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God, Math, and the Multiverse | Satyan Devadoss

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The Veritas Forum

Several years ago, The Veritas Forum at Caltech hosted Satyan Devadoss, who, at the time, was an associate professor of math at Williams College. Devadoss talks about String Theory the way most people talk about their favorite piece of art. In the numbers and symbols of mathematical equations, he experiences beauty, unity, and wonder. In our post-Enlightenment world, we forget that the beauty in Michelangelo's sculptures draws from the same well as the beauty on display in quantum mechanics. When we learn to reunite these often divided realms, we may regain our vision of the Wellspring. Devadoss helps us bring these together.

Transcript

And so the idea is, all of us in this dualism, we've ripped math into pieces, where one, you can talk about math in terms of integral signs and equations, but don't you dare bring pictures into math. Right? Because that's a different way of thinking about it. And then you can talk about pictures all you want, but don't you dare bring math into that realm.

Enlightenment has brought this dualism and ripped the pieces into two.

[MUSIC PLAYING] Welcome to The Veritaas Forum Podcast. My name is Caleb Gothart, and I am the online and social media manager for Veritaas.

In college, I took a class called String Theory for Poets. And as it turns out, String Theory just might not be for poets. It's very hard.

It's a lot of math. But if you were to ask Satyan Devadas, he would tell you String Theory is one of the most poetic things in the known universe. In the numbers and symbols of mathematical equations, he experiences beauty, unity, and wonder.

Several years ago, the Veritaas Forum at Caltech hosted Devadas, who, at the time, was an associate professor of math at Williams College. In the following talk, Devadas explores why String Theory is so exciting for physicists and mathematicians, but also

why the dualism so often present in our post-enlightment world actually hinders our ability to make sense of the world around us.

[Music] Thanks, guys.

It's great. It's fantastic. I'm excited.

First of all, I'd like to thank the students at Caltech for the invitation for me to come here. And the people in the Veritaas Forum for taking care of a lot of these behind the scenes things that you don't see. And thanks to the rest of you for just coming to listen.

I just hope that these 40 minutes or so are worth your time. I really want to be valuable and honor you for what you're doing to take time out. I know you're missing the basketball game I hear to come out here, so that's a big deal.

It's a big deal. So let me start by, first of all, telling you what I'm not, all right? I am not a cosmologist. I am not a physicist.

I am not a theologian. So this entire talk, what we're going to talk about is going to be framework in what I am. And what I am is a Christian and a mathematician.

Now I know when you guys hear the word "mathematician," no matter who says it, you all think the same thing. Super cool. [Laughter] So what I want to do, instead of being starstruck by my career choice, I just want to dial it down a little bit.

And tell you guys some of the ideas that I've been struggling with. And the foundational setup for what we're going to talk about today is based on this book. So let me show you this book here by Stephen Hawking and Leonard Mlodenov, it's called "The Grand Design." It's a beautiful book, and I want to talk about a perspective of my perspective on it from a mathematician and a Christian's perspective as a starting point.

And before we do this, I really want us to look at really quickly at the story of physics, sort of where it's been from my viewpoint. So you can start with Isaac Newton. You can go farther back than that, but you can start with Isaac Newton and his way of framing the world through mechanics, you know, gravity and the way forces interact with one another.

You can push it to the next level in terms of works by Niels Bohr, in terms of understanding what the atom was like, how that completely changed the way we think and interact with what we want to study in the physics realm. We can push ahead to Albert Einstein, works of special relativity, talking about how time and this idea of energy and this idea of light, of related, and pushing on to general relativity, the curvature of spacetime. What a glorious thing.

So each time this physics model has been increased even more, we get to things like

Erwin Schrodinger's work in quantum mechanics. Glorious. And each one of these models sort of encompasses the previous one.

For example, the ideas in quantum mechanics doesn't throw away Newtonian mechanics, it takes it, embraces it, and says let me now show you what Newtonian mechanics is really about. It makes us more beautiful than it was before. So before we talk about the grand design, I don't know how much of us know physics, so let me give you just a quick perspective on the details of physics needed to understand the setup that Stephen Hawking has.

And it starts in quantum mechanics, right? That's one way to think about this. So let me give you this perspective. We've all heard, you're in Caltech, so I know we've all heard of this understanding that light is both a wave and a particle.

