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Speaking of Faith®
with Krista Tippett

# Einstein's Ethics

TRANSCRIPT

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KRISTA TIPPETT, HOST: I'm Krista Tippett. Today, "Einstein's God." Albert Einstein did not believe in a personal deity, but his life and his science were rich with wonder, and he often made half-serious, half-whimsical reference to God or the Lord. Most famous is Einstein's tantalizing line, often quoted out of context, that "God does not play dice with the universe." This hour we'll learn what he meant when he said that, and we'll probe the contours of what Einstein called his cosmic religious sense.

MR. PAUL DAVIES: Sometimes he was really using God as just a sort of convenient metaphor. But he did have, I think, a genuine cosmic religious feeling, a sense of admiration at the intellectual ingenuity of the universe. Not just its majesty, but its extraordinary subtlety and beauty and mathematical elegance.

MS. TIPPETT: This is *Speaking of Faith*. Stay with us.

*[Announcements]*

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MS. TIPPETT: I'm Krista Tippett. This hour, with two physicists and through the words of Albert Einstein himself, we begin a two-part series exploring Einstein's way of thinking about mystery, eternity and the mind of God.

From American Public Media, this is *Speaking of Faith*, public radio's conversation about religion, meaning, ethics and ideas.

Today, "Einstein's God."

In the year 1905, a 26-year-old examiner in the Swiss patent office in Bern made a series of discoveries that altered the course of modern science. Most famously, Albert Einstein proposed the theory of special relativity, which changed the way we think about space, time and matter. The theory is best known by a single elegant equation: $E=mc^2$. Ten years later he took that a step farther by accounting for the effects of gravity in his theory of general relativity. Here's the voice of Albert Einstein speaking about an application of his discoveries in 1947:

MR. ALBERT EINSTEIN: It followed from the special theory of relativity that mass as an entity of different manifestations of the same things. Furthermore, the equation, E is equal of $mc^2$, showed that very small amount of mass may be converted into a very large amount of energy.

MS. TIPPETT: Though most of us can't grasp the full sense of general relativity, scientists agree that it describes the fabric of the universe we inhabit and that without Albert Einstein we still might not know it.

One of my guests today, the astrobiologist Paul Davies, offers this analogy: "Until Einstein, people thought of time and space as fixed, unchanging and absolute, the backdrop to the great show of life. Einstein revealed that time and space themselves are elastic and mutable, that they exist in relationship with unfolding life. They are part of the show themselves. Time, space, matter, gravity and light are all intertwined. They curve and collapse and change in response to each other. Such insights gave rise to the grand ideas that occupy physicists and cosmologists today: the Big Bang, black holes, quantum mechanics."

Albert Einstein often attributed his genius to the fact that he was a late bloomer as a child. In consequence, he proposed, he remained enthralled into adulthood with elemental features of existence which most of us take for granted. Here's a reading from Albert Einstein's autobiographical notes published in 1949.

READER: Why do we come, sometimes spontaneously, to wonder about something? I think that wondering to one's self occurs when an experience conflicts with our fixed ways of seeing the world. I had one such experience of wondering when I was a child of four or five and my father showed me a compass. This needle behaved in such a determined way and did not fit into the usual explanation of how the world works. That is that you must touch something to move it. I still remember now, or I believe that I remember, that this experience made a deep and lasting impression on me. There must be something deeply hidden behind everything.

MS. TIPPETT: After seeing that compass, Einstein became mesmerized in turn by light and gravity. He spent his life seeking to comprehend the order deeply hidden behind everything and to describe it mathematically. Einstein often spoke of this as his longing to understand what God was thinking.

When my first guest this hour, Freeman Dyson, was born in England in 1924, Albert Einstein was at the height of his fame. As a young

boy, Dyson yearned to speak Einstein's language of mathematics. He went on to become an eminent theoretical physicist at the Institute for Advanced Study in Princeton, where Einstein spent the last two decades of his life.

MS. TIPPETT: Let's talk about the way Einstein used the word "God." And even, I mean, he did seem to make frequent references to the Lord. And he had also said that what drove him all his life, what drove him as a scientist, was understanding if God had to make the world this way.

