Has Physics Made Philosophy and Religion Obsolete?
By Ross Andersen

"I think at some point you need to provoke people. Science is meant to make people uncomfortable."

It is hard to know how our future descendants will regard the little sliver of history that we live in. It is hard to know what events will seem important to them, what the narrative of now will look like to the twenty-fifth century mind. We tend to think of our time as one uniquely shaped by the advance of technology, but more and more I suspect that this will be remembered as an age of *cosmology*---as the moment when the human mind first internalized the cosmos that gave rise to it. Over the past century, since the discovery that our universe is expanding, science has quietly begun to sketch the structure of the entire cosmos, extending its explanatory powers across a hundred billion galaxies, to the dawn of space and time itself. It is breathtaking to consider how quickly we have come to understand the basics of everything from star formation to galaxy formation to *universe formation*. And now, equipped with the predictive power of quantum physics, theoretical physicists are beginning to push even further, into new universes and new physics, into controversies once thought to be squarely within the domain of theology or philosophy.

In January, Lawrence Krauss, a theoretical physicist and Director of the Origins Institute at Arizona State University, published *A Universe From Nothing: Why There Is Something Rather Than Nothing*, a book that, as its title suggests, purports to explain how something---and not just any something, but the entire universe---could have emerged from nothing, the kind of nothing implicated by quantum field theory. But before attempting to do so, the book first tells the story of modern cosmology, whipping its way through the big bang to microwave background radiation and the discovery of dark energy. It's a story that Krauss is well positioned to tell; in recent years he has emerged as an unusually gifted explainer of astrophysics. One of his lectures has been viewed over a million times on YouTube and his cultural reach extends to some unlikely places---last year Miley Cyrus came under fire when she tweeted a quote from Krauss that some Christians found offensive. Krauss' book quickly became a bestseller, drawing raves from popular atheists like Sam Harris and Richard Dawkins, the latter of which even compared it to *The Origin of Species* for the way its final chapters were supposed to finally upend the "last trump card of the theologian."

By early spring, media coverage of "A Universe From Nothing" seemed to have run its course, but then on March 23rd the New York Times ran a blistering review of the book, written by David Albert, a philosopher of physics from Columbia University. Albert, who has a PhD in theoretical physics, argued that Krauss' "nothing" was in fact a something and did so in uncompromising terms:

"The particular, eternally persisting, elementary physical stuff of the world, according to the standard presentations of relativistic quantum field theories, consists (unsurprisingly) of relativistic quantum fields... they have nothing whatsoever to say on the subject of where those fields came from, or of why the world should have consisted of the particular kinds of fields it does, or of why it should have consisted of fields at all, or of why there should have been a world in the first place. Period. Case closed. End of story."

Because the story of modern cosmology has such deep implications for the way that we humans see ourselves and the universe, it must be told correctly and without exaggeration---in the classroom, in the press and in works of popular science. To see two academics, both versed in theoretical physics, disagreeing so intensely on such a fundamental point is troubling. Not because scientists shouldn't disagree with each other, but because here they're disagreeing about a claim being disseminated to the public as a legitimate scientific discovery. Readers of popular science often assume that what they're reading is backed by a strong consensus. Having recently interviewed Krauss for a different project, I reached out to him to see if he was interested in discussing Albert's criticisms with me. He said that he was, and mentioned that he would be traveling to New York on April 20th to speak at a memorial service for Christopher Hitchens. As it happened, I was also due to be in New York that weekend and so, last Friday, we were able to sit down for the extensive, and at times contentious, conversation that follows.

I know that you're just coming from Christopher Hitchens' memorial service. How did that go?

Krauss: It was a remarkable event for a remarkable man, and I felt very fortunate to be there. I was invited to give the opening presentation in front of all of these literary figures and dignitaries of various sorts, and so I began the only way I think you can begin, and that's with music from Monty Python. That got me over my initial stage fright and my concern about what to say about someone as extraordinary as Christopher. I was able to talk about a lot of the aspects of Christopher that people may not know about, including the fact that he was fascinated by science. And I also got to talk about what it felt like to be his friend.