It has this duality, this dual sense of this property. And there's something called the dual slit experiment that you might have heard off the floor. So you take a light beam and you shine it at a wall with two slits on it, and the light goes through this wall to the other side, and we observe what happens to light when you get to the other side, and you end up with a picture like this.

So there's the left here, sort of that dark red is the wall, and there are the two slits on the wall, and I'm shining a light beam from the left side to the right, and you see that there's this interference. It looks like waves of water are colliding with each other, right? And there's this increase and decrease in the intensity of light because light is acting like a wave, and it's colliding with itself. So we can see from this experiment that light is, has this property of a wave.

And then there's this idea that came about what happens instead of pouring a wave's worth of light. What happens if we just shot one particle of light? Right, just take one photon, like a quantum packet, the smallest piece of light. I'm going to throw it at this thing and take a bunch of them and throw it one after the other one, instead of pouring a whole wave's worth, what happens, and it turns out you get a picture like this.

In some sense, when you're measuring how those things are hitting the receptor, they are having increasing and decreasing values. There are some places that there's interference. So this is what is going on here? How could one piece have interference in terms of throwing it compared to a whole wave's worth? And the understanding of what was going on was revolutionized by one of the greatest universities in the world, Caltech.

And it was done by one of the greatest professors of physics in the world, which we should find then, and he gave us this glorious way of thinking about this. I think it's fantastic. And here's his idea.

If you have point A, and if you have point B, and imagine you have something going from

A to B, quantum packet, photon, whatever, do not think that A goes from, this particle goes from A to B in one path. Think of it going from A to B in all possible paths at the same time. This was a revolutionary idea.

It hurt your head. In fact, Feynman even said this. This is one of those mysteries of quantum mechanics.

He said if you could really wrap your mind around this, you've gotten quantum mechanics. And he said basically each one of these paths has some sort of probability function, as to the chance of what it's going to go through. So as you're shooting these photons one at a time, you don't think of this photon as going through one slit and landing somewhere.

Think of it as going through every possible way to go from A to B. It goes from A, it goes to Boston, and it goes to B. It goes from A, it goes to Mars, it goes to B. It goes from A, it goes directly to B, the shortest path. Every possible way, and all of it must be encapsulated at once. This is the idea of quantum mechanics.

It does not make sense, but it's glorious and stunning. This is Feynman's idea. Now based on this, Stephen Hawking has his proposal.

He says the following thing. Instead of talking about a particle going from A to B, think about the universe. Instead of just one thing going from A to B, think of the universe.

Here's what Hawking's idea is. He says, take the universe and consider all possible paths of the universe. Every possible way the universe could have happened.

Here is one thing that the grand design says that Hawking is right. The universe does not have just one single existence or history. For example, the particle did not go just from A to B in one way, but rather every possible version of the universe exists simultaneously.

This is exactly Feynman's idea of a particle going from A to B to make sense of this effect, of this wave kind of resonance that you see on the other side. Except from a particle perspective Feynman said, we've got to think of it this way. And Hawking says, you know what? Take that glorious idea and don't just talk about it for particles.

Talk about it for everything. Everything that exists. Push it in all possible ways.

Here's another result based on this thing. Em theory, which I'm going to talk about in a little bit, has solutions that allow for many different internal spaces, perhaps as many as 10 to the 500, which means it allows for 10 to the 500 different universes each with its own laws. So if you consider these possible ways, you have possibly up to 10 to the 500 ways of thinking about all the universes existing, not different ones, at the same time.

They all exist at once. And this is the concept of the multiverse. This is the idea.

So what is Em theory? This is the foundation in which Hawking makes this claim. What is Em theory? So let me give you guys a quick bit of history. So there are four forces that we know of in this world.

There's the electromagnetic force, the weak force, the strong force, and gravity. Now the first three forces, I said, E and M, strong and weak, these forces are used to understand things that are very small, very, very small. So if you talk about protons, neutrons, electrons to the smallest level, then these forces play a big role in the nucleus of an atom.

But in terms of big things like you and I, in terms of bigger things like the sun and the moon, these forces don't play a big role because they just cancel each other out. They're not that important. So the first three forces dominate in the realm of the small.

And now you have gravity. Here's the fourth force. The gravity dominates in the realm of the large.

Gravity is not useful for even you and me. Gravity is not even useful for very small things. It's not worth it to even calculate those things.

They're basically negligible. But for the big, it completely dominates that picture. But in physics, the physicists sort of have these two camps.