MR. FREEMAN DYSON: Yes. Well, certainly it was not the kind of personal God that many people believe in. And he said that very explicitly, that he did not believe in a personal God who was interested in human affairs. He did believe in nature as some sort of universal spirit, or I suppose you might say world soul, or some kind of universal mind which ruled the universe and which was far beyond our comprehension. That's what he called "God" or "The Lord." He was not a practicing Jew, but he certainly knew that Jewish literature and "The Lord" is a phrase that's used in the Bible, in the Old Testament.

MS. TIPPETT: There's a kind of reverence in that term, isn't there? Implicit.

MR. DYSON: Yes.

MS. TIPPETT: I mean, you have written of yourself that you are a practicing Christian, but not a believing Christian. And it seems to me that Einstein might well have made the same statement about himself as a Jew.

MR. DYSON: Well, he wasn't really a practicing Jew in that he didn't observe the Sabbath. But still, I mean, it was certainly true that he was a sort of a cultural Jew, but not a believing Jew.

MS. TIPPETT: I'm quite intrigued by how he seemed to have developed a real reverence for Judaism, I guess, later in his life. That he saw it as a moral attitude in life and to life, not a transcendental religion. But he wrote, "It is concerned with life as we live it and can, up to a point, grasp it and nothing else." It seemed to him to be compatible with his, you know, his faith, as you described it, as a scientist.

MR. DYSON: Oh, yes. Because he took a very solemn view of science. And science was, to him, a religion. I mean, he said that quite explicitly. Of course, in later life he became much more philosophical than he was as a young man. But in later life, he said explicitly that anybody who does not approach science with religious awe is not a true scientist.

MS. TIPPETT: When you say that you're a practicing Christian, but not a believing Christian, aren't you also saying that you don't need or even desire to pin down a theology? That you, as a scientist — and I think that Einstein was like you in this respect — that you are accustomed to and even thrilled by what you can't yet know or haven't yet discovered?

MR. DYSON: Absolutely. I mean, the world is full of mysteries, and I love mysteries. That's, of course — science is full of mysteries. Every time we discover something, we find two more questions to ask, and so that there's no end of mysteries in science. That's what it's all about. And the same's true of religion.

MS. TIPPETT: Theoretical physicist Freeman Dyson.

In an address at a conference on science, philosophy and religion in 1941, Albert Einstein declared that science can only be created by those who aspire toward truth and understanding. He famously concluded: "Science without religion is lame. Religion without science is blind." Einstein understood science and religion to be separate realms, but joined by reciprocal relationships and dependencies. Most often he stressed how both realms acknowledge and honor the human sense of mystery.

READER: The fairest thing we can experience is the mysterious. It is the fundamental emotion which stands at the cradle of true art and true science. He who knows it not and can no longer wonder, no longer feel amazement, is as good as dead. A snuffed-out candle. It was the experience of mystery, even if mixed with fear, that engendered religion. A knowledge of the existence of something we cannot penetrate, of the manifestations of the profoundest reason and the most radiant beauty. It is this knowledge and this emotion that constitute the truly religious attitude. In this sense, and in this alone, I am a deeply religious man. I cannot conceive of a God who rewards and punishes his creatures, or has a will of the type of which we are conscious in ourselves. Enough for me, the mystery of the eternity of life and the inkling of the marvelous structure of reality, together with the single-hearted endeavor to comprehend a portion, be it ever so tiny, of the reason that manifests itself in nature.

MS. TIPPETT: From *The World As I See It* by Albert Einstein, published in 1956.

I'm Krista Tippett, and this is Speaking of Faith from American Public Media. Today, "Einstein's God."

In his greatest discoveries, Einstein focused on the laws that govern the largest dimensions and energies of physics. "The mountaintops," as my guest, Freeman Dyson, puts it. But Einstein's work also opened physics to the study of the smallest quantum particles. And during Einstein's lifetime, quantum physicists such as Niels Bohr and Werner Heisenberg proceeded to find randomness and unpredictability in that sphere. In ordinary space, we throw a ball into the air and it comes back down. But at the atomic level, Heisenberg proclaimed,

"…anything could happen. Atoms veer off in wholly unpredictable, illogical directions, seemingly of their own will."