I closed with an anecdote, a true story about the last time I was with him. I was reading the New York Times at his kitchen table, and there was an article about the ongoing effort to keep Catholic students at elite colleges like Yale from losing their faith. The article said something like "faced with Nietzsche, coed dorms, Hitchens, and beer pong, students are likely to stray." There are two really amazing aspects of that. For one, to be so culturally ubiquitous that you can be mentioned in a sentence like that without any further explanation is pretty exceptional. But also to be sandwiched between "Nietzsche" and "beer pong" is an honor that very few of us can ever aspire to.

I want to start with a general question about the relationship between philosophy and physics. There has been a fair amount of sniping between these two disciplines over the past few years. Why the sudden, public antagonism between philosophy and physics?

Krauss: That's a good question. I expect it's because physics has encroached on philosophy. Philosophy used to be a field that had content, but then "natural philosophy" became physics, and physics has only continued to make inroads. Every time there's a leap in physics, it encroaches on these areas that philosophers have carefully sequestered away to themselves, and so then you have this natural resentment on the part of philosophers. This sense that somehow physicists, because they can't spell the word "philosophy," aren't justified in talking about these things, or haven't thought deeply about them---

Is that really a claim that you see often?

Krauss: It is. Philosophy is a field that, unfortunately, reminds me of that old Woody Allen joke, "those that can't do, teach, and those that can't teach, teach gym." And the worst part of philosophy is the philosophy of science; the only people, as far as I can tell, that read work by philosophers of science are other philosophers of science. It has no impact on physics what so ever, and I doubt that other philosophers read it because it's fairly technical. And so it's really hard to understand what justifies it. And so I'd say that this tension occurs because people in philosophy feel threatened, and they have every right to feel threatened, because science progresses and philosophy doesn't.

On that note, you were recently quoted as saying that philosophy "hasn't progressed in two thousand years." But computer science, particularly research into artificial intelligence was to a large degree built on foundational work done by philosophers in logic and other formal languages. And certainly philosophers like John Rawls have been immensely influential in fields like political science and public policy. Do you view those as legitimate achievements?

Krauss: Well, yeah, I mean, look I was being provocative, as I tend to do every now and then in order to get people's attention. There are areas of philosophy that are important, but I think of them as being subsumed by other fields. In the case of descriptive philosophy you have literature or logic, which in my view is really mathematics. Formal logic is mathematics, and there are philosophers like Wittgenstein that are very mathematical, but what they're really doing is mathematics---it's not talking about things that have affected computer science, it's mathematical logic. And again, I think of the interesting work in philosophy as being subsumed by other disciplines like history, literature, and to some extent political science insofar as ethics can be

said to fall under that heading. To me what philosophy does best is reflect on knowledge that's generated in other areas.

I'm not sure that's right. I think that in some cases philosophy actually generates new fields. Computer science is a perfect example. Certainly philosophical work in logic can be said to have been subsumed by computer science, but subsumed might be the wrong word---

Krauss: Well, you name me the philosophers that did key work for computer science; I think of John Von Neumann and other mathematicians, and---

But Bertrand Russell paved the way for Von Neumann.

Krauss: But Bertrand Russell was a mathematician. I mean, he was a philosopher too and he was interested in the philosophical foundations of mathematics, but by the way, when he wrote about the philosophical foundations of mathematics, what did he do? He got it wrong.

But Einstein got it wrong, too---

Krauss: Sure, but the difference is that scientists are really happy when they get it wrong, because it means that there's more to learn. And look, one can play semantic games, but I think that if you look at the people whose work really pushed the computer revolution from Turing to Von Neumann and, you're right, Bertrand Russell in some general way, I think you'll find it's the mathematicians who had the big impact. And logic can certainly be claimed to be a part of philosophy, but to me the content of logic is mathematical.

