lens of *BHoT*. After all, Hawking was around when the universe was in its earliest stages, and recorded its observations for us.

Sam, however, has a colleague, Jim. Jim insists that science relies on observations, not on commitments to ancient texts. As such, he has trouble seeing why Sam is so attached to ancient writings about the cosmos. It is clear that either they were just making up stories, or their equipment was so old-fashioned that it just appeared to look that way. Jim has been studying the cosmos for his entire adult life. He has used telescopes and even invented new kinds of telescopes. He may have even traveled between solar systems. Jim also has a lot of friends who travel with him, solar system to solar system, observing the known universe.

Jim and all of his friends agree that there is absolutely nothing in their observations that would lead them to believe that the universe was anything but static. Sam, though not having read Krauss and Scherrer, makes the suggestion that perhaps it just looks that way *now*, and that, after so much expansion, the expanding parts are too far away to be seen. Jim is laughing now. Sam's excuse is that the evidence has disappeared? What will he think of next!

As you can see, Sam and Jim follow two different epistemologies. Sam takes seriously what has come before him, and Jim is only willing to consider facts that are experimentally verifiable. According to Krauss and Scherrer, in this hypothetical scenario, it will be Sam who is closer to the truth, not Jim.

That alone is not evidence for any particular alternative to experimental evidence, but it does demonstrate both that experimental evidence is merely one of the modes of knowledge, and that traditional knowledge cannot be *a priori* excluded from consideration. I don't suggest to provide an entire epistemology here, but merely to offer up the suggestion that good epistemology is a far deeper well than many people today admit.

Conclusions

A BETTER PATH IS APPROPRIATE HUMILITY TOWARD THE LIMITS OF WHAT WE CAN OBSERVE, WHAT WE CAN KNOW, AND WHAT WE CAN PROVE.

I don't claim to know which particular cosmological model we should follow. There are several interesting contenders, such as the Hartnett-Carmeli model and Jason Lisle's Anisotropic Synchrony Convention. What I do know is that hubris about the reliability with which experimental observations alone, untempered by any other consideration, is not only *likely* to lead in the wrong direction, Krauss and Scherrer have shown that it is *mathematically guaranteed*. A better path is appropriate humility toward the limits of what we can observe, what we can know, and what we can prove. This is expressed much more carefully in a paper on the same topic from three decades earlier by Rothman and Ellis. Having more of a philosophical background (as opposed to Krauss' stated antiphilosophical stance, as demonstrated in Ross Andersen's article "Has Physics Made Philosophy and Religion Obsolete?"), Rothman and Ellis pointed out that it might be that "our theories reflect not so much the features of the Universe but rather the age in which they were invented." If only present cosmologists would maintain such humility at the task before them.

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