Einstein found this idea unacceptable. He drew the closest thing he had to a theology from his reverence for the writings of the 17th-century Dutch philosopher Baruch Spinoza. Spinoza described God's superior intelligence manifest in the determined harmonious order of nature. And Einstein made his most famous quip about God as he disputed the disorderly universe of quantum physics. He said, repeatedly, "I do not believe that God plays dice with the universe."

MR. DYSON: He had this religious faith, I would say, in the power of nature, and he saw nature as something causal so that, in some way, it was predetermined from the beginning of time how it was going to go on, and that is not the way we see things happening today.

MS. TIPPETT: Right. There's this exchange, it's said that Einstein said to Niels Bohr, "God does not play dice with the universe," and Bohr responded, "Who is Einstein to tell the Lord what to do?"

MR. DYSON: Yes. And I think — I mean, I'm on the side of Bohr, no doubt.

MS. TIPPETT: Well, you've also written — you wrote, "The old vision which Einstein maintained until the end of his life of an objective world of space and time and matter independent of human thought and observation is no longer ours. Einstein hoped to find a universe possessing what he called objective reality, a universe of mountaintops which he could comprehend by means of a finite set of equations. Nature, it turns out, lives not on the mountaintops but in the valleys." Explain to me what you're describing there.

MR. DYSON: If you look at the real nature, it's just so much more imaginative than a set of equations. What really happens in the universe is that nature finds all these extraordinarily complex structures which have their own rules. So I mean, for example, the whole of biology is an example of that. I mean, that, you know, things happen in living creatures which you can't just describe with a set of equations. But that's true of most of science. That's true of chemistry and geology, of the whole of historical sciences.

MS. TIPPETT: You say it's more like a rainforest than a mountaintop.

MR. DYSON: Exactly. Exactly. But it's true, that's exactly the metaphor. I mean, the complexity is the essence of things, so Einstein's universe of sort of cold, hard space and time and defined by a set of differential equations, it's there, but it's a very small part of the real universe. It's just the mountain peaks.

MS. TIPPETT: But help me understand this. I mean, I think what's so intriguing is that — and we don't always think about it this way, but that the equations — I mean, the $E=mc^2$, that what Einstein was laying out was not something that we were creating, but discovering, of equations, of facts, rules, principles, that somehow were there and undergird all of this. And I think that those equations and rules still somehow undergird this complex reality, the rainforest you're describing. Is that right? But it's just a lot bigger than that.

MR. DYSON: Yes. These equations are quite miraculous in a certain way. I mean, the fact that nature talks mathematics, I find it miraculous. I mean, I spent my early days calculating very, very precisely how electrons ought to behave. Well, then somebody went into the laboratory and the electron knew the answer. The electron somehow knew it had to resonate at that frequency which I calculated. So that, to me, is something at the basic level we don't understand. Why is nature mathematical? But there's no doubt it's true. And, of course, that was the basis of Einstein's faith. I mean, Einstein talked that mathematical language and found out that nature obeyed his equations, too. Of course, his great moment was when they measured the deflection of light by the sun in 1919 and found that it followed his theory of gravitation.

MS. TIPPETT: Was that the expedition?

MR. DYSON: Yes, that was the expedition where Eddington made the observations and confirmed the theory.

MS. TIPPETT: It did seem miraculous, didn't it, to people, that he was right?

MR. DYSON: It was miraculous.

MS. TIPPETT: Physicist Freeman Dyson.

In 1919 Einstein's theory of relativity was confirmed by two expeditions to Brazil and the West African coast to observe the total eclipse of the sun. The eminent British astrophysicist Arthur Eddington led the project. To the amazement of Eddington and the rest of the world, Einstein had correctly calculated that space could be distorted and light curved by gravity. Einstein was on the front page of newspapers worldwide, but when asked what he would have said had his theory not been proven correct by observation, Einstein replied, "I would have had to pity our dear Lord. The theory is correct all the same."

MR. DYSON: He had a marvelous sense of humor, and that's a very important part of life. And, of course, the fact is that scientists have, on the whole, cultivated a sense of humor, because so much of science is a history of failures. I mean, most — if you're a creative person,

it's true in other kinds of creative life, but more in science that so much of science ends up to be wrong. And that you do something, you spend weeks and months and finally the whole thing collapses. Well, you need to have a sense of humor, otherwise you couldn't survive. And Einstein, I think, understood that particularly well.