Do you find this same tension between theoretical and empirical physics?

Krauss: Sometimes, but it shouldn't be there. Physics is an empirical science. As a theoretical physicist I can tell you that I recognize that it's the experiment that drives the field, and it's very rare to have it go the other way; Einstein is of course the obvious exception, but even he was guided by observation. It's usually the universe that's surprising us, not the other way around.

Moving on to your book "A Universe From Nothing," what did you hope to accomplish when you set out to write it?

Krauss: Every time I write a book, I try and think of a hook. People are interested in science, but they don't always know they're interested in science, and so I try to find a way to get them interested. Teaching and writing, to me, is really just seduction; you go to where people are and you find something that they're interested in and you try and use that to convince them that they should be interested in what you have to say.

The religious question "why is there something rather than nothing," has been around since people have been around, and now we're actually reaching a point where science is beginning to address that question. And so I figured I could use that question as a way to celebrate the revolutionary changes that we've achieved in refining our picture of the universe. I didn't write the book to attack religion, per se. The purpose of the book is to point out all of these amazing things that we now know about the universe. Reading some of the reactions to the book, it seems like you automatically become strident the minute you try to explain something naturally.

Richard Dawkins wrote the afterword for the book---and I thought it was pretentious at the time, but I just decided to go with it---where he compares the book to The Origin of Species. And of course as a scientific work it doesn't some close to The Origin of Species, which is one of the greatest scientific works ever produced. And I say that as a physicist; I've often argued that Darwin was a greater scientist than Einstein. But there is one similarity between my book and Darwin's---before Darwin life was a miracle; every aspect of life was a miracle, every species was designed, etc. And then what Darwin showed was that simple laws could, in principle,

plausibly explain the incredible diversity of life. And while we don't yet know the ultimate origin of life, for most people it's plausible that at some point chemistry became biology. What's amazing to me is that we're now at a point where we can plausibly argue that a universe full of stuff came from a very simple beginning, the simplest of all beginnings: nothing. That's been driven by profound revolutions in our understanding of the universe, and that seemed to me to be something worth celebrating, and so what I wanted to do was use this question to get people to face this remarkable universe that we live in.

Your book argues that physics has definitively demonstrated how something can come from nothing. Do you mean that physics has explained how particles can emerge from so-called empty space, or are you making a deeper claim?

Krauss: I'm making a deeper claim, but at the same time I think you're overstating what I argued. I don't think I argued that physics has definitively shown how something could come from nothing; physics has shown how plausible physical mechanisms might cause this to happen. I try to be intellectually honest in everything that I write, especially about what we know and what we don't know. If you're writing for the public, the one thing you can't do is overstate your claim, because people are going to believe you. They see I'm a physicist and so if I say that protons are little pink elephants, people might believe me. And so I try to be very careful and responsible. We don't know how something can come from nothing, but we do know some plausible ways that it might.

But I am certainly claiming a lot more than just that. That it's possible to create particles from no particles is remarkable---that you can do that with impunity, without violating the conservation of energy and all that, is a remarkable thing. The fact that "nothing," namely empty space, is unstable is amazing. But I'll be the first to say that empty space as I'm describing it isn't necessarily nothing, although I will add that it was plenty good enough for Augustine and the people who wrote the Bible. For them an eternal empty void was the definition of nothing, and certainly I show that that kind of nothing ain't nothing anymore.

But debating physics with Augustine might not be an interesting thing to do in 2012.

Krauss: It might be more interesting than debating some of the moronic philosophers that have written about my book. Given what we know about quantum gravity, or what we presume about quantum gravity, we know you can create space from where there was no space. And so you've got a situation where there were no particles in space, but also there was no space. That's a lot closer to "nothing."

But of course then people say that's not "nothing," because you can create something from it. They ask, justifiably, where the laws come from. And the last part of the book argues that we've been driven to this notion---a notion that I don't like---that the laws of physics themselves could be an environmental accident. On that theory, physics itself becomes an environmental science, and the laws of physics come into being when the universe comes into being. And to me that's the last nail in the coffin for "nothingness."