Those who worry about the small. And there are a collection of equations and ideas that are beautifully well-defined and make sense here. And those who worry about the big, the cosmologists.

They have big ideas, so the people who study the universe in that realm. But when is it that both of these equations can be put together? It turns out when you try to make a theory, when you try to make a collection of equations super understanding of these four forces, we don't know how to make it fit. And this is what Einstein was struggling with, the grand unifying theory or the theory of everything.

Can you make sense of all of these ideas we have in this one model? And it doesn't work. But it turns out in real life, nobody really wants to do all of these at once. There are people who study the small and there are people who study the big and they never really hang out.

[laughter] Except when you get to things like the big bang. See, in the big bang, we take something that is very big, the universe, and you make it very small. And all of a sudden, all these forces are fundamentally and foundationally important.

So now people who worry about such things, such extreme cases of bringing these forces together are at a dilemma. Because we don't have the weapons needed to bring these forces together. Now enter string theory.

What string theory says is, it says in a simple way, if you take the most foundational building block, not as an atom, not as a cork, if you keep going down to the smallest subatomic level. If you assume that smallest thing is a point, you have a problem. But if you assume the smallest thing is a string, a circle, of a certain radius or diameter, and as a string vibrates, you get different properties of objects.

This is the idea of string theory. It says somehow, if you make these assumptions, then it seems like these four forces are all clicking together in a beautiful way. So it's cool.

And then string theories, string theories said, you know what, why are we talking about string circles wiggling around and vibrating? Why don't we talk about sheets of paper, vibrating and moving around, or surfaces of a donut, or three-dimensional manifolds, or higher-dimensional objects? And these are called brains, the one brains and the two brains and three brains. And you take all the brains, you put it in a bag, and you have M theory. This is a quick load-on of what this theory is about.

It's the generalization of string theory in a great way. So, what do I, as a mathematician, think of this idea of hawking, or this idea of M theory? You know, I study topology and geometry. I study things of shape, and I also am in love with configuration spaces.

Spaces of always things can be. This is exactly what these guys are talking about. Always the universe can be.

What do I think of this? I think it is absolutely beautiful. Oh my goodness, it's gorgeous. You know, this idea of taking a particle and looking at all possible ways it can go from A to B, now generalizing it to all possible universes? Oh my, that is gorgeous, right? And maybe string theory, this M theory idea can actually explain this thing.

Find it fabulous, but you guys must know a secret. There is the secret that you have to know. The people who are obsessed, who love, who like the most of anything else in academia, string theory and M theory are mathematicians.

We're the ones who love it more than anybody else, because it has given mathematicians something that we really, really want. It has given us jobs. [laughter] But string theory and M theory has actually what it does is not in the physics world, but in the mathematics world, given us new ideas.

The moment you make assumptions about vibrating strings and vibrating P-brains, all of a sudden, now you have ideas and mathematics that new mathematics is being formed, and we're getting excited. Here's an evidence. Professor Edward Witten, superstar physicist, one of the fathers of string theory, a professor in the Institute of Advanced Studies, where Einstein was, in Princeton, Edward Witten has won, not the Nobel Prize, the highest prize in physics, but he's won the fields medal, which is the highest prize in mathematics.

The string theory is just getting a math award, because we think he's giving us things we love. String theory is really a mathematical phenomenon, so I read this and I'm going, this is great, this is better for us, better for my kind. Now, from this framework, I hope I've given you a little bit of history for physics and a little bit of understanding for M theory.

Now, from this framework, now Stephen Hawking makes this cool assertion, right? He makes this assertion that God is no longer needed to give us the Big Bang. In other words, God isn't needed to light that fuse to set the Big Bang in motion because of M theory. Now we have this thing, so here's another version of, sorry, here's a quote from the Grand Design.

It says, "The multiverse concept, this idea that I've told you guys about all possible universes, can explain the fine tunings of physical law without the need for a benevolent creator who made the universe for our benefit." Now, we don't need somebody to say, "How did that initial Big Bang happen? How did the match get lit and the fuse blow up? We don't need it because M theory explains it away." Now Richard Dawkins, superstar evolutionary biologist, he makes the following statement. He said, "Darwin isn't kicked God out of biology, but physics remained more uncertain. Hawking is now administering the coup de gras." He's saying, "Finally, in bio, we've gotten that taken care of.

He's out of there." Now, there's always this scaffolding that you need to kind of hold things in place of how that started. We got Stephen. He's done the work for us.