MS. TIPPETT: I wanted to ask you what physicists are learning now that would befuddle him, what would intrigue him, and I suppose we've already wandered into that territory. What else is happening now that perhaps he made possible, but that might surprise him?

MR. DYSON: Well, I think the big thing that he made possible, but which he never accepted, was black holes. Places where big stars have collapsed and effectively disappeared from the universe, except that there's left behind a hole where the star used to be. So you have there a very strong gravitational field without any bottom. The black hole is the only place where space and time are really so mixed up that they behave in a totally different way. I mean, you fall into a black hole and your space is converted into time and your time is converted into space.

MS. TIPPETT: Sort of the ultimate relativity?

MR. DYSON: Yes. In a way, it's the most exciting, the most beautiful consequence of his theory. I mean, nature would not be the same without them. And I think if Einstein came back, he really would be surprised by that. I mean, he would have to accept, if he came back now, he would have to accept that black holes are real and they're here to stay, and they are actually a tremendous triumph for his own ideas. So I think it would be amusing to see his reaction. I'm sure he would accept it. Probably make some joke.

MS. TIPPETT: Freeman Dyson's most recent book is *The Scientist as Rebel*.

Einstein's humor and humanity were revealed in his public appearances, but also in the vast correspondence he conducted with people of all walks of life. Here's a passage of a letter he wrote to one of his early biographers, who had asked Einstein to recall the details of receiving his first honorary degree. While still a patent examiner in 1909, four years after he discovered special relativity, Einstein was honored during the 350th anniversary of the founding of the University of Geneva by the Protestant reformer John Calvin.

READER: So I traveled there on the appointed day, and in the evening in the restaurant of the inn where we were staying, met some Zurich professors. I had with me only my straw hat and my everyday suit. My proposal that I stay away was categorically rejected, and the festivities turned out to be quite funny, so far as my participation was concerned. The celebration ended with the most opulent banquet that I have ever attended in all my life. So I said to a Geneva patrician who sat next to me, "Do you know what Calvin would have done if he were still here?" Then he said, "No," and that's what I thought. I said, "He would have erected a large pyre and had us all burned because of sinful gluttony." The man uttered not another word. And with this ends my recollection of that memorable celebration.

MS. TIPPETT: Albert Einstein writing to a biographer in 1952.

If Albert Einstein can be said to have had a spiritual side, this expressed itself in part in his love of music. He played the violin from a young age and was a passionate concertgoer. He attended the stunning debut in 1929 of the 13-year-old Yehudi Menuhin with the Berlin Philharmonic. Menuhin played as soloist in a daunting program of Bach, Beethoven and Brahms concertos. Einstein was so moved that, as one story goes, he rushed into the boy's room after the performance, he took him in his arms and exclaimed, "Now I know that there is a God in heaven!"

Einstein once mused that had he not been a physicist he would have been a musician. "I often think about music," he revealed. "I daydream about music. I see my life in the form of music." He carried his violin with him wherever he went. This is an older Menuhin playing Einstein's beloved Bach.

*[Music excerpt]*

This is *Speaking of Faith*. After a short break, physicist and astrobiologist Paul Davies on Einstein's view of time and eternity and the mind of God.

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I'm Krista Tippett. Stay with us. *Speaking of Faith* comes to you from American Public Media.

*[Announcements]*

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with Krista Tippett

Welcome back to *Speaking of Faith*, public radio's conversation about religion, meaning, ethics and ideas. I'm Krista Tippett. Today, "Einstein's God."

With two physicists, and through the words of Einstein himself, we're exploring Albert Einstein's way of thinking about God, mystery and eternity. My next guest, Paul Davies, is a theoretical physicist and cosmologist. I interviewed him from Sydney, Australia, where he spent 15 years at the Australian Centre for Astrobiology, which he co-founded. He's currently at Arizona State University, where he is creating BEYOND — a new center for fundamental concepts in science.