It sounds like you're arguing that 'nothing' is really a quantum vacuum, and that a quantum vacuum is unstable in such a way as to make the production of matter and space inevitable. But a quantum vacuum has properties. For one, it is subject to the equations of quantum field theory. Why should we think of it as nothing?

Krauss: That would be a legitimate argument if that were all I was arguing. By the way it's a nebulous term to say that something is a quantum vacuum in this way. That's another term that these theologians and philosophers have started using because they don't know what the hell it is, but it makes them sound like they know what they're talking about. When I talk about empty space, I am talking about a quantum vacuum, but when I'm talking about no space whatsoever, I don't see how you can call it a quantum vacuum. It's true that I'm applying the laws of quantum mechanics to it, but I'm applying it to nothing, to literally nothing. No space, no time, nothing. There may have been meta-laws that created it, but how you can call that universe that didn't

exist "something" is beyond me. When you go to the level of creating space, you have to argue that if there was no space and no time, there wasn't any pre-existing quantum vacuum. That's a later stage.

Even if you accept this argument that nothing is not nothing, you have to acknowledge that nothing is being used in a philosophical sense. But I don't really give a damn about what "nothing" means to philosophers; I care about the "nothing" of reality. And if the "nothing" of reality is full of stuff, then I'll go with that.

But I don't have to accept that argument, because space didn't exist in the state I'm talking about, and of course then you'll say that the laws of quantum mechanics existed, and that those are something. But I don't know what laws existed then. In fact, most of the laws of nature didn't exist before the universe was created; they were created along with the universe, at least in the multiverse picture. The forces of nature, the definition of particles---all these things come into existence with the universe, and in a different universe, different forces and different particles might exist. We don't yet have the mathematics to describe a multiverse, and so I don't know what laws are fixed. I also don't have a quantum theory of gravity, so I can't tell you for certain how space comes into existence, but to make the argument that a quantum vacuum that has particles is the same as one that doesn't have particles is to not understand field theory.

I'm not sure that anyone is arguing that they're the same thing--

Krauss: Well, I read a moronic philosopher who did a review of my book in the New York Times who somehow said that having particles and no particles is the same thing, and it's not. The quantum state of the universe can change and it's dynamical. He didn't understand that when you apply quantum field theory to a dynamic universe, things change and you can go from one kind of vacuum to another. When you go from no particles to particles, it means something.

I think the problem for me, coming at this as a layperson, is that when you're talking about the explanatory power of science, for every stage where you have a "something,"---even if it's just a wisp of something, or even just a set of laws---there has to be a further question about the origins of that "something." And so when I read the title of your book, I read it as "questions about origins are over."

Krauss: Well, if that hook gets you into the book that's great. But in all seriousness, I never make that claim. In fact, in the preface I tried to be really clear that you can keep asking "Why?" forever. At some level there might be ultimate questions that we can't answer, but if we can answer the "How?" questions, we should, because those are the questions that matter. And it may just be an infinite set of questions, but what I point out at the end of the book is that the multiverse may resolve all of those questions. From Aristotle's prime mover to the Catholic Church's first cause, we're always driven to the idea of something eternal. If the multiverse really exists, then you could have an infinite object---infinite in time and space as opposed to our universe, which is finite. That may beg the question as to where the multiverse came from, but if it's infinite, it's infinite. You might not be able to answer that final question, and I try to be honest about that in the book. But if you can show how a set of physical mechanisms can bring about our universe, that itself is an amazing thing and it's worth celebrating. I don't ever claim to resolve that infinite regress of why-why-why-why-why; as far as I'm concerned it's turtles all the way down. The multiverse could explain it by being eternal, in the same way that God explains it by being eternal, but there's a huge difference: the multiverse is well motivated and God is just an invention of lazy minds.