Glorious points. Now let me say, what are my thoughts about this? There's one thing from a mathematician perspective that I would say about M theory. Now this is making a different claim.

So what are my thoughts about this? Well, it turns out that there is to me nothing to be taken seriously here. There's nothing serious at all. My faith hasn't decreased.

My faith hasn't increased. This is just a sentence that kind of passes through my mind. And I'll tell you why.

I'm going to give you two reasons. One reason is based on physics and the second reason is based on faith. So here's my first reason based on physics.

Quantum mechanics is the most accurate theory in the history of mankind. Quantum mechanics is ridiculously good. It can measure in accuracies we could never imagine.

This theory is so powerful. The scientific phenomena is so repeatable and accurate. It is almost flawless.

We still can't figure out how to combine it with gravity, but it is really, really fantastic. But M theory, this theory of strength theory, it hasn't even been tested yet. It is a

collection of ideas.

So here is Roger Penrose, Sir Roger Penrose. He was a professor at Oxford. He was a mathematical physicist.

He has written, works with Stephen Hawking in terms of cosmology. And here is what he writes. What is referred to as M theory isn't even a theory.

It's a collection of ideas, hopes, aspirations. I think the book is a bit misleading in that respect. It gives you the impression that here is this new theory which is going to explain everything.

It's nothing of the sort. He continues. It's not an uncommon thing in popular descriptions of science to latch on to some idea, particularly things to do with strength theory, which have absolutely no support from observation.

They're just nice ideas that people have tried to explore. So if you're making a faith statement based on a theory, which is not really a theory, but a collection of cool ideas, then what is there to really explore? In fact, this whole concept of nice ideas that people try to explore, that's exactly what math is. This is pure a mathematical realm.

This is what we do. We love nice ideas. But let me also tell you something from the faith perspective.

What does it mean for God to create the universe? From a faith perspective. Is it this person lighting the universe on fire and starting it up in the beginning? Well, William, for example, let me share with you this quote from William Carroll. He's a professor of theology at Oxford, and he writes, "Creation is the ongoing, complete causing of the existence of all that is." At this very moment where God not causing all that is to exist, there would be nothing at all.

Creation concerns the origin of the universe, not its temporal beginnings. In other words, it's not that there is a person who needs to start something to say, "This is creation." The fact that we're here, this is creation. The existence is what creation means.

The fact that God is sustaining everything that's happening now, this is the concept of creation, to water it down into a spark that needs to start anything. That's silliness. Let me explain to you more about William Carroll says.

He says, "Contemporary cosmological theories which employ a multiverse hypothesis or infinite series of big bangs do not challenge the fundamental feature of what it means to be created." That is the complete dependence upon God as cause of existence. So from my concept of faith, this is my perspective on faith as a Christian. I would say I am not moved by these claims by Stephen Hawking about creation not being needed from God's perspective.

And from my concept as a mathematician, I'm not moved by his Hawking's note because Em Theory isn't really a theory to explain physical phenomena yet.

[Music] So where are we? What I would like to do is to explain to you some of these ideas but from a bigger perspective. What I really want to do is sort of step back.

Instead of worrying about Em theory and string theory and sort of the details of all this, I really want to pull back and tell you guys something from my perspective. And I would like to do this from the concept of the Enlightenment era. The Enlightenment era started around the 18th century, on 1750 we can say we can debate sort of exactly when it started from.

But here reason was advocated as the primary source of authority. That's what it was. So if somebody says the earth is the center of the universe, we say no, you just can't make such claims.

Let's actually experiment. Let's use reason. Let's use logic and understand such things.

Don't just make statements that have no ground. And then the Enlightenment era began this movement of reassessing everything that there was and starting fresh and thinking about how we can view reality from these claims, from these ideas. Things have to be measured, tested, evaluated and not just accepted on faith.

Not just because somebody said so. If somebody says the sun is the center of our solar system, you simply can't say that's true. We have to say why? Let's see.

Is it making sense from the experimental data we have? Now, I am a huge fan of the Enlightenment. This lets you guys know it has given to me something I value more than anything else, a clean bathroom. Isn't that important? You walk into a bathroom, the tiles are clean, the sink is white.

Oh, potpourri smell. That is because of the Enlightenment. You have antibiotics now to clean that bathroom.

And one of the worst things is a dirty bathroom. You know what I am talking about? That is exactly what the Enlightenment has given us. Cleanliness.