Davies has written widely about Einstein's understanding of time and the intriguing scientific and existential questions it raises. Einstein referred to the human perception of time divided into past, present and future as a "stubbornly persistent illusion." Before Einstein, science itself had taught society to think of time as a matter of fixed precision. Time was a universal constant, an arrow progressing at the same rate for everyone everywhere. Nineteenth-century notions of progress hinged on this belief about time. So did the modern Western concept of selfhood, of personal identity accumulated through the passage of time. But Einstein saw time as elastic, not absolute, curving and warping in response to space and mass and motion. I asked Paul Davies why this idea still sounds outlandish to a 21st-century mind.

MR. PAUL DAVIES: The reason that people find Einstein's ideas weird is because we don't notice the effects that he discussed in daily life, and our brains have evolved their common-sense notions in order to cope with daily life. But we now have instruments of such extraordinary sensitivity that we can easily measure the warping of time just from everyday speeds. And I suppose the one that is most dramatic is the global positioning system, without which, in Sydney at least, the taxi drivers would always get lost. This system relies upon satellites which are orbiting the earth, and if you don't factor in the warping effects of both motion and gravitation on time, you would very soon get lost, within minutes. And so this is an application of the theory of relativity.

MS. TIPPETT: I think one of the most interesting stories you tell, as you describe what Einstein's contribution was to our understanding of space and time, is that, in fact, before Newton and Galileo, ancient cultures thought of time as organic and subjective and cyclical and part of nature. And you say that the clock is an emblem of an intellectual straitjacket that was created in a relatively modern era by scientists, and that Einstein then restored time to its rightful place at the heart of nature. That's a very interesting idea.

MR. DAVIES: It's certainly true that it was Galileo that recognized that time is the appropriate parameter in which to discuss the nature of motion and, in particular, falling bodies. And Newton then developed that idea into what is now sometimes called "the clockwork universe," that the entire cosmos is a gigantic clockwork mechanism slavishly following accurate mathematical laws to arbitrary precision. But it didn't enter into the practical world nearly so much until about probably the 19th century. The railroads were being established, and it was important for people to be at the station on time. And it was important to establish international time zones and national time zones of common ways of doing business. And the telegraph was another very important step in establishing common time zones. And it was curious that probably no more than a few decades after ordinary people began to be subjected to this temporal straitjacket, Einstein came along and upset the apple cart again. And I think historically part of the reason for this was that he was working in the patent office in Switzerland, and precision timekeeping and inventing clocks that would give ever greater precision and enable time zones to be synchronized ever more accurately would have been something he would deal with on a daily basis.

MS. TIPPETT: Right. And he was in the capital of clocks as well, I guess, in Switzerland.

MR. DAVIES: That's right. And so he was obviously thinking very much about measuring time, and this is what led him to the notion that your time and my time might appear different. We might measure different time intervals between the same two events if we're moving differently. And also your gravitational circumstances. Gravity slows time. Time runs a little bit faster on the roof than it does in the basement. We don't notice it in daily life. When you go upstairs and come down again, you don't notice a mismatch, but you can measure it with accurate clocks.

MS. TIPPETT: From a religious perspective, there's something intriguing, though, in how these ideas of physics might seem to echo spiritual notions that you can find in Eastern and Western religious thought. And in Australia — you're speaking from Australia — there's the notion of Dreamtime. There do seem to be echoes of that, of a sense of time as larger and malleable and mutable and not captive to human reality.

MR. DAVIES: It's true that the Australian aboriginal concept of the dreaming reflects the perception of time of many ancient cultures, the notion that in a way there are two times. There's the one that we live our lives by on a minute-by-minute basis. But then there's this small abstract notion, which is, maybe time is the wrong word. Maybe it's the opposite of time. Maybe it's eternity. This is a dualism, I think, that runs through all cultures, that there is time and then there is eternity, and that some things…

MS. TIPPETT: Something beyond time.

MR. DAVIES: …in some sense, have an existence outside of time. They are eternal. And I don't fully understand, can't really grasp the aboriginal concept of the Dreamtime, but I think it will come closer to the Christian notion of eternity than it does to day-to-day, temporal sequence. And I've been inspired by the work of Augustine, who lived in the fifth century and wrote extensively about the nature of time. And where I think he was spot on and where it resonates with Einstein has to do with the origin of time, the fact that time may have come into existence with the beginning of the universe. We think now that the universe began with a big bang, and people are fond of asking what happened before the Big Bang.