In the past you've spoken quite eloquently about the Multiverse, this idea that our universe might be one of many universes, perhaps an infinite number. In your view does theoretical physics give a convincing account of how such a structure could come to exist?

Krauss: In certain ways, yes---in other ways, no. There are a variety of multiverses that people in physics talk about. The most convincing one derives from something called inflation, which we're pretty certain happened

because it produces effects that agree with almost everything we can observe. From what we know about particle physics, it seems quite likely that the universe underwent a period of exponential expansion early on. But inflation, insofar as we understand it, never ends---it only ends in certain regions and then those regions become a universe like ours. You can show that in an inflationary universe, you produce a multiverse, you produce an infinite number of causally separated universes over time, and the laws of physics are different in each one. There's a real mechanism where you can calculate it.

And all of that comes, theoretically, from a very small region of space that becomes infinitely large over time. There's a calculable multiverse; it's almost required for inflation---it's very hard to get around it. All the evidence suggests that our universe resulted from a period of inflation, and it's strongly suggestive that well beyond our horizon there are other universes that are being created out of inflation, and that most of the multiverse is still expanding exponentially.

Is there an empirical frontier for this? How do we observe a multiverse?

Krauss: Right. How do you tell that there's a multiverse if the rest of the universes are outside your causal horizon? It sounds like philosophy. At best. But imagine that we had a fundamental particle theory that explained why there are three generations of fundamental particles, and why the proton is two thousand times heavier than the electron, and why there are four forces of nature, etc. And it also predicted a period of inflation in the early universe, and it predicts everything that we see and you can follow it through the entire evolution of the early universe to see how we got here. Such a theory might, in addition to predicting everything we see, also predict a host of universes that we don't see. If we had such a theory, the accurate predictions it makes about what we can see would also make its predictions about what we can't see extremely likely. And so I could see empirical evidence internal to this universe validating the existence of a multiverse, even if we could never see it directly.

You have said that your book is meant to describe "the remarkable revolutions that have taken place in our understanding of the universe over the past 50 years--revolutions that should be celebrated as the pinnacle of our intellectual experience." I think that's a worthy project and, like you, I find it lamentable that some of physics' most extraordinary discoveries have yet to fully penetrate our culture. But might it be possible to communicate the beauty of those discoveries without tacking on an assault on previous belief systems, especially when those belief systems aren't necessarily scientific?

Krauss: Well, yes. I'm sympathetic to your point in one sense, and I've had this debate with Richard Dawkins; I've often said to him that if you want people to listen to you, the best way is not to go up to them and say, "You're stupid." Somehow it doesn't get through.

It's a fine line and it's hard to tell where to fall on this one. What drove me to write this book was this discovery that the nature of "nothing" had changed, that we've discovered that "nothing" is almost everything and that it has properties. That to me is an amazing discovery. So how do I frame that? I frame it in terms of this question about something coming from nothing. And part of that is a reaction to these really pompous theologians who say, "out of nothing, nothing comes," because those are just empty words. I think at some point you need to provoke people. Science is meant to make people uncomfortable. And whether I went too far on one side or another of that line is an interesting question, but I suspect that if I can get people to be upset about that issue, then on some level I've raised awareness of it.

The unfortunate aspect of it is, and I've come to realize this recently, is that some people feel they don't even need to read the book, because they think I've missed the point of the fundamental theological question. But I suspect that those people weren't open to it anyway. I think Steven Weinberg said it best when he said that science doesn't make it impossible to believe in God, it just makes it possible to not believe in God. That's a profoundly important point, and to the extent that cosmology is bringing us to a place where we can address

those very questions, it's undoubtedly going to make people uncomfortable. It was a judgment call on my part and I can't go back on it, so it's hard to know.