It has given us the fact that I can leave now and almost within 24 hours be anywhere in the globe. It is amazing. It has given us technology.

It has given us antibiotics. It has given us transportation. It is a glorious thing.

But unfortunately, it has come with something that I would just want right now to label as dualism. By partitioning the world we live in into pieces, what was once a place where science and art and music and literature and all of these things were together has now been broken into pieces. Now, I am not a professor who understands things of all those

worlds.

I am not even a professor who understands the mathematics. I know this one small slice of that world. It has broken us into it into specialists.

Now, but I have a doctor and my doctor is not just a specialist of medicine. He is just not a specialist of the eye. He is a specialist of the retina.

You get very specialized because of the enlightenment. We are very focused because of this thing. It is a good thing.

But there is a danger to this thing. First of all, let me show you this danger from the perspective of mathematics. Because I am a mathematician.

If a mathematics undergrad, if a math major was Superman, who would be this person's Lex Lutor? Who would be a math major's exact opposite art rival? I will tell you who it is. It is the art student. I sit on planes.

I give conferences. I go to talks. I am sitting there and I am talking to somebody else.

What do you do? I am a math professor. Oh, I am sorry. The first things you hear, they apologize for their sins.

I am sorry, Father. Forgive me. For I like to geometry, but algebra stumbled.

Listening to confessions everywhere you go. The greatest confessions are those ones. I am an artist.

Those things don't make any sense to me. They are really forgiving in this dualism that has existed what used to be Da Vinci. Where art and math and science blended in together because of the enlightenment era, the Renaissance has been cut into pieces.

You have on one side the art student who feels, who is emotional, who doesn't do things objectively but subjectively. And then on the other side you have this cold-hearted math snake. You know, just logic and reason and a knife of death.

Let me show you something right here, right? Gao Spone theorem. To me, be greatest result in that. I am-- Thank you.

I am in love with this result, right? What does it say? The integral of the curvature over a surface is equal to two pi times the Euler characteristic. What this says is, if you take a surface, if you take an object like a sphere, just deform it. Pull it and stretch it.

The curvature of this object as you pull and stretch, no matter how you do this, the total curvature at every point of this object has to just be the fact it's related to the shape of the surface itself. It's related to the fact it's just a sphere. It is one of the most beautiful

results.

It is a visual result embedded into a formula. Now, when most people in this world look at this thing, look at this, what they see is something that Stephen Colbert says. Equations are the devil's senses.

[laughter] You just want to laugh, just looking at the guy, right? It is fantastic. And so the idea is, all of a sudden we have this dualism. We've ripped math into pieces, where one, you can talk about math in terms of integral signs and equations, but don't you dare bring pictures into math, right? Because that's a different way of thinking about it.

And then you can talk about pictures all you want, but don't you dare bring math into that realm, right? Enlightenment has brought this dualism and ripped the pieces into two. So let me give you a quote by John Littlewood, who's a famous mathematician. He wrote this book called Miscellini.

And here's a quote from what he wrote. "A heavy warning used to be given that pictures are not rigorous." This has never had its bluff called and has permanently frightened its victims. What does it mean? People have been telling me, have been telling the mathematicians throughout time, that you cannot use pictures to be rigorous.

That's not the way we do things. That's over there. We have to use equation symbols, algebraic notation.

But my friends, symbols and algebraic notation, those are pictures. They're just in a different language. So let me give you a really concrete example.

Here's an example of a four dimensional object. So a two dimensional object is like a pentagon, a three dimensional object is like a cube. And here is a projection of four dimensional objects called a Schniegel diagram.

Of this four dimensional object here. I've drawn this for you guys. And here are three other four dimensional polytopes.

It's a polyhedra, you have something called polytopes, and you're four of them. It turns out, although they look different, they're all the same. They're all equivalent.

In other words, you can morph one into the other one by just stretching and rearranging. You don't have to cut it or rip it. What is the proof that all four of these are the same? And the answer is, you're looking at the proof.

That is the proof. It is the proof using a picture. And you might say, whoa, whoa, whoa.

You can't just prove things by a picture. I don't understand what the heck is going on here. Well, that's because you're not that smart.

When it comes to understanding pictures, right? You might not be trained in the visual realm, but that doesn't mean you can throw it away. This is the warning that little wood is talking about. The goal is, we don't have to just necessarily use equations and symbols to talk about it.