MS. TIPPETT: And that was also a legacy of Einstein also, that we could discern that. Correct?

MR. DAVIES: Einstein gave us the so-called general theory of relativity in 1915, in which the notion of the expanding universe is based, and by extension of that, the universe beginning with a so-called Big Bang. We know this is now 13.7 billion years ago. Einstein's theory of relativity says this was the origin of time. I mean, there's no time before it. And Augustine was onto this already in the fifth century because he was addressing the question that all small children like to ask, which is, "What was God doing before he created the universe?" And so Augustine said that the world was created with time and not in time. So he placed God outside of time altogether, a timeless, eternal being. So we're back to eternity.

MS. TIPPETT: Physicist and astrobiologist Paul Davies. In 1930 Albert Einstein published an essay on religion and science in *The New York Times Magazine.* It was quoted and reprinted around the world. Einstein described his understanding that emotions such as longing and pain and fear gave rise to primitive forms of religion. Later he wrote moral impulses drove what he called "the religions of civilized peoples, especially of the Orient." Einstein described his own inclination towards another kind of religious sensibility which he called a cosmic religious sense. He discerned kindred glimpses of this feeling in such diverse figures as the prophets and psalmists of the Hebrew Bible, St. Francis of Assisi and the Buddha.

READER: It is very difficult to elucidate this feeling to anyone who does not experience it. The individual feels the vanity of human desires and aims and the nobility and marvelous order which are revealed in nature and in the world of thought. Individual existence strikes him as a sort of prison, and he wants to experience the universe as a single, significant whole. The religious geniuses of all ages have been distinguished by this kind of religious feeling. In my view, it is the most important function of art and science to awaken this feeling and keep it alive in those who are receptive to it.

MS. TIPPETT: Albert Einstein writing in *The New York Times* in 1930.

I'm Krista Tippett, and this is *Speaking of Faith* from American Public Media. Today, "Einstein's God."

My guest, the physicist and astrobiologist Paul Davies, has written that theology was the midwife of science. In 1995 Davies won the Templeton Prize for Progress in Science and Religion, but like Albert Einstein, he's not a traditionally religious person. At the same time, like Einstein, he speaks often of God and especially of the mind of God. So I asked Davies what a physicist understands in using that phrase, and did Einstein's discoveries influence a new understanding for our time?

MR. DAVIES: You have to understand how science emerged in Western culture. Under the twin influences of Greek philosophy, which taught that human beings can come to understand their world through rational reasoning. And then the second tradition began with Judaism, the notion of a creative world order, that there is a supreme lawgiver who brought the universe into existence at a finite time in the past and orders the universe according to a rational plan. So both Christianity and Islam adopted this linear time and a creative world order, and the scientists had that tradition. They said, "Well, there's an order in nature, but it's hidden from us." We don't see it in daily life. We have to use arcane procedures of experiment and mathematics to uncover this, what I like to call, mathematical code which underpins nature. We now call that the laws of physics. But this notion that human beings could come to understand it, could read the mind of God, because the application of human reasoning and human inquiry was a tremendous thing. And the birth of science can be identified with this step.

MS. TIPPETT: I do hear echoes of Einstein also in that kind of language. Here's something he said in 1955: "I want to know how God created this world. I'm not interested in this or that phenomenon, in the spectrum of this or that element. I want to know His thoughts. The rest are details."

MR. DAVIES: Einstein was fond of using the word God, and there are many famous quotations. "God does not play dice with the universe" is his antipathy to quantum physics and its indeterminism. Sometimes he was really using God as just a sort of *façon de parle*, a convenient metaphor. But he did have, I think, a genuine theological position. He did not believe in a personal God. He made that very clear. But he did believe in a rational world order, and he expressed what he sometimes called a "cosmic religious feeling," a sense of awe, a sense of admiration at the intellectual ingenuity of the universe. Not just its majesty, its grandness, its vast size, but its extraordinary subtlety and beauty and mathematical elegance. Something that people who are not physicists find it very hard to grasp. But to a professional physicist, this notion of an underlying mathematical beauty is part and parcel of the subject.