You've developed this wonderful ability to translate difficult scientific concepts into language that can enlighten, and even inspire a layperson. There are people in faith communities who are genuinely curious about physics and cosmology, and your book might be just the thing to quench and multiply that curiosity. But I worry that by framing these discoveries in language that is in some sense borrowed from the culture war, that you run the risk of shrinking the potential audience for them---and that could ultimately be a disservice to the ideas.

Krauss: Ultimately, it might be. I've gone to these fundamentalist colleges and I've gone to Fox News and it's interesting, the biggest impact I've ever had is when I said, "you don't have to be an atheist to believe in evolution." I've had young kids come up to me and say that affected them deeply. So yes it's nice to point that out, but I actually think that if you read my book I never say that we know all the answers, I say that it's pompous to say that we can't know the answers. And so yeah I think that maybe there will be some people who are craving this stuff and who won't pick up my book because of the way I've framed it, but at the same time I do think that people need to be aware that they can be brave enough to ask the question "Is it possible to understand the universe without God?" And so you're right that I'm going to lose some people, but I'm hoping that at the same time I'll gain some people who are going to be brave enough to come out of the closet and ask that question. And that's what amazes me, that nowadays when you simply ask the question you're told that you're offending people.

But let me bring that back full circle. You opened this conversation talking about seduction. You're not giving an account of seduction right now.

Krauss: That's true, but let me take it back full circle to Hitchens. What Christopher had was charm, humor, wit and culture as weapons against nonsense, and in my own small way what I try and do in my books is exactly that. I try and infuse them with humor and culture and that's the seduction part. And in this case the seduction might be causing people to ask, "How can he say that? How can he have the temerity to suggest that it's possible to get something from nothing? Let me see what's wrong with these arguments." If I'd just titled the book "A Marvelous Universe," not as many people would have been attracted to it. But it's hard to know. I'm acutely aware of this seduction problem, and my hope is that what I can do is get people to listen long enough to where I can show some of what's going on, and at the same time make them laugh.

From: https://www.theatlantic.com/technology/archive/2012/04/has-physics-made-philosophy-and-religion-obsolete/256203/

Philosophers have a type of expertiseâ€”they know a lot about various philosophical issues, the history of various philosophical debates, and quite a bit about what it means to reason properly. They tend know more about these things than those who arenâ€™t philosophers (and getting a degree is a step in the right direction to becoming a philosopher). For this reason we can learn a lot from philosophers concerning their various specializations, and we can sometimes learn a lot by doing philosophy on our own as well. We can all learn a little about what philosophy has to offer by actually doing some...Â â€œHas Physics Made Philosophy and Religion Obsolete?â€ The Atlantic. (Originally published April 23, 2012.) 2 Ortiz, Claudia MarÃa Ãlvarez. Philosophy in the 20th century lost many of its competencies and was criticized by natural scientists for its alleged uselessness. The relationship between philosophy and science can be solved by adopting three standpoints, which are anti-scientism, conceptual analysis and naturalism. This article comprises characteristics of the different approaches and identification of problems which their advocates must confront.Â Philosophy in Mind, Springer, 23â€“42. Krauss, L. â€“ Andersen, R. (2012): Has Physics Made Philosophy and Religion Obsolete? The Atlantic [online], dostupnÃ© z: < http://goo.gl/Fs7BE>. Latour, B. â€“ Woolgar, S. (1979): Laboratory Life: The Construction of Scientific Facts, Sage Publications. Latour, B. (2004): Why Has Critique Run Out of Steam? Andersen, R. (2012 0). Has Physics Made Philosophy and Religion Obsolete? The Atlantic. Retrieved from http://www.theatlantic.com/technology/archive/2012/04/has-physics-madephilosophy-and-religion-obsolete/256203/. Week 3 â€“ Science and Scripture. Essential Readings.Â Dates and times will be made available on Learn. While these seminars are optional, they are strongly encouraged as an essential part of the overall learning experience. How to submit assessments. Instructions for online essay submission will be made available on Learn. Marking and feedback. Each essay is marked by two members of the academic staff, who will also provide feedback on the content and quality of the essay.