We can use the pictures. And the fact that it's not done today in mathematics tells you what the Enlightenment era has done to my own field. The field, the queen of sciences.

Even in that field, there is a shattering of this dualism between art or visualization and rigor, which should have been brought together. We've lost that because of the Enlightenment. Now, let me give you a larger scope of what the Enlightenment has done.

Let me show some of these things. History and facts. Faith and reason.

Religion and politics. Supernatural and natural. You know, if you take something like religion and politics, religion is your answers to the big questions.

Why are we here? Right? How am I responsible for these things? What is my accountability with these big, politics is how those things apply to the day-to-day world. How am I going to impact my world today? And isn't it true that your thoughts about why you're here and how these things happen should impact this? And the way you see the world should also impact this. They're both related.

But today, we have not just made history and facts. There's not this connection. It's actually a dualism.

It's not even history or facts. Now, it's history versus facts. Right? It's actually religion versus politics.

You can be natural. Talk about the natural world. But don't you dare talk about supernatural things.

Or you can talk about this all you want, but don't you bring it down to the natural level. It's not that these two things can exist at the same time. One is actually an arch-rival of the other one.

This is what the enlightened world has done to us. Now, it turns out that for me, science has become, and when I think about the Enlightenment world, the scientific realm, science has become the only source of authority. It hasn't just become a source.

It's become the source. And this is the danger. Timothy Keller writes, "It is one thing to say that science is only equipped to test for natural causes and cannot speak to any others.

It is quite another to insist that science proves that no other causes could possibly exist. It is a dangerous assumption to make from one step to the other one. Science is

designed to test natural objects.

That is, it's power. But to say that everything can only be coming from science, that's a big bold claim from dualism that's dangerous. Let me also say that the Enlightenment mindset, I don't think, is successful.

I think it's great for several things, but it's not successful. You know, there's this Star Trek mentality. The Star Trek mentality is that with more education and more technology, every problem in the world today will be solved.

That is this meta-idea that goes on in the Enlightenment era. But all we need to do is the moment you educate those guys, they will be good. Hitler could have changed if he's, oh, if he just knew the truth in this scientific way, we could have convinced him otherwise.

That's what it is. Now, my friends, I am in the education business. That's my job.

I love it. But yet to make that claim, that is a dangerous claim to say that. I believe to me, I see there is so much pain in the world today.

That is not being solved by technology or education. There's so much hopelessness. There's so much injustice.

We have more technology today than we ever did. Our concept, the world is more educated today than it's ever been. And yet I see the same problems.

We still have struggles to find what it means for love and acceptance and meaning and purpose. You know, the Enlightenment era did give us antibiotics, but it also gave us anti-tank personnel. All of these crazy weapons were given to us.

It gave us medicine to cure things, but it gave us some of the worst poison gases in the world to destroy lives. So you have to take both with it, both with Enlightenment era, to say that more knowledge alone, more technology alone can solve the problems of the world as a dangerous claim to make. I also think that this Enlightenment mindset ignores just faith that goes on in this world.

You know, in Africa and South America, if you just look at the Christian faith, it has gone in the past 50 years from 5% to 50%. It's just an explosion of faith. You look at the tragedy of 9/11, and you see that underlying this tragedy, the reason that it shook the world, that it shook the Western culture, is that religion is a huge force of it.

It is a force that you cannot hide and pretend that education will solve. There is another part to us than just reason, than just things you can write down and prove. But you know, the Enlightenment, they have an answer to this.

The Enlightenment claim has an answer to this. The answer is more knowledge. Right?

You know what? We haven't understood the mind yet.

When we understand the mind, when we get that knowledge, then these issues of religion and faith will fade away. Oh, there's more knowledge that's needed. When we understand genes, when we understand our chemical structure of our body, then that will explain the way we think about faith and religion.

That's what's really going on. It's more knowledge that's the answer. And you know what I really think about this thing? I think it is a model that is an old one.

I think this concept of Enlightenment being the model is an outdated model. Here is a quote from the grand design. It says, "When a model is found lacking, a common reaction is to say the experiment was wrong.

That doesn't prove to be the case. People still often don't abandon the model, but instead attempt to save it through modifications." We see this in physics, that once something was over, when Niels-Wort came up with the idea of the atom, it was radical. When this idea of Schrodinger, the idea of Einstein, it shook the model of what physics was.