MS. TIPPETT: And you also raise the kind of religious, theological questions that, for you, still flow out of these great discoveries of

Einstein and of physics as we know them now. You know, burning questions that remain. Maybe we don't need God for the laws of physics to do their job, but where do the laws of physics come from? Why these laws rather than others? And here's some language of yours. "Why a set of laws that drive the searing, featureless gases coughed out of the Big Bang toward life and consciousness and intelligence and cultural activities such as religion, art, mathematics and science?" I mean, are those questions that you can ask now, this way down the road? Did Einstein consider questions like that?

MR. DAVIES: For me the crucial thing is that the universe is not only beautiful and harmonious and ingeniously put together, it is also fit for life. And physicists have traditionally ignored life. It's too hard to think about. More and more, though, I think we have to recognize that if the laws of physics hadn't been pretty close to what they are, there would be no life. There would be no observers.

Now, sometimes it's just shrug and say, "Well, so what." You know, "If it had been different, we wouldn't be here to worry about it." But I think that's unsatisfactory. And the reason I think it's unsatisfactory is because the universe has not only given rise to life, it's not only given rise to mind, it's given rise to thinking beings who can comprehend the universe. Through science and mathematics, we can, so to speak, glimpse the mind of God, as we've been discussing.

And I think that this suggests, to me anyway, that life and mind are not just trivial extras. They're not just an embellishment on the grand scheme of things; they're a fundamental part of the nature of the universe. And if you imagine playing the role of God and having some sort of machine in front of you with a whole lot of knobs, and you twiddle the knobs and change things — twiddle one knob, make the electron a bit heavier; twiddle another knob and make the strong nuclear force a bit stronger — you soon discover that you have to fine-tune those settings to extraordinary precision in order for there to be life. And the question is, what are we to make of that? And, you know, really, these things, at the end of the day, boil down largely to a matter of personal choice, because we can't really test either. Or certainly not in our current state of knowledge.

MS. TIPPETT: Physicist and astrobiologist Paul Davies. He says that the current conversation between science and religion is different in physics than in biology. So when he speaks of the fine-tuning of the universe, or when Einstein spoke of a mind or superior spirit behind nature, this does not mirror the biologists' debate between Darwinian evolution and intelligent design. The order behind the universe which Einstein discerned was manifest in the laws of physics. Einstein rejected the notion of a creator who would interfere with the laws ordering his own creation. However, Einstein's discoveries did make possible the fields of quantum physics and chaos theory. And some scientists in those fields are now suggesting that there might be room for an involved God within the laws of physics themselves. I asked Paul Davies about this.

MR. DAVIES: Yes, there has always been this problem for physicists about an active God. If God does anything, God has to be at work in the world. And now, if we go back to the sort of universe that Newton had and the one that Einstein supported, the notion of a deterministic universe, a clockwork universe, then this becomes a real problem, because if God is to change anything, then God has to overrule God's own laws, and that doesn't look a very edifying prospect theologically or scientifically. It's horrible on both accounts.

But when one gets to an indeterministic universe, if you allow quantum physics, then there is some sort of lassitude in the operation of these laws. There are interstices having to do with quantum certainty into which, if you want, you could insert the hand of God. So, for example, if we think of a typical quantum process as being like the roll of a die — you know, "God does not play dice," Einstein said — well, it seems that, you know, God does play dice. Then the question is, you know, if God could load the quantum dice, this is one way of influencing what happens in the world, working through these quantum uncertainties. Now, some people certainly have pushed that idea. John Polkinghorne is one who's spoken about it. Bob Russell for the Center for Theology and Natural Sciences in Berkeley likes that point of view of God not in any sense usurping the laws of physics, but working within the inherent lassitude that quantum physics provides. And it's a possible way of God to gain cause or purchase in the world without changing any of the laws that we know.

MS. TIPPETT: I think, as we close, I'd like to come back to this idea of eternity. We touched on that a bit when we were talking about time — which was such an important subject for Einstein — and this idea that is in many cultures and many religious traditions of sort of a distinction between the temporal and the eternal. I'd like to read you a passage from a letter that I found that Einstein wrote when he was a bit older and just see how you respond to it as a physicist. He wrote this actually to the queen of Belgium who was suffering a great grief. And he said to her, "And yet, as always, the springtime sun brings forth new life, and we may rejoice because of this new life and contribute to its unfolding. And Mozart remains as beautiful and tender as he always was and always will be. There is, after all, something eternal that lies beyond the hand of fate and of all human delusions. And such eternals lie closer to an older person than to a younger one, oscillating between fear and hope. For us there remains the privilege of experiencing beauty and truth in their purest forms." I don't think this is an Einstein many of us know when we just think of his scientific legacy.

MR. DAVIES: Now, those are beautiful words, and I was quite unaware of them, very poetic. And I can see where they're coming from because, as we discussed earlier, Einstein was the person to establish this notion of what is sometimes called block time, that the past, present, and future are just personal decompositions of time and that the universe of past, present, and future in some sense has an eternal existence. And so even though individuals may come and go, their lives, which are in the past for their descendants, nevertheless still have some existence within this block time. Nothing takes that away. You may have your threescore years and 10 measured by a date after your death. You are no more. And yet within this grander sweep of the timescape, nothing is changed. Your life is still there in its

entirety.

MS. TIPPETT: It's a wonderful thought, isn't it? I mean, it opens up our imagination about what it means to be human and the universe, our place in it.

MR. DAVIES: I think that physics impacts upon our view of the universe and our place within it in so many ways, in the nature of time, in the nature of reality through quantum physics, and, as we've discussed, the fact that the universe is fit for life and we're a component in this bio-friendly universe that has such ingenious laws that can enable life to come into existence. And it puts our own position on this planet into a very different context. See, it cuts both ways, because on the one hand we can see that we're not the center of the universe, we're not the pinnacle of creation, that we are maybe a small part, maybe only one among myriad living systems throughout the universe. And yet, nevertheless, we have emerged, and we can truly feel part of nature in a cosmic sense, not just in a local sense, but I think in a genuinely cosmic sense. And I think that's deeply inspiring whatever one's religious convictions. and even if you have no religious convictions. I often say that if I talk to someone like Steven Weinberg, who's a professed atheist and quite militantly so…

MS. TIPPETT: He's the one who said, "The more we learn, the more pointless it seems"?

MR. DAVIES: That's right, and yet, nevertheless, he will share in the awe, the wonder, the majesty, the beauty of the universe in this cosmic connection that I've been talking about. He sees the same facts as I do but can't bring himself to believe that there's any point behind it all. And that's where he and I will part company. We'd agree on all of the science, but to me it overwhelmingly suggests that the universe is about something, that there is a point to it, and that we're part of whatever point that is.

MS. TIPPETT: Paul Davies' books include *The Mind of God* and *About Time: Einstein's Unfinished Revolution*. Earlier in this hour you heard physicist Freeman Dyson. Here in closing are some lines from a letter Albert Einstein wrote in 1927.

READER: I cannot conceive of a personal God who would directly influence the actions of individuals or would sit in judgment on creatures of His own creation. I cannot do this in spite of the fact that mechanistic causality has, to a certain extent, been placed in doubt by modern science. My religiosity consists in a humble admiration of the infinitely superior spirit that reveals itself in the little that we, with our weak and transitory understanding, can comprehend of reality. Morality is of the highest importance, but for us, not for God.

MS. TIPPETT: Contact us online at speakingoffaith.org. Listen to the second part of this series on Einstein, and let us know what you think. You can find extra audio clips of Freeman Dyson and Paul Davies, and hear more of the voice of Albert Einstein himself.

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Special thanks this week to Steven Epp and Theatre de la Jeune Lune, Professors Keith Olive and Michel Janssen of the University of Minnesota, and the Albert Einstein archives at Hebrew University of Jerusalem and Princeton University.

The senior producer of *Speaking of Faith* is Mitch Hanley, with producers Colleen Scheck and Jody Abramson. Our online editor is Trent Gilliss. Bill Buzenberg is a consulting editor. Kate Moos is managing producer of *Speaking of Faith*, and I'm Krista Tippett.

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