And so instead of just trying to patch the old one up, we have to realize we have to move on to the next one. And I feel if we just hold on to this Enlightenment era and try to patch it up and try to explain faith and religion in this other part of us, that we're really patching up something that should just not be included as the ultimate model, but should be part of a bigger one. Now, let me be really clear.

What I'm not advocating is throwing the Enlightenment away. I am a fan of it. But I'm not saying classical mechanics is wrong, we should throw it away.

I'm saying there should be a better model, quantum mechanics, something bigger, something that takes classical mechanics and then folds it into a bigger model that makes more sense. To just hold on to the fact that reason alone is the right way of doing it is a dangerous game to play. C.S. Lewis says this in a bigger setting.

He says, "One passes to the realization that our own age is also a period, that what we live in, we're in the middle of some period of life, and certainly has, like all periods, its own characteristic illusions. They are likeliest to lurk in those widespread assumptions which are so ingrained in the age that no one bears attack or feels it necessary to defend them. We are blinded by the fact that we're in the middle of the era.

We think we are the greatest, but we're just in a phase. I think we should be ready for the next phase that goes on, not just to hold on to the fact that absolute truth comes just from science. Let me just close with just a few thoughts about why I am a Christian.

This is interesting, because I've advocated for the fact that we're more than just beings

of just reason and logic. There's more to us than this. That's my claim that this dualistic tendencies that the Enlightenment brought as a dangerous one if we do it across the board.

Why a Christian? Why can't I just say, "I am a spiritual person? I am one who believes in things more than what I can see. I'm into the concept of the other or supernatural, "why Christianity?" I'm trained in concepts of logic. This is my job as an mathematician to break down arguments.

Let me just give you two things about the Christian faith that I think personally are fantastic. First of all, to me, this ultimate truth of the Christian faith is not given to me in an abstract setting. In other words, I believe that the God of Scripture, the God of history does not just give us in an abstract way, rules of living of his creation.

The God of the universe and the Christian faith bends his need and comes to us where we are to interact. This concept of God coming to us, Emmanuel, God with us, he's interacting with us throughout history. The recordings of his interaction are the Scripture.

That is how I think it is reality because it is not just an abstract concept I'm supposed to believe in. I believe it's measured through what history is, that these events are historical. The Enlightenment idea has this claim.

Check out this claim. The Enlightenment idea says this. World history, the history of the entire world, had a new beginning 250 years ago.

1750, around that time, the entire world history was changed. Before that point, the world was dark. The world people did not understand.

They were clueless in just the thoughts that did not make sense. But then, come the era of Enlightenment, the light shone. A new revelation, a new creation is formed, and now we are growing towards the ultimate goal.

That is the Enlightenment era's vision. Christianity makes a very similar claim. It says not 250 years ago, but 2000 years ago, the world was changed.

A new creation comes in this person of Jesus. The whole world is radically changed because of that one historical event. You take away the birth of Jesus, you've lost four chapters of the Bible.

You take away the resurrection of Jesus, you've lost the New Testament. That one event, that one historic event of the resurrection of Christ is what my hope is on. That is what I'm clinging to.

That, to me, makes historical sense. From the things I've read, that is what's attractive to

me about the Christian faith. Now, science, science says you can measure repeatable events.

That is what the definition of science is in terms of experimentation. How do you measure an event that happened once that is supposed to be the ultimate event of uniqueness? Well, you cannot use science, you have to use history, you have to use some other means. So this is what I think works.

And the second reason that I'm attracted to the Christian faith is not the fact that it's just historical. It's based somehow in history. But I'm actually attracted to how it was given to us.

You know, this concept of absolute truth is not presented to us somehow in a blind sense of allegiance. Here's the truth you must obey, nor is it given to us as a God of power play. I'm the God of the universe who has ultimate power.

Because of that, I demand you to obey me. But it is actually given to us in a person, in a person of Jesus. And this is the God who shows us how much he loves us, not by exerting his power.

But the way the truth was given is he actually gave up his power. This to me is stunningly attractive. But the God of the universe came down and said, "I give up everything for you." And this is glorious things.

So these are the two main reasons that the Christian faith, to me, is exciting. So that's exactly what I wanted to close with today. Just to give you a sense of these ideas.

Now I know we started with a lot of different stuff. We started with string theory and M theory and the history of models of physics. And then we went through these ideas of hawking in terms of how we can think of the multiverse.

And this concept of this dualism from math. So thank you for the ride. Thank you for your patience.

I hope that was enjoyable. Thank you. [Applause]

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